



Rise Urban


Abbey South Structure Plan
Part I – Implementation Report
May 2024

This Structure Plan is prepared under the provisions of the City of Busselton Local Planning Scheme No.21

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

13 August 2024

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



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



Witness: -----

Date: 14 August 2024 -----

Expiry Date: 14 August 2034 -----



Table of Amendments

Amendment Number	Summary of the Amendment	Amendment Type	Date approved by the WAPC

Document Control

Version	Comment	Author	Approved By	Issue Date
3	Modified as per City of Busselton Resolution	NG	CL	Jan 2023

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Rise Urban Pty Ltd, 2022.

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Executive Summary

Executive Summary

The Abbey South Structure Plan has been prepared to guide the subdivision and development of approximately 30.5 hectares of land on Lots 4, 12 and 402 Caves Road, and Lots 14 and 15 Bussell Highway, Abbey, within the City of Busselton.

The Structure Plan has been prepared on behalf of the landowners (“The Abbey Landowner Group”) and in collaboration with the City of Busselton. The Structure Plan is informed by extensive technical reporting and analysis prepared by the following specialist consultant team:

- Rise Urban – Town planning and project coordination
- Studio CFM – Urban design
- Emerge Associates – Environment, hydrology, landscaping and bushfire
- Stantec – Civil engineering and transport planning

The Abbey South Structure Plan provides an overarching planning framework to guide and facilitate the development of the structure plan area for urban purposes, and has been prepared in accordance with the requirements of the *Planning and Development (Local Planning Schemes) Regulations 2015*.

The plan provides for an integrated and coordinated approach to an appropriate mix of land uses and infrastructure, necessary to create a strong and vibrant community, whilst delivering triple bottom line sustainability outcomes in accordance with the State and Local Government policy requirements.

Design Approach

The design approach has been a rigorous multidisciplinary process with continuous reflection upon the purpose of the Structure Plan. Design principles and considerations which have informed the design approach include:

- Understanding of the local vernacular and characteristics that make Abbey a unique place within the Geographe region and the broader South West region.
- Consideration of existing environmental and physical assets and infrastructure.
- Public Open Space allocation, function and community creation.
- Urban structure and place making that is environmentally responsive.
- Movement systems and connectivity that promote pedestrian activity and local street activation.

Project Overview

The Abbey South Structure Plan will create a framework for the future urban development of an anticipated 350+ dwellings, which will ultimately house a new community in the vicinity of 800-950 people, as well as a mix of commercial uses that recognise the existing commercial operations and provide an appropriate interface to Bussell Highway.

The Structure Plan recognises the unique location, and surrounding land use context whilst enabling a diverse range of housing typologies. The Structure Plan fulfils the strategic planning objectives identified in the Leeuwin Naturaliste Sub-regional Planning Strategy which was amended by the Western Australian Planning Commission in December 2021 to identify the Abbey South area as being suitable for urban development in the short to medium term.

It also assesses and resolves the ‘Public Open Space Investigation Area’ that was identified through the review of the Strategy, and provides an open space network that respects and responds to its physical context.



The Structure Plan supports residential densities of R10 – R60 and will ultimately deliver approximately 350 – 400 residential dwellings.

The Structure Plan area is serviced by essential infrastructure already located within the adjacent Caves Road reserve and can be easily extended to service future development in the Abbey South area with no expansion of capacity required.

This report comprehensively addresses all of the relevant planning considerations and demonstrates that the land is suitable for urban development in the form proposed.

Table 1 below sets out an indicative land use summary based on the Structure Plan map provided at Plan A, and the Concept Plan contained within the explanatory report.

Table 1 – Land Use Summary

Item	Data
Structure Plan Area	30.5ha
Area of each land use proposed:	
Zones (as per LPS21):	
Residential	24.84ha
Local Centre	0.58ha
Reserves (as per LPS21):	
Recreation	4.6ha (gross)
Estimated number of dwellings	350-400
Estimated residential site density - Dwellings per site hectare	Estimated 22 dwellings per site ha
Estimated population	875 – 1,000 people (@ 2.5 people per household)



Table of Contents

1.0	Structure Plan Area	7
2.0	Structure Plan Content	7
3.0	Operation	7
4.0	Interpretation and Relationship with the Statutory Planning Framework	7
5.0	Staging	7
6.0	Land Use and Subdivision	8
6.1	Subdivision and Development	8
6.2	Zones and Reserves	8
6.3	Residential Density	8
6.4	Public Open Space	8
6.5	Road Network and Access	8
6.6	Local Centre	9
6.7	Primary Schools	9
6.8	Road Noise	9
7.0	Notifications on Title	9
8.0	Further Subdivision Reporting	9
9.0	Development Contributions	9



1.0 Structure Plan Area

The Abbey South Structure Plan Area applies to the land contained within the inner edge of the line denoting the Structure Plan boundary shown on the Structure Plan Map (Plan A: Structure Plan Map), and comprises all of Lots 4, 12 and 402 Caves Road and Lots 14 and 15 Bussell Highway, Abbey.

2.0 Structure Plan Content

This Structure Plan comprises:

- Part One – Implementation Section
- Part Two – Explanatory Report
- Appendices – Technical Reports

Part One of the Structure Plan comprises the structure plan map and planning provisions including zoning, subdivision and development controls. Part Two of the Structure Plan is the planning report component which can be used to interpret and implement the requirements of Part One.

3.0 Operation

This Structure Plan comes into effect on the date that it is endorsed by the Western Australian Planning Commission (WAPC) and expires ten years from the date that it is endorsed by the WAPC unless amended otherwise.

4.0 Interpretation and Relationship with the Statutory Planning Framework

The Structure Plan constitutes a structure plan pursuant to the City of Busselton Local Planning Scheme 21 and Schedule 2 - Deemed provisions for local planning schemes of the *Planning and Development (Local Planning Schemes) Regulations 2015*.

The Structure Plan Map (Plan A) outlines future land use, zones and reserves applicable within the Structure Plan area.

Pursuant to Schedule 2 of the *Planning and Development (Local Planning Schemes) Regulations 2015*, a decision maker of an application for development approval or subdivision approval is to have due regard to the provisions of this Structure Plan, including the Structure Plan Map, Implementation Report, Explanatory Report and any Technical Appendices.

5.0 Staging

Development staging will follow an orderly sequence and shall not exceed the extension of essential service infrastructure or constructed road access.

The first stage of subdivision shall include at least one access to Caves Road. All stages are required to provide suitable temporary or permanent emergency egress arrangements in accordance with SPP 3.7.



6.0 Land Use and Subdivision

6.1 Subdivision and Development

The subdivision and development of land is to generally be in accordance with the Structure Plan. Residential lots shall be designed such that future dwellings can achieve a minimum habitable floor level of 3.0m AHD consistent with the City's Coastal Hazard Risk Management Adaptation Plan.

6.2 Zones and Reserves

Plan A outlines land use, zones and reserves applicable within the structure plan area.

6.3 Residential Density

6.3.1 Density Codes

Where the Structure Plan Map depicts a specific residential density code, residential densities applicable to the Structure Plan shall be those residential densities shown on the Structure Plan Map.

6.3.2 Density Ranges

Where the Structure Plan Map depicts a density range (for example R20-R40), the following locational criteria shall be applied at subdivision stage:

The lower density code shall apply as the base code to all 'Residential' zoned lots.

The higher density code may be applied to 'Residential' zoned lots where one or more of the following applies:

- (a) The lot has a laneway abutting the rear boundary.
- (b) The lot is directly abutting or immediately opposite the central public open space 'spine'.
- (c) The lot is within a 400m walkable catchment of the 'Monaghans' local centre. (NOTE WE WILL SHOW THE 400M RADIUS ON THE SP MAP)

- (d) The lot or lots are located at the end of a street block.

6.3.3 Residential Density Code Plan

- (a) Where a density range applies, lot specific residential densities, within the defined residential ranges, are to be subsequently assigned in accordance with a Residential Density Code Plan approved by the Western Australian Planning Commission at subdivision stage.
- (b) A Residential Density Code Plan is to be submitted at the time of subdivision to the WAPC and shall be consistent with the Structure Plan and the Residential Density Ranges identified on the Structure Plan Map and the density range criteria in section 6.3.2.
- (c) The Residential Density Code Plan is to include a summary of the proposed dwelling yield of the subdivision.
- (d) Approval of the Residential Density Code Plan shall be undertaken at the time of determination of the subdivision application by the WAPC. The approved Plan shall then form part of the Structure Plan and shall be used for the determination of future development applications and R-Code Assessments.
- (e) Variations to the Residential Density Code Plan will require further approval of the WAPC, with a revised Plan submitted generally consistent with the approved plan of subdivision issued by the WAPC.
- (f) A revised Residential Density Code Plan, consistent with clause 6.3.3 (e) will replace, wholly or partially, the previously approved Plan, and shall then form part of the Structure Plan as outlined in Clause 6.2.2 (d).
- (g) Residential Density Code Plans are not required if the WAPC considers that the subdivision is for one or more of the following:

- i. The amalgamation of lots;
- ii. Consolidation of land for superlot purposes to facilitate land assembly for future development; or
- iii. The purposes of facilitating the provision of access, services or infrastructure.

6.4 Public Open Space

A minimum of 10% Public Open Space (POS) is to be provided at the time of subdivision in accordance with the WAPC's Liveable Neighbourhoods. POS is to be provided generally in accordance with Plan A and Table 4 – POS Schedule, with an updated POS schedule to be provided at the time of subdivision for determination by the WAPC, on the advice of the City of Busselton.

Provision shall be made for an area of unrestricted Public Open Space of between 3,000m² and 5,000m² in size that is irrigated, turfed and suitable for active uses.

6.5 Road Network and Access

All roads within the Structure Plan area are classified as 'Access Street D' pursuant to Liveable Neighbourhoods with the exception of the western access to Caves Road, which is classified as 'Access Street B' as indicated on Plan A – Structure Plan Map.

A 20m wide perimeter road for bushfire separation purposes is to be provided generally in the locations depicted on Plan A – Structure Plan Map. An indicative cross section of the perimeter road along the western edge of lot 4 is depicted at Plan B.

Access to Caves Road and Bussell Highway shall be generally in the locations and format depicted on Plan A. Direct lot access to Caves Road and Bussell Highway is not permitted.

Safe and efficient crossing facilities across Caves Road and Bussell Highway for pedestrians and cyclists are to be provided, including median island refuges, at convenient intervals.

All internal and external connecting path infrastructure (cycle and pedestrian) is to be funded and constructed by the proponent as part of the subdivision works. The path network is to provide safe and direct access to public transport (bus stops).

Caves Road access is to minimise disturbance to Western Ringtail Possum habitat and include remedial works (Possum rope bridges and tree planting) where disturbance is unavoidable and is to minimise the impact to property access on the northern side of Caves Road, where possible.

At subdivision stage, all internal roads, cycle and pedestrian paths are to be designed to achieve a balance between traffic calming, road legibility, and retention of mature trees and vegetation.

6.6 Local Centre

6.6.1 Retail Floor Space

Net Lettable Area is to be substantiated through relevant assessments at scheme amendment or development stages.

6.6.2 Land Use

Land use permissibility is in accordance with Table 1 – Zoning Table of the City's Local Planning Scheme 21, with the exception of the following:

- Residential Aged Care Facility ('A' discretionary use – requires advertising)
- Independent Living Complex ('A' discretionary use – requires advertising)
- Service Station ('X' prohibited use)

6.7 Primary Schools

At the time of subdivision, the WAPC may impose a condition requiring a pro-rata contribution to the Department of Education for the provision of primary schools in the locality. Pro rata contributions are to be in accordance with the WAPC's Operational Policy OP 2.4 Planning for School Sites.

6.8 Road Noise

At the time of subdivision, all lots within the road noise 'trigger distance' as identified by State Planning Policy 5.4 - Road and Rail Noise are to be assessed for traffic noise impacts from Caves Road and Bussell Highway, and mitigation measures are to be applied in accordance with SPP5.4.

7.0 Notifications on Title

In respect of applications for the subdivision of land, the City of Busselton may recommend to the WAPC that condition(s) be imposed on the grant of subdivision approval for a notification to be placed on the Certificate(s) of Title(s) pursuant to s.165 of the *Planning and Development Act 2005* to advise of the following:

- a) Land or lots deemed to be affected by a Bush Fire Hazard as identified in the Bushfire Management Plan (Emerge Associates) contained within Appendix 3.
- b) Land or lots deemed to be affected by coastal inundation in accordance with the City of Busselton Coastal Hazard and Risk Management Adaptation Plan and State Planning Policy 2.6 – State Coastal Planning Policy.
- c) Land or lots deemed to be in close proximity to known mosquito breeding areas.

8.0 Further Subdivision Reporting

As a condition of subdivision approval, the City of Busselton may recommend, and the WAPC may impose conditions requiring the following additional technical reports:

- Urban Water Management Plan.
- Bushfire Attack Level (BAL) Assessment.
- Traffic Noise Assessment.
- Mosquito Management Plan.
- Street Tree Implementation Plan

9.0 Development Contributions

The Structure Plan is located within DCA1 – Community Infrastructure under the City of Busselton Local Planning Scheme 21 and as such is subject to development contributions for community and service infrastructure located throughout the City of Busselton.

All shared infrastructure within the Structure Plan area, including the distribution of public open space, is to be funded via private agreement between landowners.



- STRUCTURE PLAN NOTES**
1. Future road connection to Vasse North to be constructed by others.
 2. The 2 stage T Intersection to Caves Road is to be designed and located as to minimise impacts on existing vegetation within the Caves Road reserve.
 3. The future alignment of the pedestrian / cycle linkage to Buayanyup Drain is to be designed to minimise impacts on the floodway.
 4. Pedestrian access between the Local Centre and Monaghans Store is to be confirmed at the development application stage for the Local Centre (lot 402).
 5. Existing homestead lot is to be retained on 4,000m² (approximate) residential zoned lot with a density code of R2.5 to prevent further subdivision.

LOCAL STRUCTURE PLAN
 LOTS 4 & 12 CAVES ROAD & LOTS 14, 15 & 402 BUSSELL HIGHWAY, ABBEY.

NOTE:
 Base Data supplied by Landgate / Denada Surveys
 Aerial Photo - Jan 2023
 Projection - BCGD4
 Areas and dimensions shown are subject to final survey calculations.

Revision	Date	Item
F	26/7/24	Remove PCS nbs from R10 SE corner
E	14/5/24	Revise as per COB comments
D	7/5/24	Revise as per most recent concept
C	15/1/22	Revise as per most recent concept

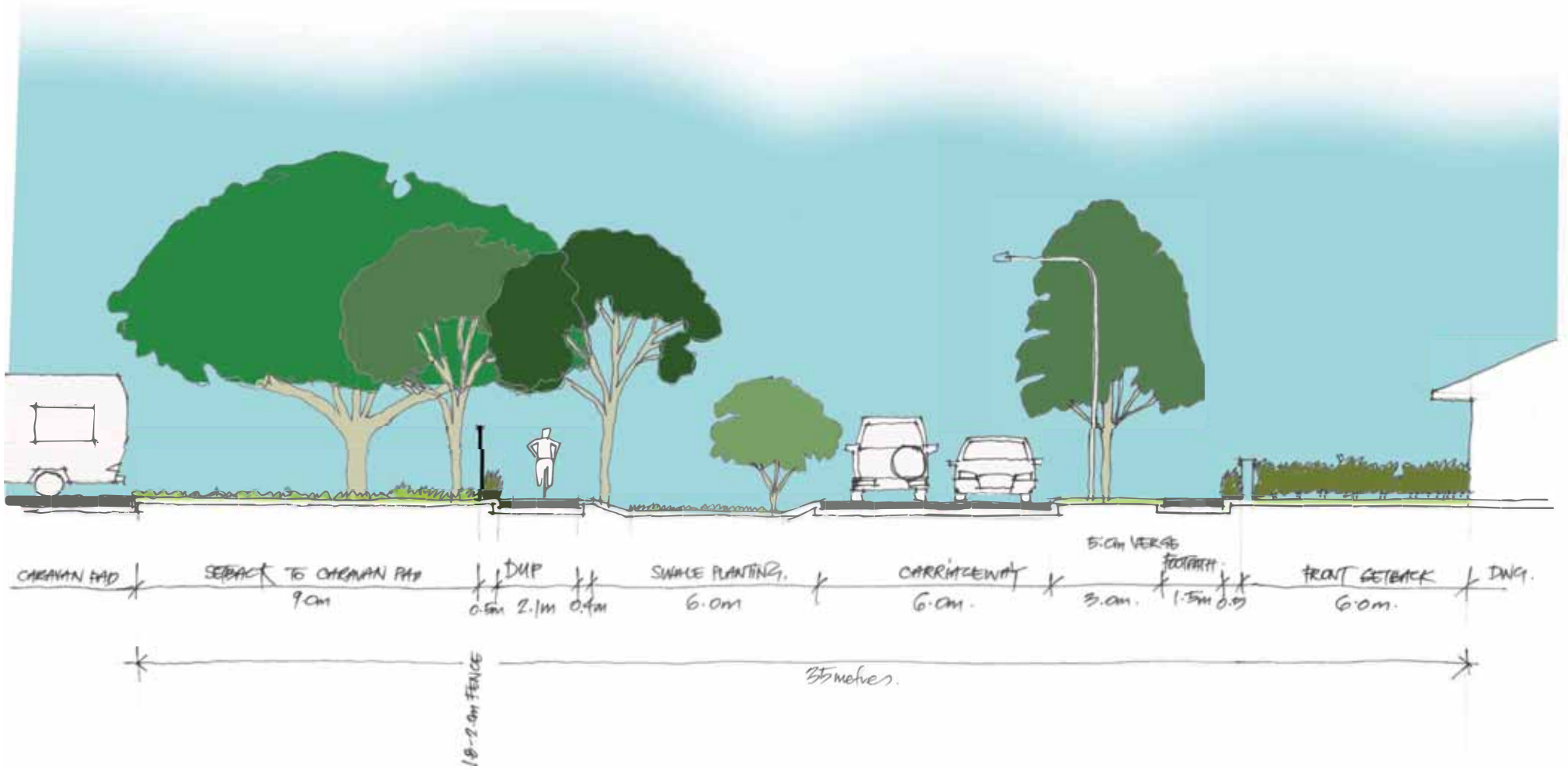
LEGEND

	STRUCTURE PLAN BOUNDARY		RECREATION RESERVE		PERIMETER ROAD
	RESIDENTIAL R2.5		LOCAL CENTRE (R80)		ACCESS STREET B
	RESIDENTIAL R10		FLOODWAY		HIGHER ORDER CYCLE PATH
	RESIDENTIAL R20				ACCESS STREET D (INDICATIVE ONLY)
	RESIDENTIAL R20 - R40				EMERGENCY SECONDARY EGRESS
	RESIDENTIAL R60				PEDESTRIAN LINK

	FUTURE PEDESTRIAN / CYCLE CONNECTION TO BUAYANYUP DRAIN CYCLE PATH
	POS NUMBER
	CUL DE SAC
	ROUNDABOUT
	2 STAGE "T" INTERSECTION
	LEFT IN / LEFT OUT INTERSECTION

-	: CLIENT
A3@1:2,500	: SCALE
26 July 2024	: DATE
IA Abbey-2-001	: PLAN No
F	: REVISION
C.L.	: PLANNER
B.L.	: DRAWN





Rise Urban

AGILE PLANNING FOR THE NEW NORMAL

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Abbey South Structure Plan
Part II – Explanatory Report
June 2024

Contents

Introduction and Purpose	4		
Part 1 - Site Context	5		
1.1 Legal Description and Ownership	5		
1.2 Location	6		
1.3 Site Description and Existing Land Uses	7		
1.4 Surrounding Land Uses	9		
Part 2 - Planning Context	11		
2.1 City of Busselton Local Planning Scheme 21	11		
2.1.1 Landscape Value Area	11		
2.1.2 Floodway and Wetland Areas	11		
2.2 Leeuwin-Naturaliste Sub-regional Strategy	13		
2.3 Statement of Planning Policy 6.1 Leeuwin Naturaliste Ridge Policy	15		
2.4 City of Busselton Local Planning Strategy (City of Busselton, 2019)	19		
2.5 State Planning Policy 2.6 – State Coastal Planning Policy (WAPC, 2013)	19		
2.6 State Planning Policy 3.7 – Planning in Bushfire Prone Areas (WAPC, 2015)	20		
2.7 State Planning Policy 5.4 – Road and Rail Noise (WAPC, 2019)	20		
2.8 Liveable Neighbourhoods Operational Policy (WAPC, 2009)	20		
Part 3 : Site Conditions, Opportunities and Constraints	21		
3.1 Vegetation and Flora	21		
3.2 Fauna	21		
3.3 Landform and Landscape	21		
3.4 Floodways and Wetlands	22		
3.5 Surface and Groundwater	23		
3.6 Bushfire	23		
3.7 Aboriginal and European Heritage	23		
3.8 Regional Road Network – Access and Capacity	23		
3.8.1 Future Regional Road Network	25		
3.8.2 Access to the Regional Road Network	25		
3.9 Traffic Noise	25		
3.10 Servicing	27		
3.10.1 Earthworks	27		
3.10.2 Wastewater	27		
3.10.3 Reticulated Water	27		
3.10.4 Underground Power	27		
3.10.5 Gas	27		
3.10.6 Telecommunications	27		
Part 4 – Abbey South Structure Plan	29		
4.1 Structure Plan Guiding Principles	29		
4.2 Urban Form	29		
4.3 Land Use	32		
4.4 Housing Density and Yield	32		
4.5 Open Space	32		
4.5.1 Open Space Principles	33		
4.5.2 Open Space Investigation Area	33		
4.5.3 Public Open Space Schedule	35		
4.5.4 Public Open Space Description	36		
4.6 Drainage and Water Management	38		
4.6.1 Water Supply and Conservation	39		
4.6.2 Stormwater Management	39		
4.6.3 Groundwater Management	39		
4.7 Bushfire Mitigation	39		
4.8 Road Network	40		
4.8.1 Access to the Regional Network	40		
4.8.2 Internal Road Network	40		
4.8.3 Pedestrian and Cyclist Network	40		
4.9 Delivery Staging and Development Contributions	42		

List of Tables, Figures and Appendices

Tables

1. Abbey South Structure Plan Property Description
2. Wetland Amenity Area Policies
3. SPP 5.4 Noise Targets
4. Public Open Space Schedule

Figures

1. Location Plan
2. Site Plan
3. Context Plan
4. LPS21 Zoning Plan
5. Leeuwin – Naturaliste Sub-regional Strategy Map
6. SPP 6.1 – Land Use Strategy Plan
7. Floodway and Waterway Features Mapping
8. BAL Contours
9. Sewer Pump Station
10. Abbey South Structure Plan
11. Abbey South Concept Plan
12. Abbey South Landscape Concept
13. Public Open Space 1 Landscape Concept
14. Drainage Strategy
15. Road Hierarchy Map
16. Perimeter Road Cross Section
17. Preliminary Staging Plan

Appendices:

1. Environmental Assessment – Emerge Associates
2. Local Water Management Strategy – Emerge Associates
3. Bushfire Management Plan – Emerge Associates
4. Traffic and Transport Assessment – Stantec
5. Servicing Strategy – Stantec
6. POS and Landscape Strategy – Emerge Associates
7. Abbey South Structure Plan and Concept Plan – Rise Urban and Studio CFM
8. Open Space Investigation Report – Rise Urban



Introduction and Purpose

This Structure Plan has been prepared in accordance with the obligations set out under Part 4 – Structure Plans of Schedule 2 – Deemed Provisions of the *Planning and Development (Local Planning Schemes) Regulations 2015*.

The purpose of this Structure Plan is to establish a contemporary planning framework that provides for future subdivision and development of the Abbey South precinct. Significantly, the Structure Plan not only establishes the spatial context for future subdivision, but also investigates the physical and environmental attributes of the 'Public Open Space Investigation' area that is identified in the Leeuwin – Naturaliste Sub-regional Strategy, and determines the extent of this area that should be set aside as public open space to provide for drainage, conservation and recreation.

Overall, the Structure Plan aims to enable development of the precinct into a residential community with a mix of housing densities and typologies that respond to the local conditions, while addressing and responding to all site features.

This Structure Plan also informs and will be processed in parallel with an amendment to the City of Busselton Local Planning Scheme 21 (LPS21) to rezone the Abbey South area from the Rural and Conservation zones to the Urban Development zone. The Urban Development Zone provides the head of power to enable this Structure Plan to be determined pursuant to clause 15 of Schedule 2 – Deemed Provisions of the *Planning and Development (Local Planning Schemes) Regulations 2015*.

This report is the explanatory report for the Structure Plan, and is to be read in conjunction with the Part 1 Implementation Report, as well as the Structure Plan Map which is contained in the Implementation Report.

Consistent with clause 27 of the Deemed Provisions, this Structure Plan is a 'due regard' document for the purposes of assessing and determining subsequent subdivision and development applications.



Part 1 – Site Context

The following sections provide an overview of the physical and legal context of the Structure Plan area.

1.1 Legal Description and Ownership

The Structure Plan area comprises the entirety of five freehold lots within the former Abbey Planning Investigation Area as defined in the Leeuwin Naturaliste Sub-regional Strategy, totaling 30.5ha. Table 1 below summarises the legal description and ownership of each of the five lots.

Table 1 – Abbey South Structure Plan Property Description

Lot Number	Street Address	Street	Diagram	Land Area (ha)	Owner
12	N/A	Caves Road	43998	2.68	Lowé Pty Ltd and Lukin Pty Ltd
4	63	Caves Road	46285	23.91	Michael Stewart and Venetia Bennett
402	12	Caves Road	252489	0.58	Donna Michelle Carlyle, Christopher Ronald Carlyle
14	5840	Bussell Highway	96590	2.77	Thomas Benford Norris, Judith Doris Driver
15	5842	Bussell Highway	96590	0.56	Erica Pauline Maisey

All of the landowners within the Structure Plan area have provided their consent and support for the progression of planning over their land.



1.2 Location

The Abbey South Structure Plan area is located within the City of Busselton municipality in the south-west of Western Australia. It can be generally described as the land immediately to the west of Bussell Highway and south of Caves Road in the Busselton suburb of Abbey.

The Structure Plan area is located approximately 8.5km west of the Busselton town centre, 15.5km east of the Dunsborough town centre, and approximately 2km north of the Vasse town centre. It comprises a significant portion of the last remaining undeveloped land with significant development potential north of Busselton Bypass and within the Busselton township.

A location plan is provided at Figure 1.

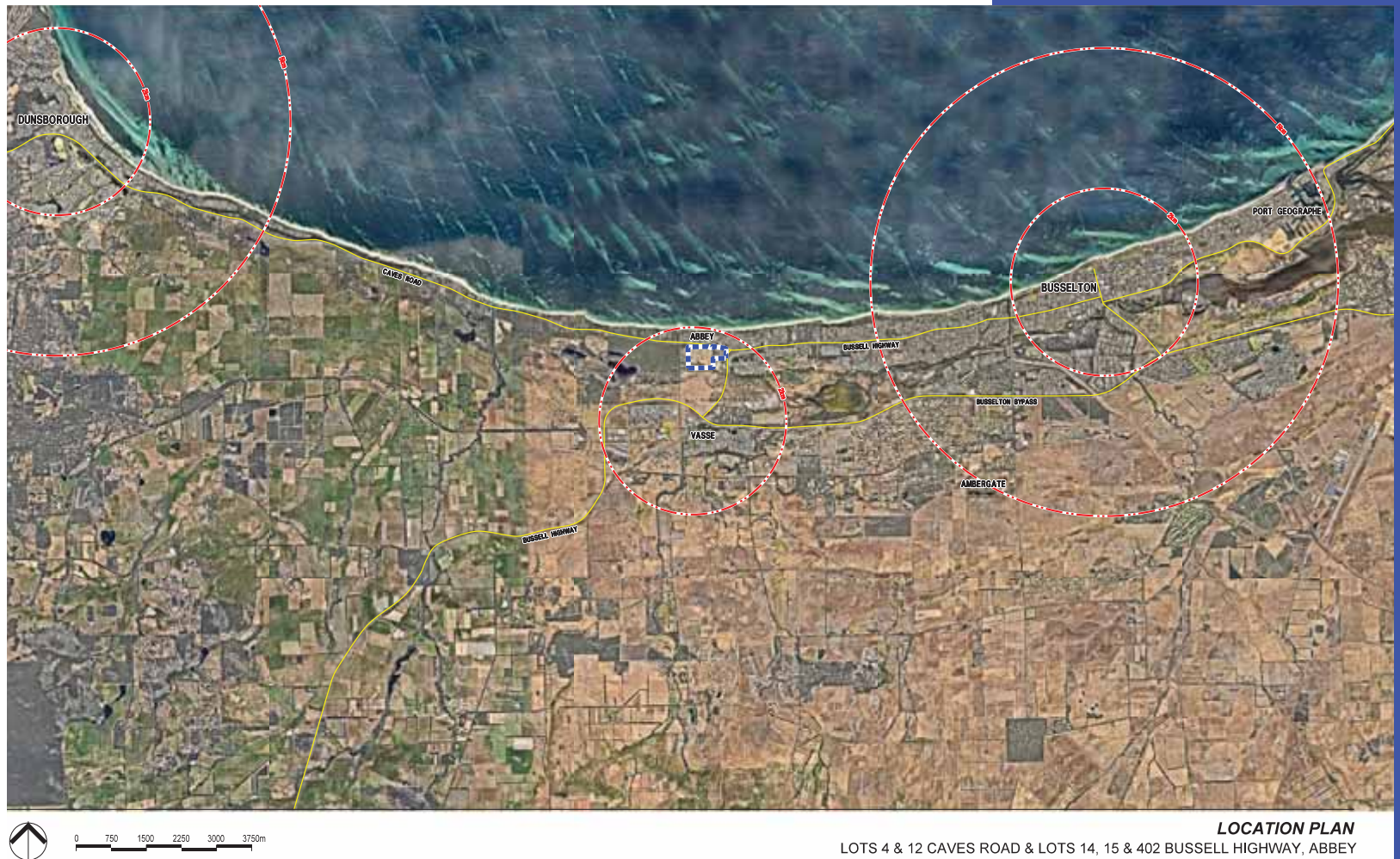


Figure 1 Location Plan

1.3 Site Description and Existing Land Uses

The Structure Plan area comprises approximately 30.5ha of land. The following sets out a brief description of the current land use and physical context of the site, while a site plan is provided at Figure 2.

The Structure Plan area is characterised by rural land uses to the north and west and an eclectic mix of rural-residential, tourism and commercial uses along the eastern edge fronting Bussell Highway.

Lots 4 and 12 Caves Road – together forming the northern interface to Caves Road, are both parkland cleared with scattered peppermint trees across Lot 4, and a strip of mature trees forming the boundary between the two properties. Both properties have previously been used for cattle grazing. Lot 12 is currently unused and vacant. Lot 4 has two separate dwellings at the northern and southern ends of the property, with the remainder of the property being used for cattle grazing.

The predominantly cleared and undeveloped nature of both lots lends itself to more intensive land uses, with opportunities to retain mature vegetation within open space and road reserves. The southern portion of Lot 4 is lower lying and some of it is prone to seasonal inundation.

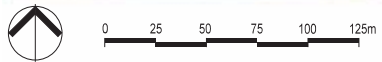
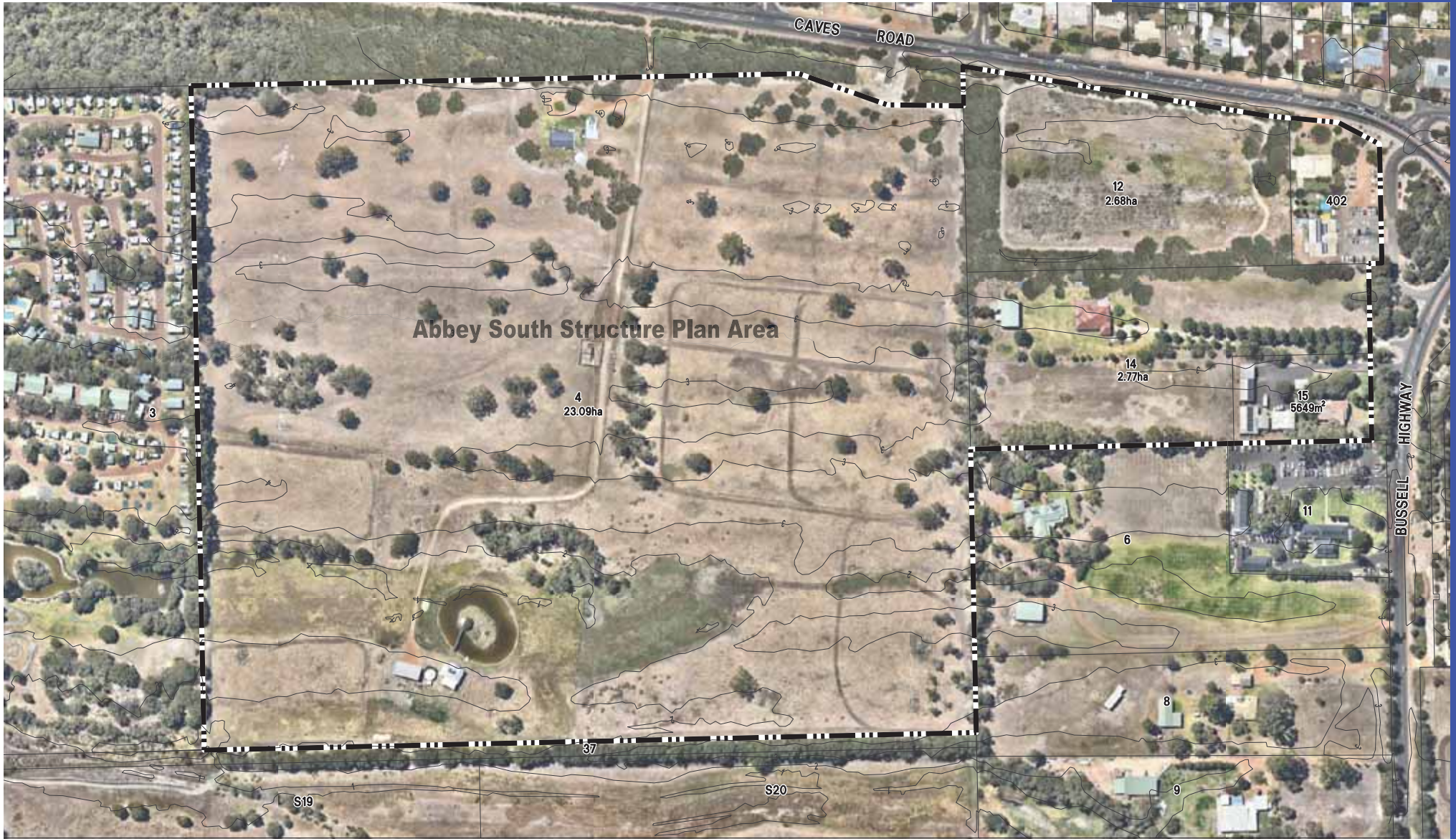
Lots 4 and 12 are screened from Caves Road by a continuous strip of dense, mature vegetation located within the Caves Road reserve. The retention of this vegetation within the Caves Road reserve ensures that the landscape and viewscape when viewed from Caves Road will be largely unaltered by development within the Structure Plan area.

Lot 402 is located on the corner of Bussell Highway and Caves Road and is currently occupied by 'The Shed Markets' – a popular local market selling fresh local produce, prepared food and coffee. The Shed Markets provides a unique opportunity for early amenity and a sense of place as the surrounding land uses evolve. There is an existing older style single dwelling on the north side of the Shed Markets with two separate crossovers to Caves Road.

Lot 14 is a rural residential property to the south of Lots 402 and 12. Lot 14 is improved by a large single dwelling and associated outbuildings. Lot 14 is separated from the lots to the north and west by a strip of mature peppermint trees, providing interim opportunities for screening and amenity if Lots 4 and 14 develop at different times. Lot 14 has an existing paved driveway and crossover access to Bussell Highway.

Immediately adjacent to the east and south of Lot 14 is the Busselton Ice Supply (Lot 15), which is an existing commercial / light industrial use supplying ice and cold storage facilities. Lot 15 is occupied by a number of large sheds and warehouses, as well as an older style single dwelling located towards the front (east) of the property. Both the Busselton Ice Supply business and the single dwelling have separate crossovers and access to Bussell Highway. Intensification and future subdivision of the Structure Plan area creates an opportunity to consolidate these access points to Bussell Highway, improving efficiency and safety on this stretch of the highway.





SITE PLAN
 LOTS 4 & 12 CAVES ROAD & LOTS 14, 15 & 402 BUSSELL HIGHWAY, ABBEY

Figure 2 Site Plan

1.4 Surrounding Land Uses

The Structure Plan area is framed on all sides by boundary-defining natural and man-made land uses which combine to make the site a self-contained enclave that is well suited to urbanisation without encouraging further sprawl into less suitable areas. A context plan is provided at Figure 3 and demonstrates the self-contained nature of the site.

The Structure Plan area is bordered by Bussell Highway and Caves Road on its eastern and northern boundaries respectively. Having regional roads on two sides is a significant advantage as it provides for a range of access options, ensures the early delivery of key service infrastructure (which is typically located within the regional road reserves) and avoids congestion on existing local roads. Intensification of land uses adjacent to regional roads is a sound planning principle as it makes efficient use of the existing infrastructure, and prevents undue pressure from being applied to less suitable roads and infrastructure elsewhere. The opposite sides of both Caves Road and Bussell Highway are developed with low to medium density urban residential uses, while a small local commercial centre is located on the north side of the Bussell Highway / Caves Road roundabout, providing local retail convenience for surrounding residents.

To the south east of the Structure Plan area are Lots 6, 8 and 11 Bussell Highway. Lots 6 and 8 are used for rural residential purposes. Lot 11 accommodates the Amelia Park Lodge – a popular hospitality complex incorporating a restaurant, tavern and guest accommodation, as well as the heritage listed Newtown House – an 1850s limestone homestead. Like The Shed, the Amelia Park Lodge is a fantastic opportunity to leverage early amenity and a sense of place for residential and ‘urban’ style development within the adjoining Structure Plan area.

Adjacent to the western edge of the site is the existing RAC Busselton Holiday Park, a large scale holiday park including

chalets / cabins, camping and caravan sites, as well as an extensive range of recreation infrastructure and amenities in a landscaped setting. Direct interface between holiday parks and more traditional residential development is common in the western part of Busselton, and has been managed through the Structure Plan design process such that the amenity of both the holiday park users and the permanent residents will be adequately protected.

At present there is no safe pedestrian or cycle connection between the RAC Busselton Holiday Park and The Shed Markets, Amelia Park Lodge, and other non-residential, high amenity uses further to the east. The Structure Plan is an opportunity to connect these two uses via a series of pedestrian and cycle friendly links located away from the busy Caves Road and Bussell Highway.

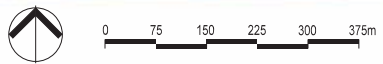
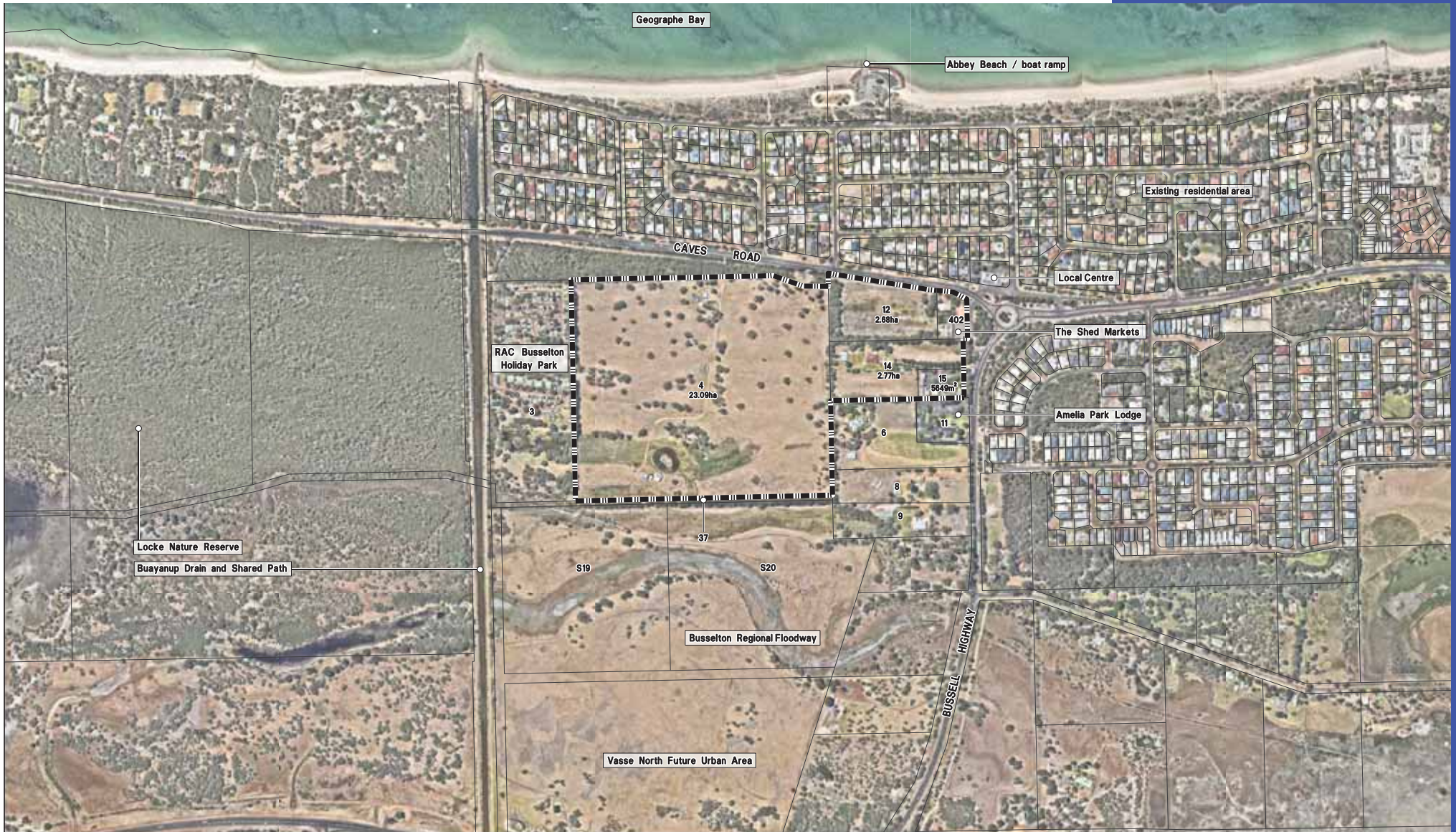
Buanyanyup Drain is located west of the Holiday Park. The Buanyanyup Drain forms the lower portion of the Buanyanyup River system and has been artificially straightened into a drain for several kilometres before the river meets Geographe Bay at Abbey beach. The Structure Plan area is not within the Buanyanyup catchment, however flooding of the drain during peak storm events and the potential for inundation over portions of the site is an important consideration, and has been addressed in the Local Water Management Strategy that accompanies this Structure Plan.

Locke Nature Reserve is located immediately to the west of Buanyanyup Drain (220m west of the Structure Plan area). The Locke Nature Reserve is a 220ha, publicly accessible nature reserve that provides a conservation and passive recreation function for the Busselton and Dunsborough communities. In contrast to the Structure Plan area it is heavily vegetated, and largely undisturbed by rural or urban land uses. The proximity of the Structure Plan area to the Locke Nature Reserve is an ideal opportunity to create a unique sense of place and to encourage future residents to take on a high level of local custodianship

of this reserve. It also provides a clear demarcation and permanent ‘green belt’ between the settlements of Abbey to the east and greater Dunsborough to the west.

The southern boundary of the Structure Plan area is framed by Lot 37 (Reserve 44754) which is Crown land under the care and control of the City of Busselton, and is a 10m wide unmade road reserve often referred to as Fox Road. Fox Road contains a strip of planted peppermint trees and eucalypts, and forms a natural bund between the southern extent of the Structure Plan area (which sits at around 2.5m-3m AHD on the southern boundary) and the lower lying floodway further to the south which sits at around 1m AHD. Lot 37 and the floodway provide both a natural and cadastral boundary between the Structure Plan area and the surrounding rural areas. There is an opportunity to utilise Fox Road to connect through to the existing cycle way along the edge of the Buanyanyup Drain, and provide direct cycle and pedestrian access to the existing schools, retail facilities and amenities at Vasse to the south.

The area to the south of Fox Road, commonly referred to as Vasse North, is also identified for future urban purposes in the Leeuwin - Naturaliste Sub-regional Strategy. It is understood that there are no current proposals to rezone this land, and that further investigations into the suitability of the northern portions of the Vasse North site for urban development are required prior to any formal planning being progressed over the site.



CONTEXT PLAN
 LOTS 4 & 12 CAVES ROAD & LOTS 14, 15 & 402 BUSSELL HIGHWAY, ABBEY

Figure 3 Context Plan

Part 2 – Planning Context

The following provides a brief synopsis of those planning instruments and decisions that are directly relevant to the Structure Plan.

2.1 City of Busselton Local Planning Scheme 21

The City of Busselton Local Planning Scheme 21 (LPS21) forms the primary statutory land use control over the Structure Plan area. There is no higher-order region scheme or similar applicable to the Structure Plan area.

At present LPS21 zones the majority of the Structure Plan area, including the entirety of lots 12, 402, 14 and 15 and the northern half of lot 4 as 'Rural'. The Rural zoned portion of the Structure Plan area is not affected by any special control areas or similar.

The southern portion of lot 4, along with the lower lying land to the south is zoned 'Conservation'. It is unclear as to how the zoning boundary between the Conservation and Rural zones on lot 4 was derived as it does not correspond to any specific natural feature on the site (i.e. contours, vegetation, wetlands etc). As discussed further in the following section, the detailed environmental investigations have confirmed that there are no specific conservation-worthy features within this portion of the Conservation zone.

The Conservation zoned portion of lot 4 is identified in the WAPC's Leeuwin - Naturaliste Sub-regional Strategy as 'Public Open Space Investigation' and requires further investigation into its suitability for public open space as part of the structure plan process. This Structure Plan is the mechanism through which these further investigations can occur.

A Scheme amendment request has been lodged with the City of Busselton concurrently with this Structure Plan to rezone the Structure Plan area to the 'Urban Development' zone; thereby providing a head of power for this Structure Plan to proceed and be determined.

LPS21 identifies three separate Special Control Areas (SCAs) over the southern portion of the Structure Plan area within Lot 4, being Landscape Value, Floodway and Wetland. Consideration of these SCAs and the values that they contain is discussed below

2.1.1 Landscape Value Area

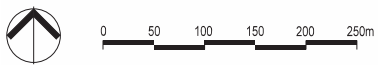
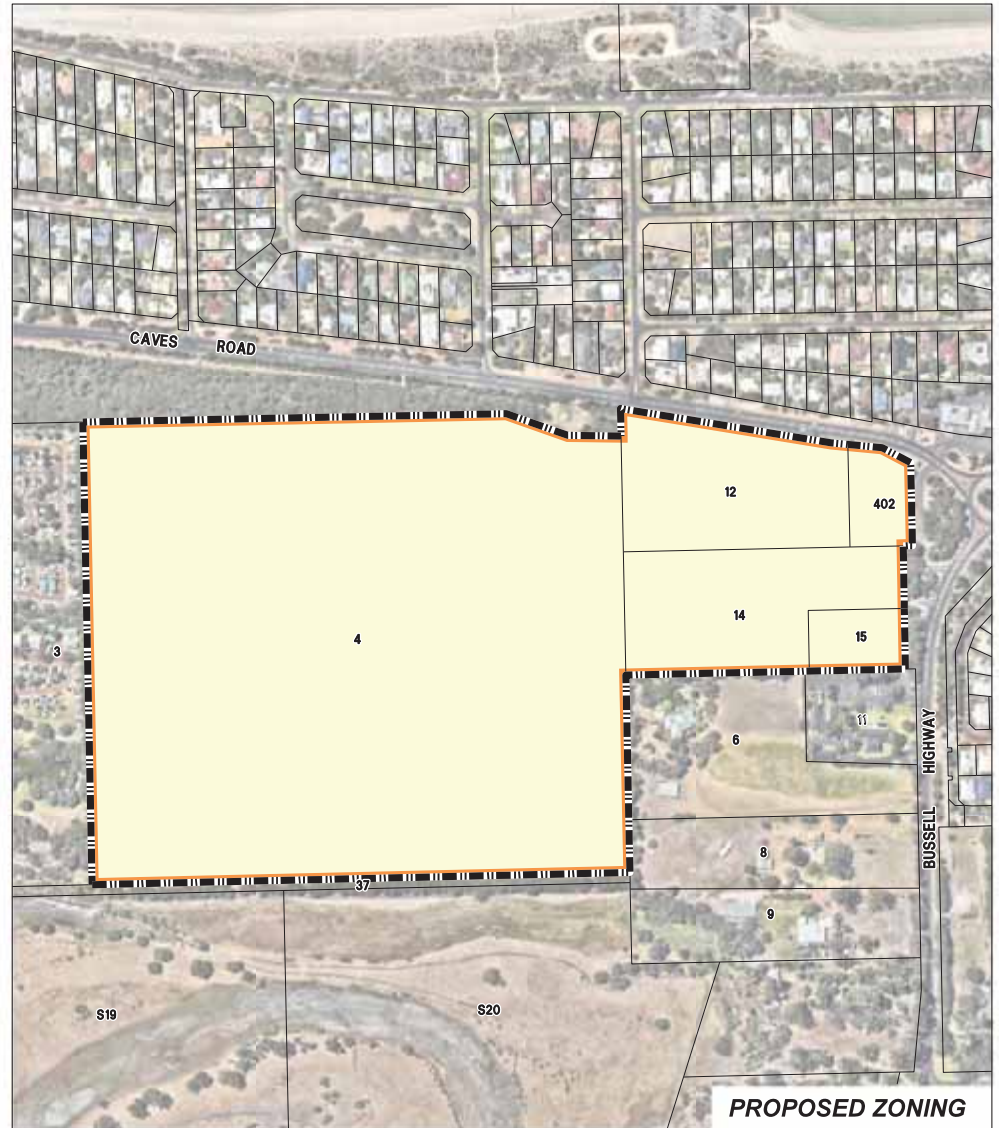
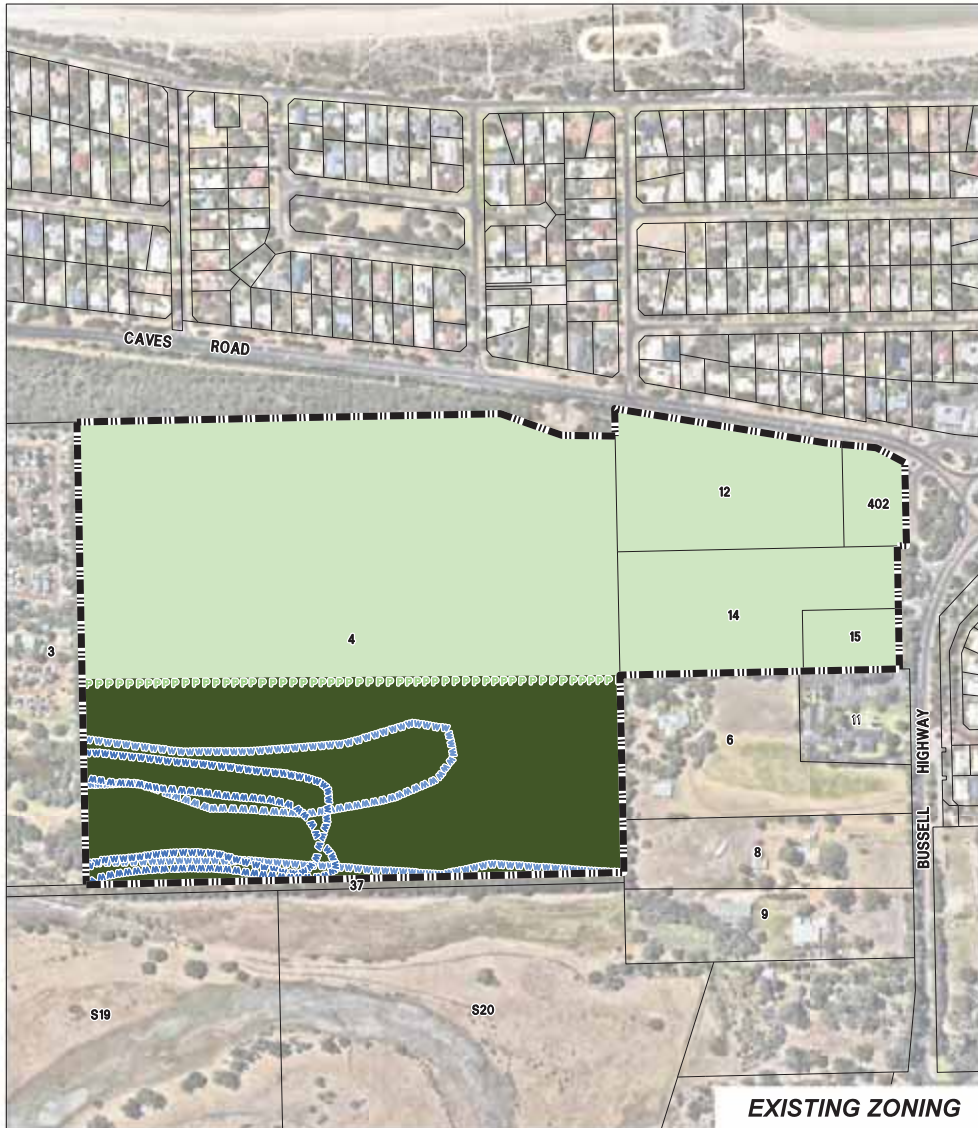
The portion of Lot 4 that is currently zoned 'Conservation' is also located within the Landscape Value Area SCA. All clearing and development in the Landscape Value area requires development approval from the City of Busselton, and these proposals are required to be compatible with the existing landscape, viewscape or environmental values associated with the area. The Scheme amendment removes the Landscape Value Special Control area from the Structure Plan area, as the SCA will no longer be necessary to protect the landscape values once the Structure Plan is in place.

2.1.2 Floodway and Wetland Areas

Irregular parts of the southern portion of Lot 4 (in the current 'Conservation' zone) are located within the Floodway Area and Wetland Area SCA. The mapped floodway within lot 4 is essentially a small 'offshoot' of the main floodway located further to the south and outside of the subject area.

A map depicting the current and proposed LPS21 zoning and Special Control Areas is shown at Figure 4.





LPS21 ZONING PLAN
 LOTS 4 & 12 CAVES ROAD & LOTS 14, 15 & 402 BUSSELL HIGHWAY, ABBEY

Figure 4 LPS21 Zoning Plan

2.2 Leeuwin-Naturaliste Sub-regional Strategy

The *Leeuwin-Naturaliste Sub-regional Strategy* (“the Strategy”) was published by the WAPC in May 2019. The Strategy is an overarching strategic land use planning document outlining the WAPC’s approach to future planning and development within the City of Busselton and the Shire of Augusta-Margaret River over the next 20 years.

The 2019 version of the strategy identified five Planning Investigation Areas, of which the Abbey South Structure Plan area was one. These five PIAs were assessed and considered by the WAPC in November 2021, where in relation to the Abbey PIA, the WAPC resolved to:

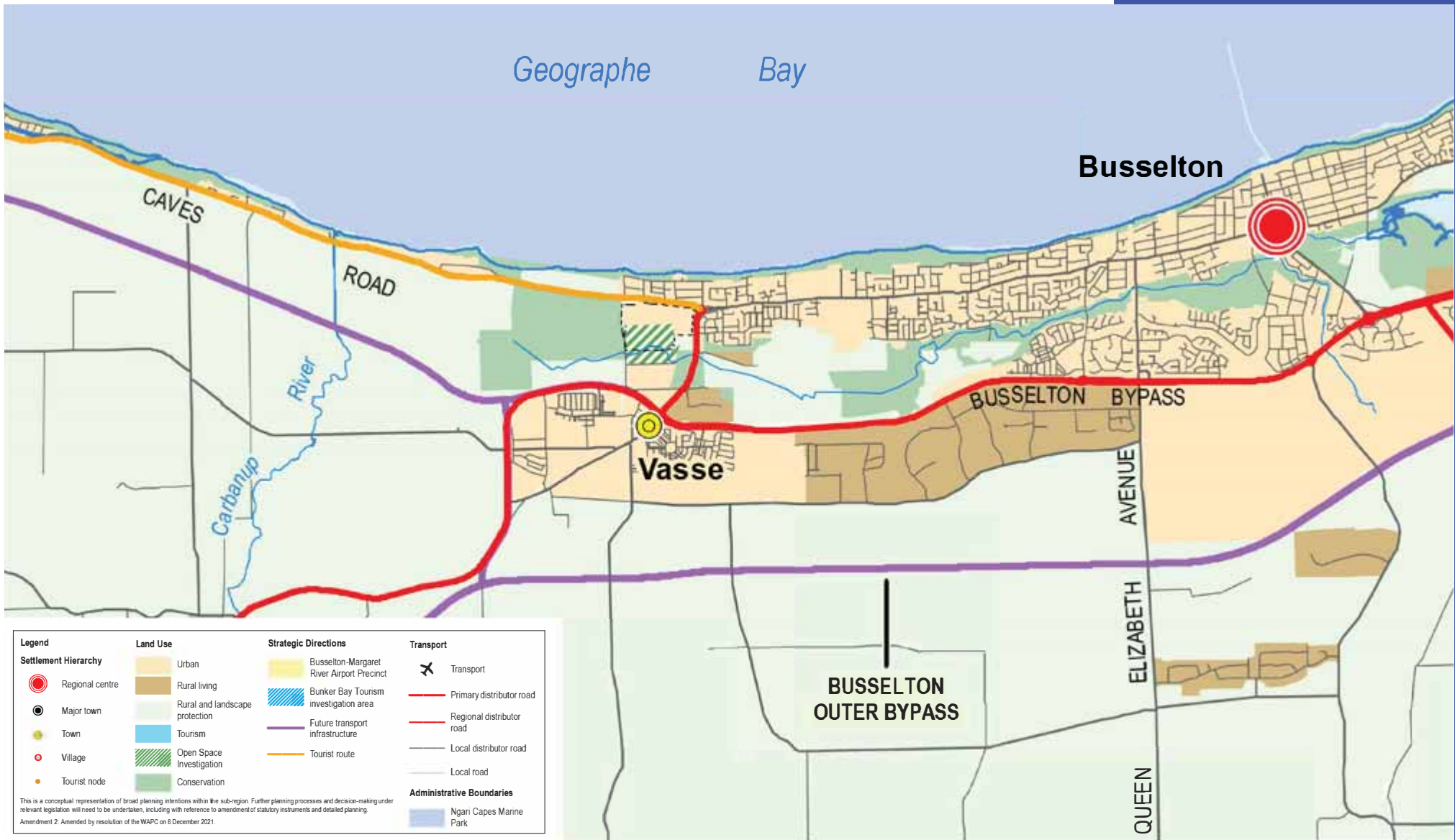
1. Designate the following lots as ‘Urban’:
 - Lot 12 on Diagram 43998
 - Lot 14 on Diagram 96590
 - Lot 15 on Diagram 96590
 - Lot 402 on Deposited Plan 252489
 - Northern portion of Lot 4 on Diagram 46285
2. Designate the following lots as ‘Open Space Investigation’:
 - Southern portion of Lot 4 on Diagram 46285.
3. Remove the Abbey Planning Investigation Area from the Strategy Plan.
4. Require the preparation of a single structure plan over the entirety of the land identified in (1) and (2) above. In addition to the information to be included in a structure plan outlined in Clause 16 of the Deemed Provisions, the structure plan is to set out the following:
 - a water management report that takes into consideration the land to the south and addresses all water-related matters relevant to the proposal.
 - measures to manage risk from coastal inundation.
 - open space requirements.

It is on the basis of this resolution of the WAPC that this Structure Plan has been prepared. The specific considerations relating to water management, coastal inundation and open space requirements are addressed in subsequent sections and appendices of this report.

In relation to the Open Space Investigation designation, it was agreed with the WAPC in November 2021 that this Structure Plan is the appropriate vehicle to determine the full extent of the open space area in the south of Lot 4. Further, it was acknowledged that the Open Space Investigation area does not necessarily dictate that the land should be set aside for conservation or recreation purposes. Rather, it was intended that the Structure Plan should determine the extent of land needed for flooding, drainage, conservation and recreation purposes and ensure that this land is integrated into the broader urban area. The Structure Plan has been designed to achieve this.

A copy of the Strategy Map for Geographe Bay area (as amended by WAPC in 2021) is shown at Figure 5.





LEEWIN NATURALISTE SUB-REGIONAL STRATEGY MAP (EXTRACT)
 LOTS 4 & 12 CAVES ROAD & LOTS 14, 15 & 402 BUSSELL HIGHWAY, ABBEY

Figure 5 Leeuwin-Naturaliste SR Strategy

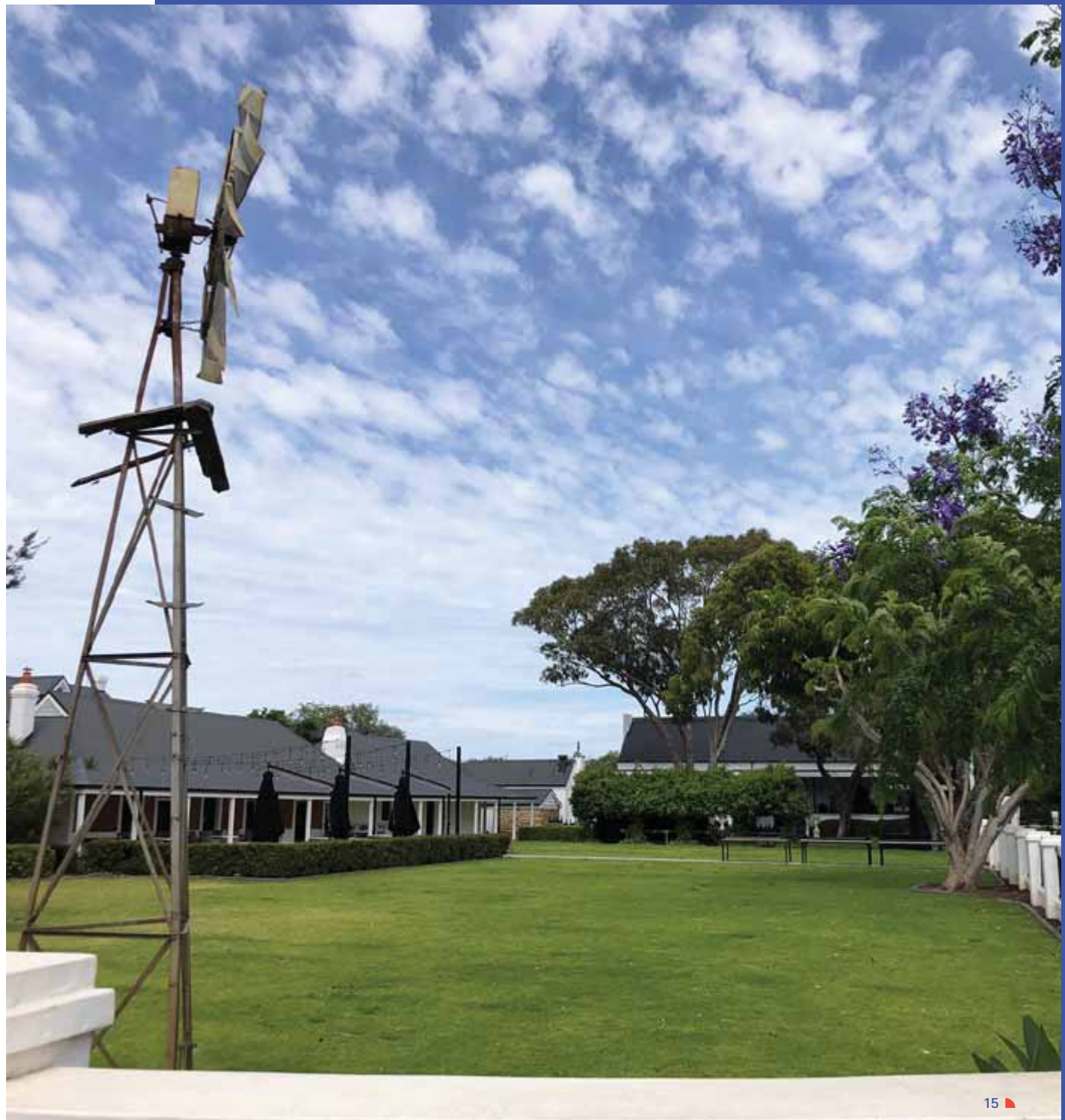
2.3 Statement of Planning Policy 6.1 Leeuwin Naturaliste Ridge Policy

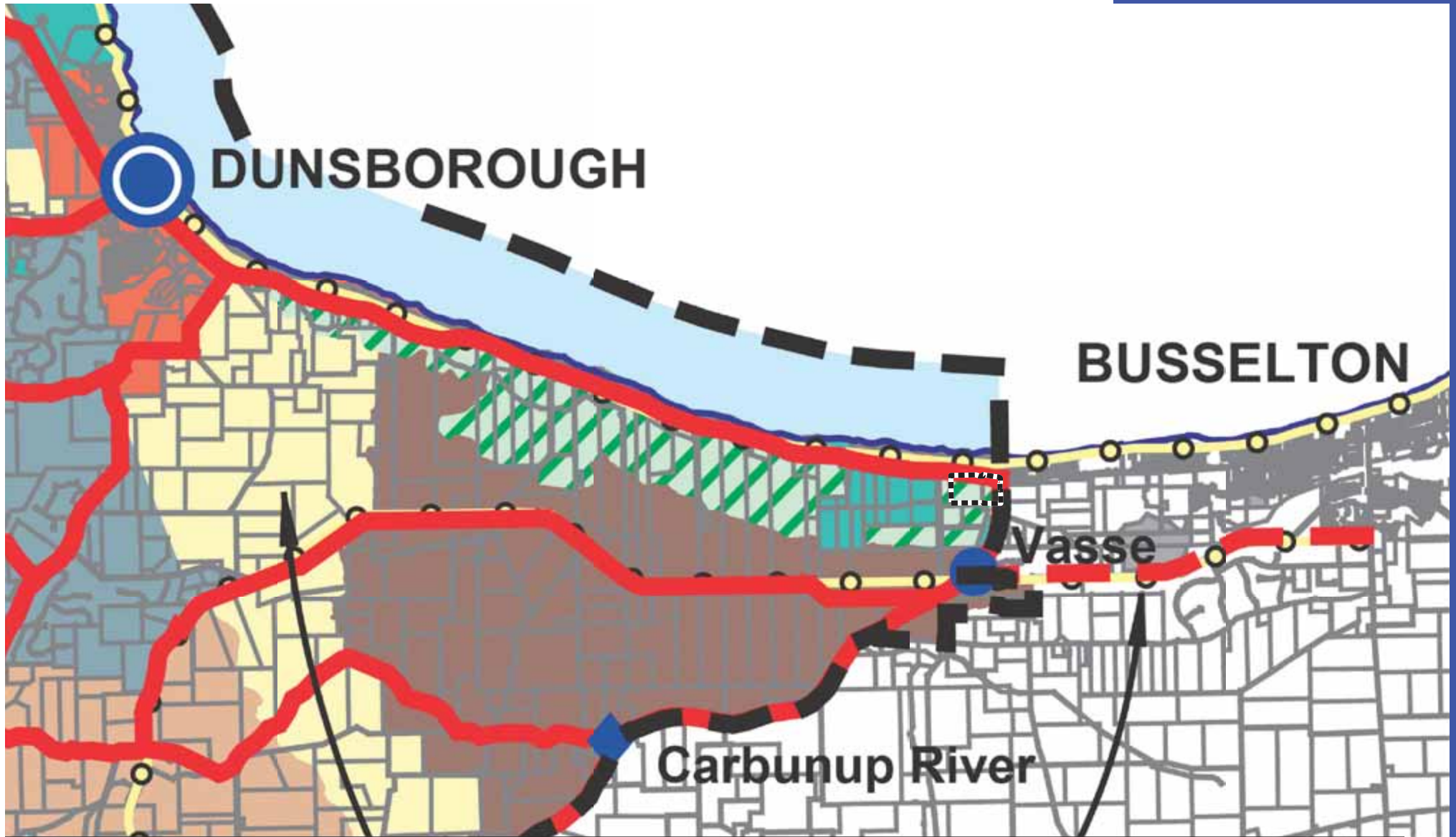
Statement of Planning Policy 6.1 – *Leeuwin-Naturaliste Ridge Policy* (SPP 6.1) sets out the principles and considerations for land use and development decision-making in the Leeuwin-Naturaliste Ridge. The Structure Plan area is located in the north eastern periphery of the policy area.

SPP 6.1 was published in 1998 with an intended lifespan of 30 years and has not been substantially reviewed or amended since then. The *Leeuwin – Naturaliste Sub-regional Strategy* identifies the review of SPP 6.1 as a key priority. Although SPP 6.1 is approaching the end of its lifespan, the vision and overall objectives for the Leeuwin-Naturaliste Ridge identified by SPP 6.1 remain relevant and important to the growth of the Policy area, and the Structure Plan area.

This Structure Plan meets the vision and objectives of SPP 6.1 by catering for population growth within an identified Structure Plan area, responding to adjacent commercial and tourism land uses and conserving and enhancing environmental values that have been confirmed are applicable to the Structure Plan area.

SPP 6.1 also includes a Land Use Strategy which identifies preferred land uses throughout the policy area and establishes specific land use policies. The Land Use Strategy identifies the Structure Plan area, along with land to the south as *Wetland Amenity Area*. An extract from the Land Use Strategy Plan of SPP 6.1 is shown at Figure 6.





SPP 6.1 LAND USE STRATEGY PLAN (EXTRACT)
 LOTS 4 & 12 CAVES ROAD & LOTS 6, 8, 11, 14, 15 & 402 BUSSELL HIGHWAY, ABBEY

Figure 6 SPP6.1 Land Use Strategy Map

The land use policies applicable to the Wetland Amenity Area are set out in Table 2 below.

Table 2 – Wetland Amenity Area Policies

Policy Number	Policy	Abbey South Structure Plan response
LUS 3.28	<i>Proposals for subdivision, development and land use within the designated Wetland Amenity Areas will be assessed for their compatibility with wetland conservation.</i>	<p>The Structure Plan does not contain any mapped or recognised wetlands of significance (conservation or resource enhancement category wetlands). The site does contain two Multiple Use wetlands, however these lower-order wetlands are generally considered to be compatible with urban development and do not require retention or rehabilitation.</p> <p>This Structure Plan is supported by a detailed Environmental Assessment (refer Appendix 1) which assesses both the presence of wetlands within the Structure Plan area, as well as the compatibility of development over the Structure Plan area with wetlands in adjoining areas. The Environmental Assessment confirms that the majority of the Structure Plan area is capable of urban development, subject to floodway areas being provided as public open space.</p>
LUS 3.29	<i>Development near the coast will conform with Department of Transport and Ministry for Planning guidelines as reflected in the proposed Shire of Busselton District Planning Scheme.</i>	<p>It is understood that this provision relates to coastal planning, in which case State Planning Policy 2.6 – State Coastal Planning is now the primary planning instrument. The suitability of the Structure Plan area for urbanisation has been considered against the policy framework of SPP 6.1 and the City of Busselton’s Coastal Hazard Risk Management Adaptation Plan. This is discussed further in section 2.5 of this report.</p>
LUS 3.30	<i>Rural landscape and coastal reserve buffers between Abbey and Vasse, and Dunsborough and Abbey will be maintained to avoid urban sprawl and to create distinct communities.</i>	<p>As noted in section 1.4 of this report, the Structure Plan area is framed by rural landscape buffers to the south and west. Given the low-lying nature of the designated floodway over the adjoining land to the south and the heavily vegetated nature and protected status of the Locke Nature Reserve to the west of the Structure Plan area, these buffers between the Structure Plan area and the settlements of Vasse and Dunsborough will be retained in perpetuity, and will not be compromised by the intensification of land use and development over the Structure Plan area.</p>



<p><i>LUS 3.31</i></p>	<p><i>Subdivision and development will be consistent with and complement the existing landscape character of the Quindalup Strip and "Old Dunsborough".</i></p>	<p>The Structure Plan area has been designed to provide for residential development that complements the Quindalup Strip and Old Dunsborough character through landscape design, generous road reserves and retention of existing Peppermint trees where viable to do so. This is balanced with higher levels of housing density and a mix of land uses in portions of the Structure Plan area, as well as the requirements of Liveable Neighbourhoods and contemporary urban design practice. The precise form of any future subdivision will be confirmed at subsequent stages in the planning process.</p>
<p><i>LUS 3.32</i></p>	<p><i>The environmental and recreation values of the Wetland Amenity Area will be protected while facilitating tourism development that responds to the natural and social values of the locality.</i></p>	<p>As demonstrated in Part 3 of this report, the environmental values of the Structure Plan area have been assessed and will be protected as part of public open space areas.</p> <p>Recreational tourism uses are limited to some of the properties fronting Bussell Highway, such as The Shed Market. These uses can be retained, while better connections through to the RAC holiday park, Locke Nature Reserve and southern floodway have been provided to integrate these environmental values with the tourism potential of the area.</p>
<p><i>LUS 3.33</i></p>	<p><i>The landscape separation of Abbey, Vasse and Dunsborough will be maintained.</i></p>	<p>Refer response to LUS 3.30 (above)</p>



In addition to the land use classifications and policy statements discussed above, Figure 3 of SPP 6.1 also classifies the policy area into differing levels of significance with respect to its landscape values and significance.

The landscape character of the southern half of the Structure Plan area is classified in Figure 3 of the Policy as 'General Character' while the north and eastern areas adjacent to Bussell Highway and Caves Road are classified as 'Travel Route Corridor'. When compared to the other landscape classifications set out in SPP 6.1 and noting the location of the Structure Plan on the eastern border of the Leeuwin-Naturaliste Ridge, the landscape values of the Structure Plan area are less significant than those elsewhere on the ridge or within the areas that are mapped specifically for their landscape significance.

SPP 6.1 sets the following policy positions in relation to the landscape values within the Structure Plan area:

- PS 3.2 Development must be responsive to local values, and be compatible with the natural characteristics and traditional settlement patterns of the area.
- PS 3.3 Development will have due regard for the landscape integrity and value of Ridge backdrops when viewed from the coastline, bays or Travel Route Corridors.
- PS 3.7 In areas of General Character, as identified in Figure 3, development or change of use should protect the rural character and conform with policies and guidelines for Travel Route Corridors.

The Structure Plan has been designed to recognise the rural character immediately to the south and generally west through the retention of key areas of vegetation and screening from travel route corridors.

2.4 City of Busselton Local Planning Strategy (City of Busselton, 2019)

The City of Busselton Local Planning Strategy was endorsed by the Western Australian Planning Commission on 13 March 2020 and provides the Council and the community with the vision and strategic planning direction for the City of Busselton for the next 10 to 15 years.

The Local Planning Strategy recognises the Structure Plan area (described as "Abbey South") as an area with significant development potential, and states:

The appropriateness of the area for urban development will be determined via the WAPC's Planning Investigation Area assessment as required by the Leeuwin Naturaliste Sub-Regional Strategy. Other than Port Geographe, this is the last undeveloped coastal or near-coastal land with significant development potential in the Busselton-Vasse Urban Area. Inclusion of housing choice and non-residential land uses are to be considered.

A Planning Investigation Area (PIA) assessment has since been undertaken for Abbey South and concluded that:

The Abbey PIA is well suited to more intensive forms of urban development ... an opportunity exists for the Abbey PIA to respond to the looming land supply issues, and to ensure an adequate supply of affordable land, promoting a variety of housing choice remains available to the Busselton community as it continues to grow.

The Structure Plan provides potential for a range of R-Codes and street block typologies to support the development of different types of housing that is responsive to the housing market, and retain the potential for non-residential development, particularly adjacent to Bussell Highway on the eastern periphery of the Structure Plan area.

The Strategy also identifies the desire to retain a form of 'green belt' between greater Busselton and Dunsborough, and emphasises the need to maintain physical separateness of the settlements. Buayanyup Drain forms a logical hard edge between Busselton and this green belt, and therefore this Structure Plan will not compromise the key objective of maintaining separation between urban settlements.

2.5 State Planning Policy 2.6 – State Coastal Planning Policy (WAPC, 2013)

State Planning Policy 2.6 – State Coastal Planning Policy ("SPP 2.6") is the State Government's response to land use planning in coastal areas throughout Western Australia, and includes specific policy considerations and requirements for both infill and greenfield scenarios across a 100 year planning horizon.

SPP 2.6 requires coastal processes and climate change to be considered in the assessment of planning proposals in coastal areas. These coastal processes include erosion, storm surge and coastal inundation as a result of extreme storm events.

The City of Busselton adopted its *Coastal Hazard and Risk Management Adaptation Plan* ('CHRMAP') in July 2022. The CHRMAP maps the hazards from coastal processes in accordance with the requirements of Schedule 1 of SPP 2.6, and identifies management and mitigation strategies for affected areas.

At its nearest point, the Structure Plan area is approximately 380m south of the current high water mark (referred to as the Horizontal Shoreline Datum or HSD in SPP 2.6). Located between the northern boundary of the Structure Plan area and the HSD is a 250m wide strip of developed residential area comprising approximately 220 existing dwellings, and a regional road reserve with a width ranging from 25m to 110m accommodating Caves Road.

The City's hazard mapping indicates that, when applying SPP 2.6, the northern extent of Lots 4 and 12 would be impacted by coastal erosion within the 100 year timeframe if no mitigation measures were undertaken to protect the infrastructure already in place.

The CHRMAP sets in place a clear management framework for protecting the Abbey area, and proposes to "protect" Abbey beach and the surrounding infrastructure via a series of coastal protection works, which would essentially halt the coastal erosion process.

Inundation from both the coast and inland waterways such as Buayanyup Drain in an extreme weather event is also an important consideration. SPP 2.6 requires risk assessments to consider the effects of a storm event with a 0.2 percent or one-in-five hundred probability of being equaled or exceeded in any given year over the 100 year planning time frame, including a 0.9m allowance for sea level rise.

The CHRMAP recognises the risk posed by coastal inundation and sea level rise, and recommends a minimum habitable floor level of 3.0m AHD to reduce the risk of flooding during the 100 year planning timeframe.

Given a significant portion of the site is at, or very close to 3.0m AHD already, it can be developed for urban purposes while minimising the risk of impacts of flooding from coastal inundation. Further consideration of inundation is outlined in the Local Water Management Strategy at Appendix 2.

2.6 State Planning Policy 3.7 – Planning in Bushfire Prone Areas (WAPC, 2015)

State Planning Policy 3.7 – Planning in Bushfire Prone Areas ("SPP 3.7") sets out the framework for land use planning to address bushfire risk management in Western Australia.

The Structure Plan area and surrounding lots are designated as bushfire prone areas in accordance with

SPP 3.7, and as such, further assessment against the requirements of SPP 3.7 is required.

A Bushfire Hazard Level Assessment and Bushfire Management Plan has been prepared and is discussed further in sections 3.6 and 4.7 of this report. The BHL Assessment confirms that bushfire risk is not a constraint to development, and can be safely mitigated through adequate separation from the hazards, along with increased construction standards for future dwellings (BAL-12.5 or BAL-19). The Concept Plan in Part 4 of this report demonstrates one possible way in which the hazard separation can be achieved.

2.7 State Planning Policy 5.4 – Road and Rail Noise (WAPC, 2019)

State Planning Policy 5.4 – Road and Rail Noise ("SPP 5.4") sets out the planning considerations for development adjacent to major road and rail transport corridors in order to minimise the impact of traffic noise on residential uses.

Bussell Highway and Caves Road are both identified as 'significant traffic routes' under SPP 5.4, and a portion of the Structure Plan area is within the mapped trigger distance (200m from the corridor). As such, traffic noise must be assessed as part of the rezoning and structure planning processes to accurately identify those areas that will be affected by noise, and to ensure adequate mitigation measures are in place for noise-sensitive uses.

2.8 Liveable Neighbourhoods Operational Policy (WAPC, 2009)

Liveable Neighbourhoods is the WAPC's operational policy for the design and assessment of new (greenfield) urban areas, and provides guidance as to key considerations such as urban form, housing density, road networks, schools and public open space.

The Structure Plan has been designed to meet the principles of Liveable Neighbourhoods including the urban form, road hierarchy, public open space distribution and urban water management.



Part 3 – Site Conditions, Opportunities and Constraints

The following section sets out the physical features of the site that inform the design of the Structure Plan. This analysis is supported by extensive technical analysis and reporting which is appended to the Structure Plan as described below:

Appendix 1 - Environmental Assessment Report - Emerge Associates.

Appendix 2 - Hydrology (Local Water Management Strategy) - Emerge Associates.

Appendix 3 - Bushfire - Emerge Associates.

Appendix 4 - Traffic and Transport Assessment - Stantec.

Appendix 5 - Servicing - Stantec.

As demonstrated below, there are some environmental and physical attributes which warrant further consideration and site-specific responses. These are not constraints to development, but rather opportunities to deliver a Plan that is site responsive, and respectful of the natural and physical setting in which it is located.

Further analysis of the physical and environmental context of the site is set out in the following sections.

3.1 Vegetation and Flora

Environmental consultants Emerge Associates have undertaken a detailed assessment of the environmental features and attributes of the Structure Plan area. In relation to vegetation and flora, Emerge has concluded that:

- There are no protected (Federal or State) vegetation or flora within the Structure Plan area.
- There are unlikely to be any threatened or priority flora, or threatened or priority ecological communities on the site based on the limited

vegetation and the disturbed nature of the site.

- Scattered remnant paddock trees, predominantly *Agonis flexuosa* (peppermint) with some *Eucalyptus rudis* (flooded gum) adjacent to a low-lying area in the south-west, are located across the Structure Plan. This includes remnant peppermint tree stands within the north-east portion of the Structure Plan (lot 12) following existing fence lines.
- The condition of the vegetation across the site is largely degraded due to historical agricultural uses.

From Emerge's analysis it can be concluded that the presence of these trees and vegetation on the site is not a constraint to more intensive forms of land use. There are opportunities to recognise some of these mature trees in areas of public open space, larger residential lots and wider road reserves where practicable.

3.2 Fauna

The environmental assessment undertaken by Emerge indicates that the Structure Plan area is unlikely to provide important habitat for conservation significant species such as the three black cockatoo species (Carnaby's, Baudin's and forest red tailed) or western ringtail possum.

The scattered paddock trees are unlikely to support breeding or foraging by the three black cockatoo species, with peppermint trees a low priority foraging species and not known to support breeding. The scattered trees are also unlikely to support western ringtail possum, given the lack of understorey and mid-storey species and also the lack of canopy connectivity and connection to other areas of remnant vegetation adjacent to the site.

Emerge notes that the vegetation located within the Caves Road reserve to the north of the site may support habitat for fauna species, particularly western ringtail possum, given it has a well-connected canopy and is connected to other areas of intact native vegetation. Development of the Structure Plan area will not result in any significant

disturbance of this area as it is located outside of the site boundary, and any clearing will be limited to a narrow access road to Caves Road in the location of the current access driveway to lot 4.

3.3 Landform and Landscape

The Structure Plan area is relatively flat and level, with the majority of the site, including the northern and eastern areas sitting at or around 2.5m – 3m AHD. The site does fall away slightly to the south, coinciding with the mapped flood fringe and floodway area. A finished level of 3m AHD for all buildings is required in order to meet the requirements of the City's CHRMAP. This can be achieved with minimal fill across the majority of the site, while the lower lying areas will be retained as multiple use public open space, performing drainage and recreation functions for future residents, and ensuring that the existing landform is recognised appropriately.

The current landscape qualities of the site are predominantly rural in nature, with broadacre pasture areas and some scattered trees and vegetation. There are no ridgelines, elevated positions or mapped views of significance within the Structure Plan area or nearby which warrant a specific landscape response.

The vegetation within the Caves Road reserve, ranging from approximately 5m up to 70m in width, screens the Structure Plan area from view from Caves Road and ensures that the landscape visible from the Caves Road transport route will not be significantly altered.

There are opportunities for the Structure Plan design to respect and respond to the rural character of the landscape through retention of mature trees and dispersion of public open space generously throughout the Structure Plan area, and to provide a managed interface to Caves Road where required.

3.4 Floodways and Wetlands

The Department of Water and Environmental Regulation has confirmed that a small area within the low-lying south western portion of lot 4 is identified as a floodway, while the area immediately surrounding is classified as flood fringe. The floodway is essentially a small 'offshoot' of the main floodway located further to the south and outside of the Structure Plan area. The floodway and flood fringe are shown at Figure 7.



Figure 7 Floodway and Waterway Features Mapping



The presence of a floodway in and adjacent to the Structure Plan area is not a constraint to the development of the remainder of the Structure Plan area. The floodway can be accommodated and integrated within larger areas of public open space, and is capable of being used as part of the broader open space network when not in flood.

Pre-lodgement consultation with the DWER has confirmed that the flood fringe may be filled and developed and does not require any specific treatment.

There are no Conservation Category Wetlands or Resource Enhancement Wetlands identified within the site. A small portion of the Structure Plan area in the south and west is mapped as Multiple Use Wetland (MUW), and a smaller MUW is located in the northeast of the site. MUWs are not a constraint to development and are generally not required to be retained or accommodated spatially. Further consideration of floodways and MUWs will be set out in the Local Water Management Strategy at Appendix 2, and at future stages of the planning process in accordance with the WAPC's Better Urban Water Management Guidelines.

3.5 Surface and Groundwater

Consistent with the overall topography, surface water and stormwater runoff typically drains in the southerly direction towards the floodway at the southern boundary of the Structure Plan area. Sandy soils, particularly in the northern half of the site, allow for a good rate of infiltration at source, ensuring that there is minimal need for conveyance swales and / or large detention basins.

Groundwater monitoring indicates that the winter peak typically sits at or around 1.19 m below ground level (BGL) in the north-eastern portion of the site; and 1.54 m BGL in the central southern portion of the site. The maximum groundwater level beneath the site therefore ranges from 2.1m AHD along the eastern boundary to 1.5m AHD in the south eastern corner of the site. Given the majority of the

site will sit at or above 3.0m AHD, the groundwater is not a constraint to development and can be managed through the subdivision and development processes in the usual manner.

3.6 Bushfire

The entire Structure Plan area is designated as 'bushfire prone' by the Office of Bushfire Risk Management (OBRM) mapping, however detailed assessment confirms that bushfire is not a constraint to development, and that the bushfire risks, which are located external to the site, can be easily managed through the imposition of appropriate interfaces, setbacks and bushfire attack level (BAL) construction requirements where necessary.

The most significant bushfire hazards external to the Structure Plan area are the vegetation within the Caves Road reserve to the north, and grassland vegetation (including a strip of trees) to the south (and the boundary shared with the Broadwater Nature Reserve Swamp). Temporary grassland hazards exist to the east, associated with existing rural lots proposed for future urban development.

BAL ratings of BAL-29 or lower for residential lots can easily be achieved through provision of setbacks to the bushfire hazards adjacent to the site, through a combination of wide public road reserves, public open space, and in limited scenarios the imposition of larger setback requirements within the lots. A map depicting the likely BAL ratings is depicted at Figure 8. The outcomes of the BMP are discussed further in Section 4.7.

3.7 Aboriginal and European Heritage

The Structure Plan area does not contain any Aboriginal heritage sites or places. There is an 'Other Heritage Place' (ID 5337), which is mapped as extending slightly into the western portion of the site, however it is understood that it is likely to be associated with the drain further to the west based on information provided in the Buayanyup River

Action Plan (Geographe Catchment Council 2010), where the Aboriginal site is described as being associated with the drain.

Newtown House, which forms part of the Amelia Park complex, is located within Lot 11 (5850) Bussell Highway, adjacent to the Structure Plan area. Newtown House is recognised by the City of Busselton as having local (European) heritage value. Urbanisation of the Structure Plan area is unlikely to impact the heritage values associated with Newtown House owing to its substantial setback from the northern lot boundary, being the site's only boundary with the Structure Plan area.

3.8 Regional Road Network – Access and Capacity

The Structure Plan area abuts Bussell Highway and Caves Road to the east and north respectively. Both of these roads are regional roads under the care and control of Main Roads WA, ensuring direct and efficient access from the Structure Plan area to the external road network. Gaining safe and efficient access to and from the regional network is an important consideration for the urbanisation of the Structure Plan area.

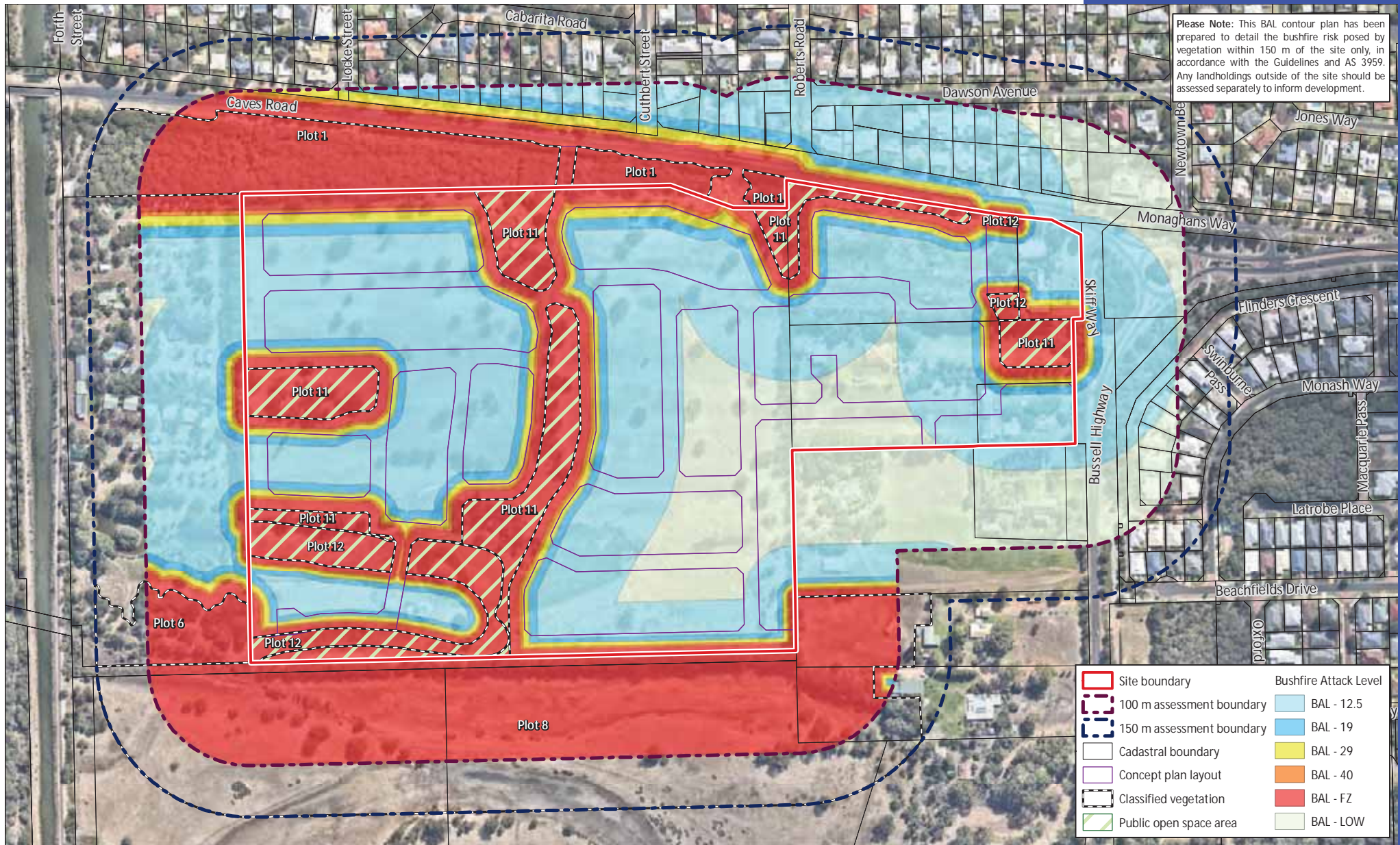


Figure 8 BAL Contours

3.8.1 Future Regional Road Network

There is a planned regional road linking Vasse to Dunsborough (referred to as the Vasse - Dunsborough Link or 'VDL') which is intended to relieve the pressure on Caves Road, and provide a more efficient connection between Vasse and Dunsborough. The alignment definition phase of the project is now complete, and Main Roads is now in the preliminary design and land acquisition phases. Notwithstanding, the timing for construction of the VDL is unknown, and not within Main Roads' 5-year capital budget.

Once operational, the VDL will have a significant impact on traffic volumes on Caves Road, with a reduction in the order of 80% being forecast by Main Roads (8,000 vpd down to 1,600vpd). The reduced traffic volumes enable improved access and permeability to Caves Road and minimise the need for significant intersection infrastructure such as roundabouts or traffic signals to be installed.

3.8.2 Access to the Regional Road Network

Given the uncertainties around timing of the VDL, it is necessary to investigate whether the Structure Plan area can gain access to the regional road network even if the VDL does not eventuate within the timeframe that the Structure Plan area is fully developed.

Stantec has undertaken a review of the regional road network, its capacity to accommodate any additional traffic arising from the Structure Plan area, and the most suitable locations and types of intersections to the regional network. Their investigations included extensive consultation with Main Roads WA in order to confirm future planning for the regional network, and to demonstrate that the transport characteristics of the Structure Plan are acceptable.

Main Roads has accepted Stantec's findings in principle and has confirmed that there are no fatal flaws from a traffic perspective which would prevent the development of the Structure Plan area. A copy of Main Roads' preliminary advice is appended to Stantec's traffic report at Appendix 4.

As demonstrated through Stantec's analysis, and as confirmed by Main Roads WA, access to the regional road network from the Structure Plan area can be achieved safely and efficiently without impacting the operation of any part of the regional road network.

3.9 Traffic Noise

As noted in the previous section, Bussell Highway and Caves Road are both identified as 'other significant freight/traffic route' under *State Planning Policy 5.4 Road and Rail Noise* (SPP 5.4). In accordance with SPP 5.4, consideration of noise for sensitive land uses is required within a 200m trigger distance of the road carriageway edge, which includes a portion of the site. As evidenced by the extensive residential development adjacent to both Caves Road and Bussell Highway in the immediate vicinity of the site, it is clear that traffic noise is not a constraint to development.

Under SPP 5.4, new noise sensitive land uses (which includes residential development) within the trigger distance of an existing transport corridor are required to meet the criteria outlined in Table 3.



Table 3: Noise targets as outlined within SPP 5.4

Proposal type	New/upgrade	Noise targets		
		Outdoor		Indoor
		Day (LAeq(Day) dB) (6 am -10 pm)	Night (LAeq (Night) dB) (10 pm – 6 am)	(LAeq dB)
Noise sensitive land-use and/or development	New noise sensitive land use and/or development within the trigger distance of an existing/proposed transport corridor.	55	50	L _{Aeq} (Night) dB 40 (living and work areas) L _{Aeq} (Night) dB 35 (bedrooms)

Noise exposure forecast tables provided as part of the implementation guidelines for SPP 5.4 indicate noise impacts requiring treatment (quiet house design) could occur for dwellings less than 40m from the road carriageway, based on this being a 1-2 lane road with a speed limit between 60 – 80 km/hr and in a rural area (as opposed to an Urban Region Scheme area). Noise impacts can be managed as per the standard planning and development process, including use of setbacks and quiet house design, with the implementation guidelines indicating the following:

- Within 0 – 20 m of the road carriage way, noise target could be exceeded between 3-7 dB, and quiet house design package B could apply; and
- Within 20 – 40 m of the road carriage way, the noise target could be exceeded by between 1-3 dB, and quiet house design package A could apply.

It should be noted that any noise impacts arising from Caves Road are likely to decrease in future due to the forecast decrease in traffic volumes along these routes over time once the Vasse – Dunsborough Link is delivered.

This preliminary analysis demonstrates that not only is traffic noise not a constraint to development, but also that an acceptable standard of noise attenuation can be achieved without having to construct a physical barrier such as a wall or bund. As such, the road noise will not have any impact on the Structure Plan from a spatial perspective.

The noise assessment is part of the Environmental Assessment included at Appendix 1.



3.10 Servicing

Consulting civil engineers Stantec have undertaken a review of the availability of existing services in the locality, and their capacity to service the Structure Plan area when developed.

Stantec's findings confirm that all major service infrastructure currently exists within close proximity to the Structure Plan area, without any major upgrades or feeder extensions required to service the increased load demands from the Structure Plan area. A brief summary of Stantec's findings is below, while the full servicing report is included at Appendix 5.

3.10.1 Earthworks

Stantec's analysis demonstrates that the Structure Plan area is capable of accommodating finished floor levels (FFL) of at least 3.0m AHD to meet the requirements of SPP2.6. In order to achieve FFLs of 3.0m or greater, and to maintain adequate clearance to ground water, some imported fill will be required however this will be minimal compared to other lower lying urban areas in greater Busselton and is not a constraint to development. The Local Water Management Strategy includes some preliminary lot and invert levels, with more detailed earthworks modelling to be undertaken at subdivision stage.

Final lot, road and public open space levels will be determined at detailed design stage in consultation with the City of Busselton.

3.10.2 Wastewater

The Structure Plan area is required to be serviced with reticulated sewerage in accordance with the Government Sewerage Policy. Stantec's analysis confirms that there are existing Water Corporation assets adjacent to the site which have been sized and located such that they will service the entire Structure Plan area.

Water Corporation has a gravity sewer network that services the catchment north of Caves Road, while two sewer pressure mains are located within the southern verge of Caves Road. A Type 40 sewer pump station (Busselton Pump Station No. 24) is located on Caves Road adjacent to the north eastern corner of Lot 4. This pump station collects sewage from the surrounding gravity sewer north and east of Lot 4, and pumps it to the Type 90 pump station located within the light industrial development in Vasse via the 200mm diameter sewer pressure main. This pump station has capacity to service the Structure Plan area once it is fully developed.

Consistent with the EPA's Guidance Statement 3 *Separation Distances between Industrial and Sensitive Land Uses*, a Type 40 WWPS requires a 10m odour buffer from the wet well location. In this instance the wet well is set back more than 10m from the Structure Plan boundary, and as such, will not have any implications for the Structure Plan design.

A map depicting the location of the pump station in relation to the Structure Plan area is shown at Figure 9.

3.10.3 Reticulated Water

The Structure Plan area will be provided with reticulated potable water via the two existing water mains within the Caves Road reserve. Civil engineers Stantec are currently working with Busselton Water to progress hydraulic modeling to determine whether there is sufficient capacity in the DN250 water main in Caves Road. In the event that there is not sufficient capacity, the DN375 main can be extended into the site from the eastern end of the Structure Plan. Regardless of the preferred method of delivery, there is an available potable water supply available to the Structure Plan area.

3.10.4 Underground Power

The Structure Plan area has access to the existing HV underground cables located in the Caves Road reserve (south side). Western Power has confirmed that there is sufficient capacity in the network to service the Structure Plan area once it is fully developed.

3.10.5 Gas

There is an existing gas main in the Bussell Highway reservation to the east of the site. ATCO has confirmed that there is sufficient capacity in the network to accommodate a connection serving the Structure Plan area without any additional upgrades required.

3.10.6 Telecommunications

There is an existing NBN fibre optic cable located in the Caves Road reserve which can provide a connection to the Structure Plan area. A fibre-ready pit and conduit network will be installed as part of subdivision works to service two lots per pit so that future residents have access to the NBN network as soon as it is made available to the Structure Plan area.



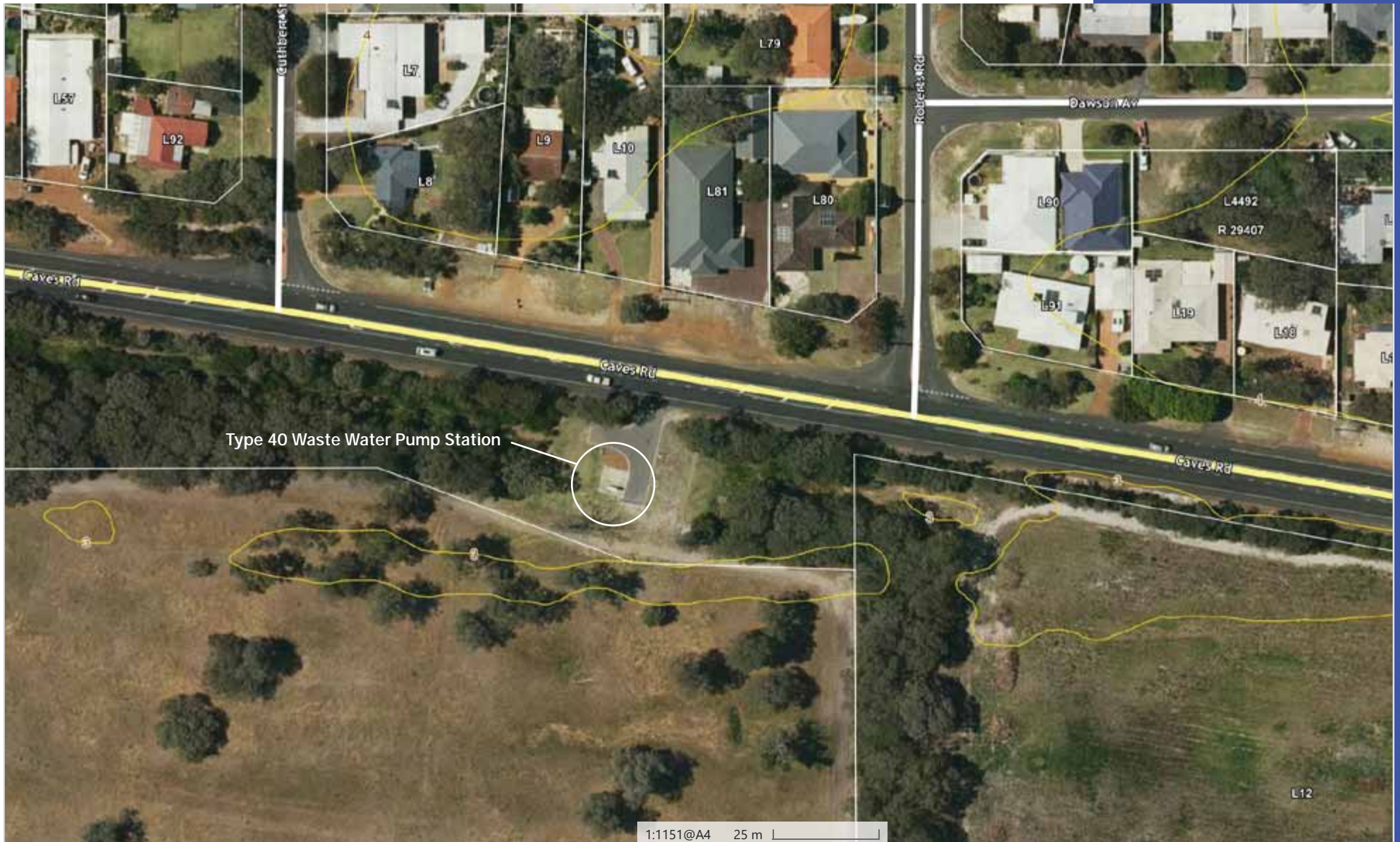


Figure 9 Sewer Pump Station

Part 4 – Abbey South Structure Plan

The Structure Plan takes into consideration all of the site characteristics, local context, policy context, and the physical opportunities and constraints identified in the previous sections of this report, and demonstrates an indicative urban form that is efficient, robust, and responds to the local character.

The Structure Plan map is included as Figure 10, while an indicative Concept Plan is Figure 11. The Concept Plan demonstrates one possible manner in which the site could be developed consistent with the Structure Plan map and implementation provisions.

4.1 Structure Plan Guiding Principles

Development of the Structure Plan and Concept Plan is based on the following key principles:

- Ensure a landscape-led plan where the focus has been on understanding the local vernacular and characteristics that make Abbey a unique place within the Geographe region and the broader South West region, and using this to inform the overall design of the site.
- Address the principles of SPP6.1 by maintaining and enhancing the vegetated buffer to Caves Road.
- Provide for a range of residential densities and housing typologies that recognise the local context and market conditions, as well as achieving key planning objectives.
- Respond to the existing commercial land uses and provide for their continuing evolution over time through a flexible framework.
- Enable a highly connected, pedestrian-friendly neighbourhood where walkability and access to local convenience and amenity is paramount, and car-dependence for local trips is minimised.
- Recognise and retain existing mature trees within areas of public open space and widened road reserves wherever practicable.

- Incorporate drainage detention and treatment areas into the broader open space network in a manner that maximises useability and amenity of the open space.
- Minimise access points to the external road network to minimise disruption to the regional network and retain the integrity of the ecological linkage within the Caves Road reserve.
- Recognise the mapped floodway within a broader expanse of open space, to enable full integration of the drainage and floodway functions within high-amenity, useable public open space reserves, and to ensure that road crossings do not impede the flow of water in flood events.
- Respect and retain the existing site levels and topography where possible in order to minimise the need for fill, and to achieve a minimum finished floor level of 3.0m AHD for residential lots.
- Include wider local road reserves where appropriate to accommodate bushfire setbacks and roadside swales, and to provide a suitable interface to the RAC Holiday Park on the western boundary.

The following subsections summarise the key attributes of the Structure Plan and how it responds to the site and policy context.

4.2 Urban Form

Based on the principles described in the previous section, the Structure Plan adopts a contemporary urban form that allows for a high degree of permeability and walkability on both the east-west and north-south axis. This 'modified grid' pattern of subdivision allows for efficient distribution of vehicle traffic, provides a safer environment for pedestrians and cyclists, and ensures that open space areas are typically visible and accessible within direct line of sight from almost every dwelling.

In this instance the modified grid layout has been adapted to recognise key attributes of the site including the mature peppermint and eucalypt trees throughout, the natural

floodway area to the south, and the interface to Caves Road.

Crossings over the floodway are minimised so as to not impede water flow in storm events. This has the effect of creating a small residential peninsula in the south of the Structure Plan area. The Structure Plan ensures that this peninsula is limited to those areas with higher ground level and no environmental or physical constraints, and identifies a low density code of R10 which better responds to the natural setting and context.

Managed interfaces are provided through wider local access roads along the western and northern boundaries of the Structure Plan area to ensure adequate setbacks for bushfire mitigation, as well as to respect and retain the existing vegetated interface to Caves Road. A short cap road has been shown in the north eastern corner of the Structure Plan area (lot 12) to enable the retention of the existing trees within the Caves Road reserve, as well as to provide a landscaped interface to Caves Road and avoid the appearance of rear fences when viewed from Caves Road.



- STRUCTURE PLAN NOTES**
1. Future road connection to Vasse North to be constructed by others.
 2. The 2 stage T intersection to Caves Road is to be designed and located as to minimise impacts on existing vegetation within the Caves Road reserve.
 3. The future alignment of the pedestrian / cycle linkage to Bauyanup Drain is to be designed to minimise impacts on the floodway.
 4. Pedestrian access between the Local Centre and Monaghans Store is to be confirmed at the development application stage for the Local Centre (lot 402).
 5. Existing homestead is to be retained on 4,000m² (approximate) residential zoned lot with a density code of R2.5 to prevent further subdivision.

Figure 10 Structure Plan Map



Figure 11 Overall Abbey South Master Plan

4.3 Land Use

Given the relatively 'contained' nature of the Structure Plan Area, and the fact that it is located some distance from any of the major centres, opportunities for employment and / or tourism generating land uses within the Structure Plan area are extremely limited, and the most suitable land use for this area is residential housing in order to accommodate greater Busselton's growing population.

The Structure Plan shows a predominantly residential zoning, with potential for small scale commercial and / or tourism uses at lot 402 (The Shed Markets) to complement the existing local centre on the opposite side of the intersection of Caves Road and Bussell Highway.

The Structure Plan presumes that the existing commercial land uses fronting Bussell Highway will remain in place for the short to medium term, however is flexible and sufficiently robust that it can accommodate changes to the intensity of these uses over time. This has been primarily achieved by providing vegetated interfaces to the existing commercial uses in order to protect the amenity and function of both uses, and allocating appropriate density codes to promote a range of housing typologies if and when the market demands this level of diversity.

With the exception of lot 402 (local centre), and the areas of public open space (recreation reserve) described further in the following sections, the entirety of the Structure Plan area is zoned Residential. As well as residential housing, the Residential zone allows for other community-based land uses such as aged care facilities, childcare centres and places of worship to be approved in the future should the market demand such services.

Lot 402 is zoned Local Centre in recognition of its current land use (The Shed Markets) as well as its potential to complement the existing local centre on the opposite

side of the Caves Road / Bussell Highway intersection. The Structure Plan includes a requirement that a Local Development Plan be prepared prior to subdivision or development of the Local Centre zone in order to better coordinate and guide an appropriate land use and built form outcome in this location. Furthermore, in order to ensure that the proposed local centre zone does not compromise or compete with the existing local centre (Monaghan's Corner), the Structure Plan restricts retail floor space within the proposed local centre zone to not more than 300m² NLA.

4.4 Housing Density and Yield

The Structure Plan has the potential to yield approximately 350-400 dwellings at full development. Densities are mixed through the Structure Plan area, with potential for higher medium density (R60) located closer to the corner of Bussell Highway and Caves Road, where access to the existing local centre, commercial uses and the coast is easily achieved.

An R20-R40 density code range has been applied to the majority of the site, which will allow for a range of lot sizes from 180m² up to 900m² in area, accommodating a diverse range of housing types and price points. The R20 code will serve as the 'base' density code, with opportunities to apply the higher code to lots in the higher amenity locations such as adjacent to POS and within a 400m walkable catchment of the local centre. Lower densities of R10 are provided for on the southern 'peninsula' adjacent to the floodway. This lower code recognises that this area is well suited to lower density housing due to the distance from the nearest amenities, and the engineering challenges and costs associated with constructing typical urban lots in this location. It is envisaged that this area will accommodate a small number of lots between 1,000m² – 2,000m² in area, with the filled areas limited to the building envelopes of the dwellings to

minimise fill and retaining requirements.

The Local Centre zoned area has been allocated a density code of R60 to promote mixed use development incorporating some form of medium density housing.

4.5 Open Space

The Structure Plan delivers an integrated network of open space that responds to and respects the natural features of the site, whilst also providing for way-finding, connectivity and a high standard of amenity throughout the Structure Plan area. The following sections summarise the overall principles and the specific form of the public open space network within the Structure Plan area, while the POS and Landscape Strategy at Appendix 6 provides further detail as to the form and function of the POS network.



4.5.1 Open Space Principles

The allocation, distribution and function of public open space is based on the following core principles:

- **Connected** – A strong north-south green spine is provided through the centre of the Structure Plan area that connects residents with Caves Road and Abbey Beach through a network of paths, vegetation and open green spaces.
- **Multi-functional** – Each open space area is multi-functional, combining integrated stormwater / drainage treatment and management with open areas for passive recreation and informal play, while also respecting and responding to the existing vegetation to ensure a high standard of amenity across all open space areas.
- **Environmentally Responsive** – The open space network is responsive to its environment and context through the retention of mature trees and vegetation, and its recognition of the natural topography and the floodway area to the south. The floodway area in particular will be fully integrated within the broader open space network, while at the same time remaining largely unmodified in order to continue to serve its primary function as a floodway for major storm events.
- **Respectful** – The open space can function as either an irrigated or non-irrigated network of high quality open space, ensuring that future restrictions on irrigation will not adversely impact the POS network.
- **Accessible** – Consistent with Liveable Neighbourhoods, all residential areas are comfortably within 150m-300m safe walking distance to the nearest local park, while the local road network has been designed to terminate at and / or connect open space areas wherever practicable.
- **Equitable** – The open space has been distributed throughout the Structure Plan area such that each individual landholding is capable of achieving a minimum of 10% POS as a standalone subdivision if required.

Landscape Architects Emerge Associates have prepared an open space strategy and landscape concepts to demonstrate how these open space areas can potentially be developed to incorporate the abovementioned principles. Emerge's concepts include both an irrigated and non-irrigated concept for each POS area, ensuring that in the event that an adequate water allocation cannot be secured, the POS will continue to be highly functional and of the highest quality. A copy of Emerge's POS Strategy and concepts is included as Appendix 6, and the overall landscape concept for the Structure Plan is shown at Figure 12.

4.5.2 Open Space Investigation Area

As noted in section 2 of this report, the Leeuwin – Naturaliste Sub-regional Strategy identifies the southern portion of the Structure Plan area as 'Public Open Space Investigation'.

As discussed and agreed with the WAPC and Department of Planning, Lands and Heritage in November 2021, the Open Space Investigation area does not necessarily dictate that the entire area should be set aside for conservation or recreation purposes. Rather, it is recognition of the land's current 'Conservation' zoning and the need for further work to be done to determine the extent of land needed for flooding / drainage / conservation and recreation purposes. It was agreed that this Structure Plan is the most appropriate 'vehicle' through which to carry out the necessary investigations. These investigations are set out in considerable detail in the report contained at Appendix 8 to this Structure Plan. Appendix 8 examines the portion of the Open Space Investigation Area within the Structure Plan boundary with respect to its environmental and hydrological value, as well as the open space requirements for the area, and addresses all of the WAPC's criteria as set out in Appendix 1 of the Leeuwin – Naturaliste Sub-regional Strategy.

As demonstrated in the Open Space Investigation Report at Appendix 8, as well as the Environmental Assessment and Local Water Management Strategy, the natural values of this Investigation Area are limited to the portion of mapped floodway itself, which was identified in section 3.4 and identified spatially in Figure 7. There are no distinct flora, fauna, wetland, heritage or other environmental values located in this area which would prevent its development. Further, the area is not well suited to other forms of passive or active open space given its location on the periphery of the structure plan area, and the lack of any suitable natural amenity in this location.

Consistent with good urban planning principles, the Structure Plan leaves the floodway area unmodified in order to retain the pre-development hydrology. It then integrates the floodway into a broader expanse of open space, ensuring that it will be entirely useable through the summer months and in drier periods, whilst still retaining its core function as an unmodified floodway.

The recognition of the floodway and integration within the broader POS network is balanced against the Liveable Neighbourhoods principle of ensuring urban land and potential urban land is used efficiently and effectively to meet the needs of a growing population.



Figure 12 Landscape Concept

4.5.3 Public Open Space Schedule

The Structure Plan includes five main areas of public open space, comprising approximately 4.7ha, or 15% (gross) of the Structure Plan area. When applying Liveable Neighbourhoods credits and deductions, the Structure Plan provides 3.2ha of 'creditable' open space, which equates to 11.2% of the gross subdivisible area. This is demonstrated further in the POS Schedule at Table 4 below.

Table 4 – Public Open Space Schedule

**Lots 4 & 12 Caves Road and Lots 14, 15 & 402 Bussell Highway
PUBLIC OPEN SPACE SCHEDULE**

Gross Site Area							30.497 ¹
Deductions							
Local Centre Zone							0.582
100 year Floodway							1.289
1 in 1 year drainage							0.156
Total Deductions						2.027	
Gross Subdivisible Area (GSA) ²							28.47
Public Open Space Contribution		10% of GSA					2.84
2%	Max % of Restricted Public Open Space Permitted						0.57
8%	Min % of Unrestricted Public Open Space to be provided						2.27
Public Open Space Breakdown							
POS Ref	Description	Gross Area ³	1 in 1 year	1:5y ARI (>20% AEP)	Other Restricted POS (buffer)	Unrestricted POS Area	
1	Entry Park	0.5412	0.0136	0.0294		0.4982	
2	Western Park	0.6034	0.0147	0.0296		0.5591	
3	Green Corridor	2.651	0.0205	0.0513		2.5792	
4	Eastern Park	0.4506	0.0365	0.0452	0.14	0.2289	
5	Bussell Park	0.3475	0.0325	0.0317		0.2833	
6	Floodway Interface	0.6500	0.0378	0.0117		0.6005	
TOTALS		5.2437	0.1556	0.1989	0.14	4.7492	
Total Non-Credited POS⁴					1.445		
Total Restricted Use POS					0.3389	1.5%	
Total Unrestricted POS					4.7492	16.7%	
Total Creditable POS Provision					5.0881	18%	

Notes:

1. All numerical values in this table are expressed in hectares (ha) unless otherwise shown.
2. In accordance with Liveable Neighbourhoods, the gross subdivisible area includes house lots, access roads, and any land incidental to the subdivision. The gross subdivisible area does not include areas for schools, shopping centres, infrastructure, dedicated drainage sites not having a recreational function and land set aside for arterial roads and other non-residential uses.
3. The Gross POS Area excludes the mapped floodway area.
4. The non-credited POS (i.e. POS which is treated as a deduction) includes all areas of POS which are not included in the 10% calculation. This includes the 1:1 year area as well as the total area of the mapped floodway.
5. The 10m vegetated buffer to Caves Road is included as Restricted Use open space as agreed with the City of Busselton.

The size and function of the POS network is subject to further refinement and revision at subdivision stage, at which point it may be necessary to prepare an updated POS schedule. A provision has been included in the Implementation section of the Structure Plan to require an updated POS Schedule to be submitted at subdivision stage where changes to the POS network are proposed.

4.5.4 Public Open Space Description

The following provides a brief description of the function and intent of each of the five POS areas identified on the Structure Plan map.

POS 1 – Entry Park (5,400m²)

The entry park is located immediately to the west of the main entry to the Structure Plan area from Caves Road. It has been deliberately located to capture the existing mature vegetation that currently surrounds the homestead, and to provide a strong sense of arrival when entering the estate from Caves Road. As well as a playground, and potentially a sales office in the short term, POS 1 will accommodate a shallow drainage basin which will be integrated with the trees and surrounding open space area in accordance with best-practice landscape design.

An indicative landscape concept of POS 1 is shown at Figure 13.

POS 2 – Western Park (6,000m²)

The western park has been deliberately located to capture the mature Marri trees and other eucalypts in this location. At present these trees are paddock trees with minimal understory, and as such are well suited to providing a shady recreation space without creating a bushfire hazard for nearby residents. The unvegetated area at the eastern end of this park will accommodate a small amount of drainage

from the surrounding roads, while the rest of the park will be parkland-cleared and landscaped to a high standard.

POS 3 – Green Corridor (2.7ha)

At approximately 2.7ha, POS 3 is the largest POS area in the Structure Plan. At the northern end POS 3 creates a seamless extension to the south from the entry park, and captures a number of the better-quality eucalypts and peppermint trees within this central spine. Towards the southern end POS 3 accommodates the mapped floodway area, which, although entirely useable as an active kick-about space, will largely be unmodified due to the need to convey floodwater in major storm events. For the purposes of calculating POS credits, the floodway area has been treated as a non-creditable deduction, however in reality will provide a high level of useability and visual amenity as part of the broader POS network.

POS 3 encircles the low-density peninsula in the south west corner of the site, and has the potential to provide a pedestrian / cycle connection to the dual use path that runs along the Buayanyup Drain to the west of the site via the Fox Road reserve.

Overall, POS 3 provides an important role in pedestrian and cyclist connectivity between the southern portion of the Structure Plan area and Caves Road, as well as passive recreation opportunities and amenity for future residents.

POS 4 – Eastern Park (4,200m²)

The eastern park has been located to capture the grove of peppermint trees that sit along the boundary between lots 4 and 12 Caves Road. These trees provide a southward extension of the vegetation in the Caves Road reserve, and a precinct-defining break in the perimeter road that runs along the northern end of the Structure Plan area. It is intended that with the exception of some thinning and

maintenance within this park, the existing trees will largely be undisturbed and retained.

The eastern park also provides opportunities for a 10m wide landscaped buffer between Caves Road and the residential area. As agreed with the City of Busselton, the portion of POS 4 that forms the buffer (1,400m²) is restricted open space for the purposes of calculating POS credits.



Figure 13 Landscape Concept



PUBLIC OPEN SPACE 1

POS TYPOLOGY

- Feature park

SIZE

- POS 1 = 6520m²

BRA-03

- 1%AEP TWL (m2) 110
- Volume (m3) 41
- Slope 1:6
- Depth (m) 0.5

FSA-03

- 1%AEP TWL (m2) 540
- Volume (m³) 309
- Slope 1:6
- Depth (m) 1.0

CONCEPT

- Feature park immediately west of the main entry providing a strong sense of arrival playful open space under retained existing vegetation
- Community focal area with space for small events.

FUNCTIONS / MATERIALS

- Passive turf recreation under existing tree shade
- Combination of nature play and custom play under tree canopy
- Shade structure and picnic facilities
- Part of the cycle/jogging network to the beach

ENVIRONMENTAL CONSIDERATIONS

- Source local materials where possible
- Large grouping of existing trees to be retained for shade and fauna habitat
- Water-wise native planting selection
- Flood storage provision



POS 5 – Bussell Park (3,900m²)

POS 5 is located adjacent to the Local Centre zone and provides important pedestrian connectivity between the local centre, Bussell Highway, and the balance of the Structure Plan area to the east. POS 5 allows for vegetation retention along the existing boundary between lots 402, 12 and 14, and will facilitate the retention of some mature peppermint trees in a managed setting. As well as providing a local drainage function, POS 5 provides opportunities for passive recreation through a picnic node, play area and shared path network.

4.6 Drainage and Water Management

Emerge has prepared a local water management strategy (LWMS) which meets the requirements of Better Urban Water Management (WAPC 2008), and demonstrates how both ground and surface water can be managed as part of the development of the Structure Plan area. A plan depicting the overall drainage catchments and strategy is Figure 14.

The LWMS has been prepared in consultation with the Department of Water and Environmental Regulation (DWER) and the City of Busselton to ensure it can meet their requirements. The LWMS takes an integrated water cycle management approach and application of Water Sensitive Urban Design (WSUD) principles to provide improvements in the management of water. The key principles of integrated water cycle management considered in the LWMS include:



Figure 14 Drainage Strategy

- Considering all water sources, including wastewater, surface water and groundwater.
- Integrating water and land use planning.
- Allocating and using water sustainably and equitably.
- Integrating water use with natural water processes.
- Adopting a whole catchment integration of natural resource use and management.

The LWMS integrated water cycle management approach addresses not only physical and environmental aspects of water resource use and planning, but also integrates other social and economic concerns. Proposed water management design objectives seek to deliver best practice outcomes in terms of:

- Water consumption/conservation;
- Surface water management;
- Groundwater management.

The integrated water cycle management for the site is based on the agreed environmental values for receiving environments, which are detailed in the LWMS in Appendix 2, and feedback from DWER and City of Busselton. The water management approach proposed in the LWMS and Structure Plan is summarised below.

4.6.1 Water Supply and Conservation

The overall approach to water supply is to utilise scheme water provided via Busselton Water and implement best practise water conservation measures (e.g. water efficient fixtures, use of water sensitive urban design (WSUD) measures, and planting of water wise species) to reduce water demand. Non-potable water for irrigation at lot scale will also be provided by scheme water within private lots and potentially rainwater tanks if installed by lot owner. The key approach for public open space (POS) will be to retain as many of the existing trees as possible, to minimise water use and provide amenity.

4.6.2 Stormwater Management

All residential lots will retain stormwater runoff up to the major (1% annual exceedance probability (AEP)) rainfall event. This is possible given the permeable soils and large lot sizes (500-600m²) where infiltration will occur within soakwells and pervious lot areas, which will also serve to treat the first 15 mm. Runoff from road reserves and POS areas will be treated as close to source as possible using either vegetated roadside swales or a vegetated bio retention area (BRA) where treatment will occur via contact with vegetation and the underlying soil profile. The majority of catchments will either have a POS area that will contain a BRA and a flood storage area (FSA) and catchments with no POS will contain a vegetated swale that will be designed to treat the first 15 mm and retain/detain runoff up to the 1% AEP event. This approach will ensure that the 1% AEP pre-development peak discharge rate and volume is not exceeded and hydraulic connectivity to the adjacent Broadwater Nature Reserve Swamp (BNRS) is maintained.

Consistent with the local character, road runoff will be discharged to bio-retention areas or swales via flush kerbs wherever practicable.

4.6.3 Groundwater Management

Groundwater management will include appropriate clearance of stormwater infrastructure above maximum groundwater levels to facilitate infiltration. These levels are conservatively set to provide mitigation against future rises in groundwater levels which could occur in the future due to potential sea level rise. Adopting a minimum finished floor level of 3m AHD accommodates for adaptive development planning required by the City under the Coastal Hazard Risk Management and Adaptation Plan whilst also providing lots with appropriate clearance to groundwater. Groundwater quality will be improved with a

change in land use and the use of WSUD measures.

The LWMS demonstrates that the concepts described above can be achieved by the spatial layout of the Structure Plan. It also provides guidance for future development/design stages to ensure that the water management criteria proposed can be achieved, and to ensure that an integrated water cycle management and best practise WSUD approach can be achieved by the implementation of the Structure Plan.

4.7 Bushfire Mitigation

The entire Structure Plan area is identified as bushfire prone by the State bushfire mapping. The site-specific Bushfire Management Plan prepared by Emerge Associates and included as Appendix 3 confirms that the bushfire hazards are limited to:

- Forest (Class A) vegetation, associated with existing remnant vegetation to the north of the site within the Caves Road reserve.
- Scrub (Class D) vegetation, associated with the RAC Busselton Holiday Park situated to the west of the site, and the proposed landscaped buffer to Caves Road adjacent to Lot 12.
- Grassland (Class G) vegetation, associated with existing paddock areas to the south and south-east of the site.

The BMP confirms that a BAL rating of BAL-29 or lower can be achieved through the inclusion of a minimum 21m separation between the edge of the hazard and the dwelling.

The Structure Plan responds to these hazards by including a 20m road reserve along the western and northern perimeters of lot 4 which, when coupled with the front setback of the dwelling, will ensure an adequate asset protection zone to achieve a suitable BAL rating. In the south western corner of the Structure Plan where there is no perimeter road, the necessary asset protection zone can be achieved through an 8m setback within the lot.

Given the low density coding and minimum lot size of 1,000m², the 8m setback is easily achievable and can be enforced either via a building envelope plan, LDP, or a BAL assessment at building licence stage.

Furthermore, in accordance with the Bushfire Guidelines, the Structure Plan identifies multiple egress routes from the site, including a secondary emergency egress through the central POS area so that in the event of a bushfire, residents of the western precinct can safely leave the area and move away from the fire. This egress is not intended as a public road, but rather a trafficable crossing through the central POS area. The form, function and management of this emergency egress will be confirmed as part of the detailed landscape design and implementation of the Bushfire Management Plan at subdivision stage.

4.8 Road Network

The Structure Plan makes provision for a comprehensive and connected road network, as described below.

4.8.1 Access to the Regional Network

The Structure Plan includes three access points to the regional road network – to Caves Road in two locations and Bussell Highway in one location. This includes a full movement ‘T’ intersection onto Caves Road approximately midway between Cuthbert Street and Locke Street to the north. This intersection will serve as the primary access to the Structure Plan area for the short and medium terms. Its functional capacity to service the entire Structure Plan area has been confirmed by Stantec’s modelling and is supported in principle by Main Roads WA. A second full movement ‘T’ intersection is provided further to the east on Caves Road, and a left in/left out intersection is provided to Bussell Highway to the south of Skiff Way in the same approximate alignment as the current crossover to lot 14.

Main Roads has advised that some minor modifications to

Caves Road and the existing turn pockets may be required in order to accommodate the new intersections, however Stantec has advised that these modifications are not fatal flaws and can be accommodated through the civil design process at subdivision stage.

In the longer term, the Structure Plan is able to accommodate a second future connection to Bussell Highway further to the south (if required) which could be extended through lot 8 Bussell Highway to connect to the highway. The Structure Plan does not propose this intersection – nor does it rely on it to be able to achieve access to the regional network, however it does allow for a future connection to be constructed by others should it be deemed necessary in the future.

4.8.2 Internal Road Network

The Structure Plan establishes the key principles and functions of the internal road network, with further refinement to occur at subdivision stage once site-specific considerations such as earthworks are better understood. The Structure Plan map depicts an indicative local street network. It is important to note that this network is subject to further refinement at subdivision stage, and the network depicted in the Structure Plan is not intended to be binding on the future subdivider.

Internally, the road network has been designed with the intention of maximising permeability and walkability whilst minimising the need for significant amounts of fill. The road network also provides opportunities for vegetation retention, drainage detention and bushfire buffers within road reserves.

Due to the higher concentration of vehicle traffic, the primary access street into the Structure Plan area from Caves Road is designated as an ‘Access Street B’ with an indicative reserve width of 16.5m – 17.9m as defined by

Liveable Neighbourhoods. A plan depicting the location of the Access Street B is shown at Figure 15.

All other streets in the Structure Plan area are forecast to carry less than 1,000 vpd and are designated as Access Street D. Typically, these access streets will be within a 15m reserve (6m pavement and 4.5m verges) with the exception of the perimeter roads which are wider reserves of 20m, intended to accommodate bushfire setbacks and drainage swales within the wider verge. An indicative cross section of the perimeter road is shown at Figure 16, and demonstrates how the reserve can accommodate the drainage swale as well as the road pavement and other infrastructure.

There may also be some localised instances where the road reserve is widened to accommodate an existing tree within the verge. These will be determined at Structure Plan stage once a detailed tree survey has been completed and earthworks design levels are confirmed.

4.8.3 Pedestrian and Cyclist Network

The Structure Plan provides a highly permeable layout with strong north-south and east-west linkages.

The north-south linkage is via the central open space corridor which connects the southern end of the Structure Plan area to Caves Road via an almost uninterrupted open space network. Once at Caves Road, pedestrians can access Abbey Beach and the Geographe Bay Principal Shared Path via Cuthbert Street and Roberts Road to the north.

The primary east-west linkages are along the northern perimeter road and through POS 1 and 4, or via any number of the east-west local access streets that cross the Structure Plan area. These linkages greatly improve connectivity between the RAC Holiday Park to the west and the local centre, tavern, and Shed Markets to the north-east.

Figure 15 Road Hierarchy Map

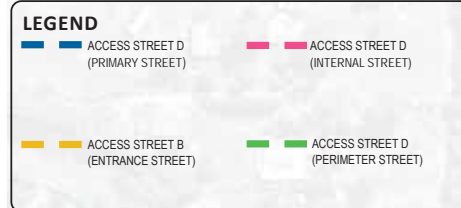
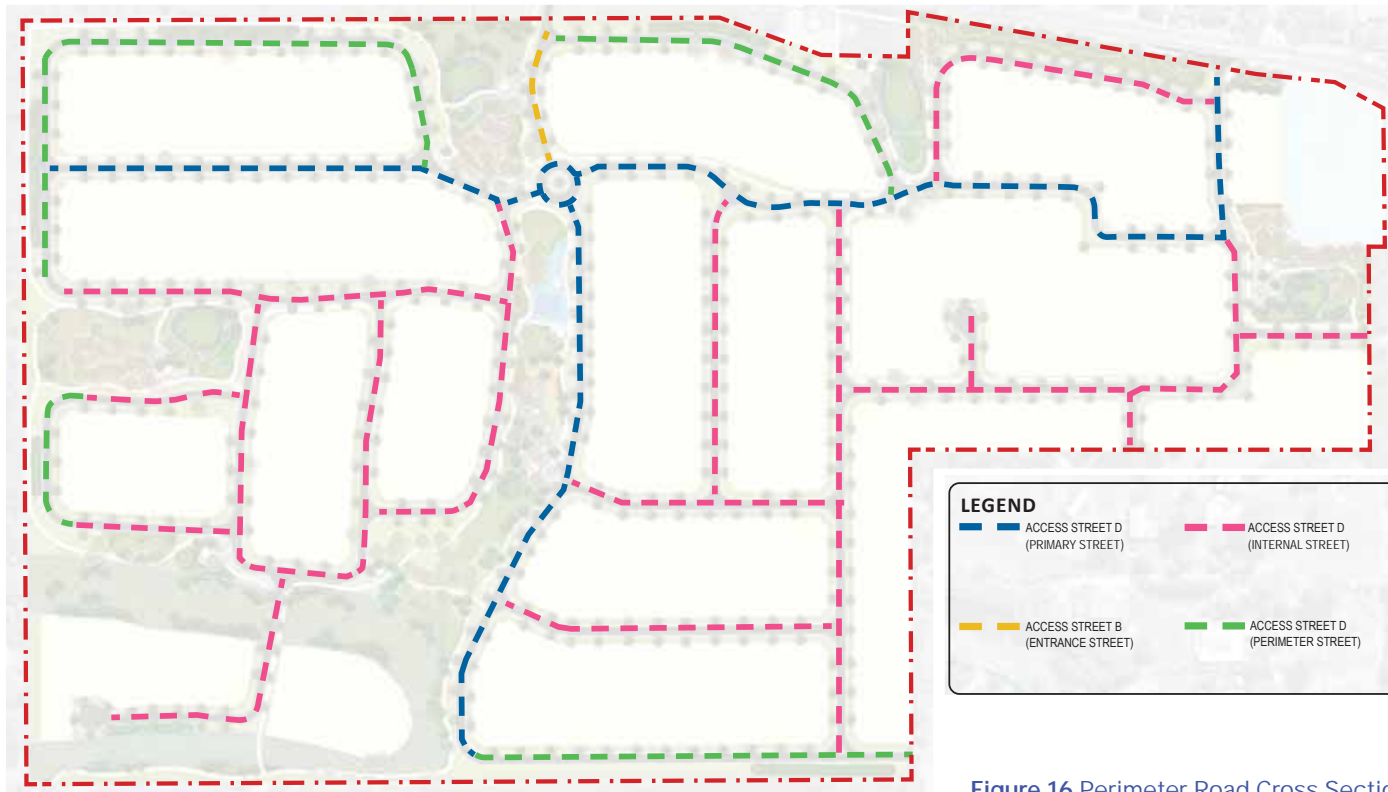
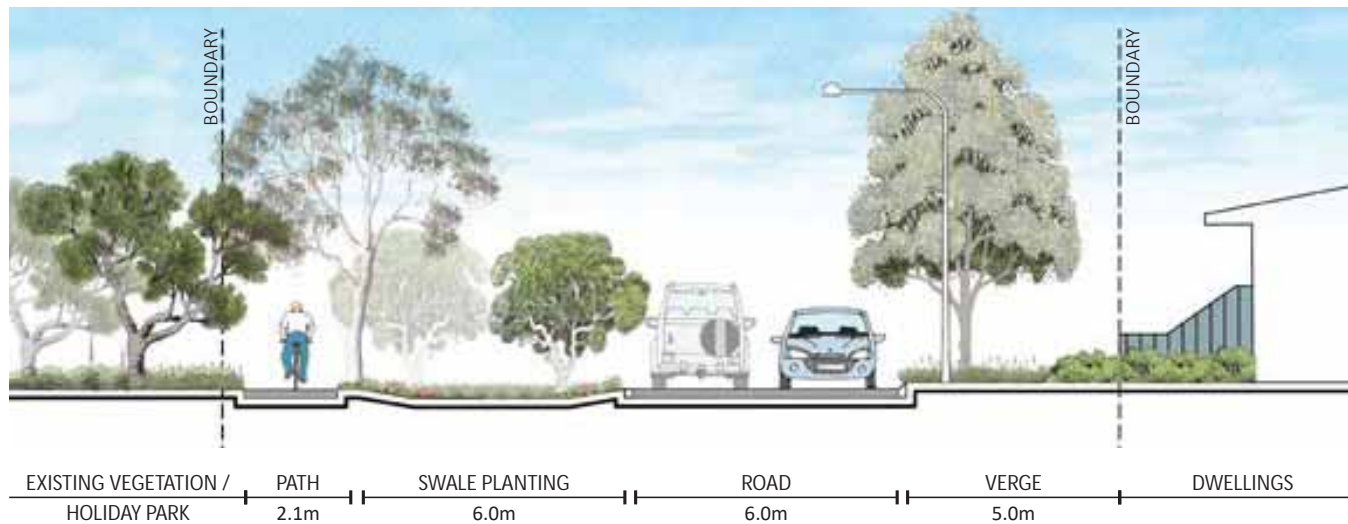


Figure 16 Perimeter Road Cross Section



Due to the low traffic volumes on all roads there is no need for designated on road cycle lanes, while footpaths and shared paths provide safe conveyance for pedestrians and other vulnerable road users.

Footpath locations and widths will be determined in consultation with the City of Busselton at the detailed design stage of the project.

4.9 Delivery Staging and Development Contributions

Due to the minimal site preparation required as well as the availability of services and accessibility from the regional road network, the first stages of the Structure Plan can feasibly be delivered to the market within 24 months.

Development staging is likely to proceed southwards in an orderly manner, with the initial stages to occur at the northern end of the site to allow for up-front connection to the existing services within the Caves Road reserve. It is envisaged that the areas fronting Bussell Highway will be the last to develop, however it is open for these landowners to commence earlier provided services can be extended in an efficient and cost-effective manner. A preliminary staging plan has been prepared by Stantec, and is included as Figure 17.

Due to the largely consolidated ownership, equitable distribution of open space, and cooperation between landowners, there is no need to implement a Development Contribution Plan at this stage. Any cost-sharing can be resolved through private agreements between landowners / developers. On this basis, staging and infrastructure cost sharing is not a constraint to development.



Figure 17 Preliminary Staging Plan

Appendix 1

Environmental Assessment – Emerge Associates



Appendix 2

Local Water Management Strategy – Emerge Associates



Appendix 3

Bushfire Management Plan – Emerge Associates



Appendix 4

Traffic and Transport Assessment – Stantec



Appendix 5

Servicing Strategy – Stantec



Appendix 6

POS and Landscape Strategy – Emerge Associates



Appendix 7

Abbey South Structure Plan and Concept Plan – Rise Urban and Studio CFM



Appendix 8

Open Space Investigation Report – Rise Urban



Rise Urban

AGILE PLANNING FOR THE NEW NORMAL

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Environmental Assessment and Management Strategy

Abbey South Structure Plan Area

Project No: EP20-141(04)

Prepared for Various Landowners
December 2022

Environmental Assessment and Management Strategy

Abbey South Structure Plan Area



Document Control

Doc name: Environmental Assessment and Management Strategy
Abbey South Structure Plan Area

Doc no.: EP20-141(04)—012d SJB

Version	Date	Author	Reviewer
1	August 2022	Sarah Beukes	SJB Kristen Knox
	Issued for client review.		
A	August 2022	Sarah Beukes	SJB Kristen Knox
	Updated in accordance with client's comments		
B	August 2022	Kirsten Knox	KK Kristen Knox
	Updated in accordance with client's comments		
C	September 2022	Kirsten Knox	KK Kristen Knox
	Updated following City of Busselton comments		
D	December 2022	Kirsten Knox	KK Kristen Knox
	Updated to address change to structure plan layout		

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Environmental Assessment and Management Strategy

Abbey South Structure Plan Area



Executive Summary

This Environmental Assessment and Management Strategy (EAMS) has been prepared on behalf of various landowners (the proponent) to support a scheme amendment and structure plan over Lots 4, 12 and 402 Caves Road, and Lots 14 and 15 Bussell Highway, Abbey (also described as the 'Abbey South Structure Plan Area' and herein referred to as 'the site') for future residential development. The site encompasses 30.52 hectares (ha) and is found approximately 9 km west of the Busselton town centre. The site is generally bound by Bussell Highway to the east, Caves Road to the north, the RAC Busselton Holiday Park to the west and an existing nature reserve/agricultural area to the south.

The site has been historically cleared to support agricultural land use and contains pasture areas with scattered trees. This is in accordance with the uses permitted under the current 'rural' and 'conservation' zoning under the City of Busselton Local Planning Scheme (LSP) No. 21. The scheme amendment proposes to rezone the site to 'urban development' (or similar), which will support urban development. This is in line with the Leeuwin-Naturaliste Sub-regional Strategy (DPLH 2021), which identified the majority of the site as suitable for 'Urban', while the southern portion of Lot 4, which corresponds with the current 'conservation' zoning, has been identified as 'Open Space Investigation'.

This EAMS has been prepared for the site to support the proposed scheme amendment and future development and provides a synthesis of information relating to the environmental features, attributes and values. It outlines how these environmental values should be considered and can be managed as part of the proposed development.

The environmental attributes and values relevant to the site are summarised below and include:

- Site topography ranges from 2 metres Australian Height Datum (mAHD) within the southern portion of the site to 3 mAHD in the northern portion of the site, with the exception of a depression within the southern portion of the site, which has elevations of approximately 1 mAHD.
- Available regional mapping has identified a 'moderate to low' risk of acid sulfate soils (ASS) occurring within 3 m of the natural soil surface across the majority of the site. Within the southern third of the site, it is mapped as having a 'high to moderate' risk of ASS occurring within 3 m of the natural soil surface.
- The site is located within approximately 400 m of Geographie Bay, with the northern portion of the site located within the 2120 coastal erosion hazard line (and recommended coastal management area) based on the City of Busselton Coastal Hazard Risk Management and Adaption Plan (CHRMAP).
- The entire site has been historically cleared of native vegetation and is composed of cleared paddocks, with only scattered remnant trees remaining. It is highly unlikely that the site contains threatened or priority flora species, threatened or priority ecological communities or habitat that in its current condition provides important for conservation significant fauna species.
- Limited regional groundwater level information is available. Emerge Associates undertook monthly groundwater monitoring between July 2021 and November 2021 and July 2022 and November 2022 within five monitoring bores across the site. The results indicate the annual winter peak groundwater level ranges between 1.19 metres below ground level (mBGL) and 1.54

Environmental Assessment and Management Strategy

Abbey South Structure Plan Area



mBGL. The maximum groundwater level beneath the site therefore ranges from 2.1 mAHD along the eastern boundary to 1.5 mAHD in the south-eastern corner of the site.

- Four multiple use wetlands (MUWs) are located within the southern, south-western and north-eastern portions of the site. A 1% annual exceedance probability (AEP) floodway and flood fringe area is located within the lower south-western portion of the site and is associated with The Broadwater and the Broadwater Nature Reserve Swamp, located approximately 100 m south of the site. Buayanyup River Main Drain is a sub-A drain located approximately 180 m west of the site and discharges north to Geographe Bay.
- An 'other heritage place' (ID 5337), which is described as 'skeletal material/burial' for the purposes of the Aboriginal Heritage Act 1972. This feature is likely to be associated with the Buayanyup River Main Drain and not within the site.
- Caves Road and Bussell Highway abuts the northern and eastern boundaries of the site respectively, and are identified as 'other significant freight/traffic route' under State Planning Policy 5.4 Road and Rail Noise (SPP 5.4). Portions of the site are identified within the associated road noise impact trigger distances.
- The site is designated as a bushfire-prone area under the state-wide Map of Bush Fire Prone Areas prepared by the Office of Bushfire Risk Management (OBRM). A bushfire hazard level assessment for the existing vegetation indicates that the majority of the site is subject to a 'moderate' bushfire hazard, as it is largely cleared paddocks, and this will be removed as development progresses.

Based on the environmental values or attributes identified within the site, this EAMS provides recommendations for environmental management considerations for future development of the site, including:

- **Coastal:** A finished level of 2.7 mAHD for all buildings is required in order to meet the requirements of the City of Busselton's CHRMAP. This can be achieved with minimal additional fill required across the majority of the site.
- **Acid sulfate soils:** it is possible that future investigations and management will be required at subdivision, particularly if services are likely to be installed below the permanent groundwater table. This can be managed through the standard subdivision approval process.
- **Flora, vegetation and fauna:** The site has been historically cleared of native vegetation with only pasture and scattered remnant trees remaining. The management of vegetation and fauna values as part of future development of the site can be appropriately managed through the standard subdivision process. The proposed structure plan proposes areas of public open space in locations to maximise retention of existing trees, and to provide green linkages across the site and between areas of remnant vegetation or nature reserve outside the site. The proposed urban development will provide an opportunity to increase the composition of plant species and vegetation structure, improving biological diversity and ecological integrity as well as vegetation connection (supporting fauna movement and flora dispersion).
- **Hydrology:** The 1% AEP floodway has been accommodated within public open space, while flood fringe areas will be subject to minor filling to ensure the minimum floor level (based on 1% AEP flooding with development of the flood fringe) is achieved. Water management within the site will ensure the first 15 mm of stormwater is treated and retained within the development so that the pre-development discharge rate and volumes are not exceeded, and water quality is

Environmental Assessment and Management Strategy

Abbey South Structure Plan Area



- improved. Separation to groundwater is able to be achieved based on the proposed minimum 2.7 MAHD lot finished floor levels (which includes that required to manage coastal processes). Future development will be supported by Urban Water Management Plan(s) as per the standard subdivision process.
- **Heritage:** A portion of an 'Other Heritage Place' (ID 5337) is mapped as extending into the western portion of the site. As it is an 'other heritage site' and not considered to be 'a site' as defined by the Aboriginal Heritage Act 1972, no specific approval is required under the existing enacted Aboriginal heritage legislation.
 - **Road noise:** Consideration of noise has been undertaken in accordance with SPP 5.4, and indicates that noise impacts can be addressed through the 'deemed-to-satisfy' pathway. This can be managed through the standard subdivision process, and through the application of quiet house design.
 - **Bushfire management:** Bushfire hazards (classified vegetation) that have the potential to impact the site are associated with forest vegetation immediately to the north of the site (within the Caves Road reserve), grassland vegetation within rural landholdings to the south-east (considered to be temporary hazards) and within the Broadwater Nature Reserve Swamp to the south, as well as future public open space areas (which as per consultation with the City of Busselton has been assumed to be a bushfire hazard). The proposed structure plan layout accommodates required setbacks to achieve a bushfire attack level (BAL) rating of BAL-29 or less (as per State Planning Policy 3.7 Planning in Bushfire Prone Areas) to identified bushfire hazards through the proposed road or through development cells that can accommodate in-lot setbacks. Development within the site is not reliant on vegetation modification or management external to the site, or management within public open space areas. Where management of public open space is able to occur, this would reduce BAL ratings within development cells.

Overall, there are no significant environmental issues or constraints within the site that would preclude the entire site from being rezoned to 'urban development' (or similar) under the City of Busselton Local Planning Scheme No. 21 and being developed in accordance with the structure plan. The proposed structure plan provides for the retention and protection of the existing floodway, maximising retention of existing trees and addressing bushfire risk without relying on modification to existing remnant native vegetation. The key environmental value associated with the 'Open Space Investigation' area identified within the Leeuwin-Naturaliste Sub-regional Strategy (DPLH 2021) requiring consideration is the floodway feature, which has been fully accommodated within public open space, with the remainder of the "Open Space Investigation" area able to support urban development.

The environmental values can be appropriately accommodated through the implementation of the structure plan and standard subdivision process.

Environmental Assessment and Management Strategy

Abbey South Structure Plan Area



Table of Contents

1	Introduction	1
1.1	Background	1
1.2	Purpose of this report	1
2	Planning and Environmental Assessment Concept	2
2.1	Existing zoning and reservations	2
2.2	Leeuwin-Naturaliste Sub-regional Strategy	2
2.3	Future land use planning processes	3
2.3.1	Proposed local planning scheme amendment	3
2.3.2	Structure Plan	4
2.3.3	Subdivision and development	4
2.4	Future environmental assessment processes	4
2.4.1	Environmental Protection Act 1986 – Section 48	5
2.4.2	Environmental Protection Act 1986 – Section 38	5
2.4.3	Environment Protection and Biodiversity Conservation Act 1999	6
2.5	Future offset requirements	6
3	Existing Environment	7
3.1	Climate	7
3.2	Landform and soils	8
3.2.1	Topography	8
3.2.2	Landform, soils and geology	8
3.2.3	Acid Sulfate Soils	9
3.2.4	Land capability	9
3.3	Biodiversity and natural area assets	10
3.3.1	Flora and vegetation	10
3.3.1.1	Vegetation condition	11
3.3.1.2	Threatened and priority ecological communities	13
3.3.1.3	Threatened and priority flora	14
3.3.2	Terrestrial fauna	15
3.3.3	Conservation reserves	16
3.3.3.1	DBCA managed lands	16
3.3.3.2	City of Busselton managed lands	17
3.3.4	Ecological linkages	17
3.3.5	Environmentally Sensitive Areas	17
3.4	Hydrology	17
3.4.1	Groundwater	17
3.4.2	Surface water	18
3.4.3	Wetlands	19
3.4.4	Public drinking water source area	20
3.5	Coastal processes	20
3.6	Heritage	20
3.6.1	Aboriginal heritage	20
3.6.2	Non-Indigenous heritage	21
3.7	Other land use considerations	21
3.7.1	Historic and existing land uses	21
3.7.2	Potential site contamination	21
3.7.3	Mosquitos and nuisance insects	22
3.8	Surrounding land uses	22
3.9	Bushfire hazard	23
4	Environmental Factors Considered by the EPA	26

Environmental Assessment and Management Strategy

Abbey South Structure Plan Area



4.1	Environmental principles	26
4.2	Key environmental factors	27
5	Impact Assessment and Management Approach	34
5.1	Coastal Processes	34
5.1.1	Policy framework, site context and management objectives	34
5.1.2	Structure plan layout considerations for coastal processes	34
5.1.3	Future coastal management requirements	35
5.2	Flora and vegetation	36
5.2.1	Policy framework, site context and management objectives	36
5.2.2	Structure plan layout considerations for flora and vegetation	36
5.2.3	Future flora and vegetation management requirements	36
5.3	Acid sulfate soils	37
5.3.1	Policy framework, site context and management objectives	37
5.3.2	Structure plan layout considerations for acid sulfate soils	37
5.3.3	Future acid sulfate soils management requirements	37
5.4	Native fauna	38
5.4.1	Policy framework, site context and management objectives	38
5.4.2	Structure plan layout considerations for terrestrial fauna	38
5.4.3	Future terrestrial fauna management requirements	39
5.5	Hydrology	39
5.5.1	Policy framework, site context and management objectives	39
5.5.2	Structure plan layout considerations for hydrology	40
5.5.2.1	Floodway	40
5.5.2.2	Surface water and groundwater	40
5.5.3	Future management requirements	40
5.5.3.1	Floodway	40
5.5.3.2	Surface water and groundwater	41
5.5.3.3	Overall	42
5.6	Acoustic impacts – Bussell Highway and Caves Road	42
5.6.1	Policy framework, site context and management objectives	42
5.6.2	Structure plan layout considerations for management of acoustic impacts	43
5.6.3	Future acoustic management requirements	44
5.7	Bushfire management	45
5.7.1	Policy framework, site context and management objectives	45
5.7.2	Structure plan layout considerations for bushfire management	45
5.7.3	Future bushfire management requirements	46
6	Implementation Framework	48
7	Conclusions	51
8	References	53
8.1	General references	53
8.2	Online references	57

Environmental Assessment and Management Strategy

Abbey South Structure Plan Area



List of Tables

Table 1: Summary of threatened and priority ecological communities with potential to occur in general area .	14
Table 2: Annual winter peak (mBGL) collected between August and November 2021 and August and November 2022	18
Table 3: EP Act Principles	26
Table 4: EPA factors applicable to the site. Shaded green cells indicate factors relevant for further assessment.	28
Table 5: Noise targets as outlined within SPP 5.4	43
Table 6: Environmental management framework implementation table	49

List of Plates

Plate 1: City of Busselton Local Planning Scheme (No. 21) Zones and Reserves.....	2
Plate 2: Average monthly temperature and rainfall at the Busselton Aero station (station number 009603) (BoM 2022)	7
Plate 3: Vegetation Complexes (DBCA 2021b)	10
Plate 4: Paddock grass extending through the south-western portion of the site (associated with the floodway area). Trees in background are located outside the site, adjacent to the southern boundary	12
Plate 5: Paddock grasses and paddock trees (Agonis flexuosa), found across the majority of the site	12
Plate 6: Existing commercial uses (The Shed Markets), currently established within the north-eastern corner of the site	13
Plate 7: Geomorphic Wetlands (DBCA 2022a)	19
Plate 8: SPP 5.4 'other significant freight/traffic routes' 200 m trigger distance	23
Plate 9: Areas within and surrounding the site identified as 'bushfire prone areas' (as indicated in purple) under the state-wide Map of Bush Fire Prone Areas (OBRM 2021).....	25

Figures

Figure 1: Site Location and Topography	10
Figure 2: Soils and Geology	
Figure 3: Acid Sulfate Soil Risk Mapping	
Figure 4: Existing Hydrological Features	
Figure 5: Aboriginal and Non-Indigenous Heritage Values	
Figure 6: Bushfire Hazard Level	
Figure 7: Key Management Considerations	

Appendices

Appendix A

Structure Plan and Concept Plan (Rise Urban 2022)

Appendix B

List of conservation significant flora and fauna

Environmental Assessment and Management Strategy

Abbey South Structure Plan Area



List of Abbreviations

Table A1: Abbreviations – General terms

General terms	
ASS	Acid sulfate soils
BAL	Bushfire Attack Level
BHL	Bushfire hazard level
BMP	Bushfire Management Plan
EAMS	Environmental Assessment and Management Strategy
ESA	Environmentally sensitive area
LWMS	Local Water Management Strategy
MNES	Matters of National Environmental Significance
PEC	Priority ecological community
TEC	Threatened ecological community

Table A2: Abbreviations – units of measurement

Units of measurement	
ha	Hectare
km	Kilometre
m	Metre
mAHD	metres in relation to the Australian Height Datum
mBGL	metres below ground level
mm	Millimetre

Environmental Assessment and Management Strategy

Abbey South Structure Plan Area



Table A3: Abbreviations – Organisations

Organisations	
BoM	Bureau of Meteorology
DAFF	Department of Agriculture, Fisheries and Forestry
DBCA	Department of Biodiversity, Conservation and Attractions
DCCEEW	Department of Climate Change, Energy, the Environment and Water
DFES	Department of Fire and Emergency Services
DoW	Department of Water (now DWER)
DPIRD	Department of Primary Industries and Regional Development
DPLH	Department of Planning, Lands and Heritage
DWER	Department of Water and Environmental Regulation
EPA	Environmental Protection Authority
OBRM	Office of Bushfire Risk Management
WALGA	Western Australia Local Government Association
WAPC	Western Australian Planning Commission

Table A4: Abbreviations – Legislation or standards

Legislation	
AH Act	Aboriginal Heritage Act 1972
AS 3959	Australian Standard 3959-2018 Construction of buildings in bushfire prone areas
BC Act	Biodiversity Conservation Act 2016
EP Act	Environmental Protection Act 1986
EPBC Act	Environment Protection and Biodiversity Conservation Act 1999

Table A5: Abbreviations – Planning terms

Planning terms	
LPS	Local Planning Scheme
LSP	Local Structure Plan
SPP	State Planning Policy
Guidelines	Guidelines for Planning In Bushfire Prone Areas version 1.4 (DPLH & WAPC 2021)

Environmental Assessment and Management Strategy

Abbey South Structure Plan Area



1 Introduction

1.1 Background

Various landowners (the proponent) are proposing a scheme amendment and structure plan over Lots 4, 12 and 402 Caves Road, and Lots 14 and 15 Bussell Highway, Abbey (herein referred to as the 'site') to facilitate future residential development. The site encompasses 30.52 hectares (ha) and is situated approximately 8 km west of the Busselton town centre. The location of the site is shown in **Figure 1**.

A structure plan (and concept development plan) has been prepared to support the scheme amendment process and will be approved as part of the same process. This has been included in **Appendix A** and is discussed further in **Section 2**.

1.2 Purpose of this report

Emerge Associates were engaged to prepare an Environmental Assessment and Management Strategy (EAMS) to inform and support the scheme amendment and structure plan process, by assessing the potential environmental impacts that could arise from the land use change and subsequent development of the site, in accordance with the requirements of the Western Australian Planning Commission (WAPC).

This EAMS has been prepared by EmERGE Associates to provide a synthesis of information regarding the environmental values and attributes of the site. Specifically, this report:

- Discusses the land use planning context and the proposed development of the site (**Section 2**).
- Identifies the existing environmental values and attributes of the site (**Section 3**).
- Outlines how the objectives of the Environmental Protection Authority (EPA) relating to each environmental factor can be met (**Section 4**).
- Outlines how the existing environment and key considerations can be managed as part of the future planning and development process (**Section 5**).

The EAMS is the key supporting environmental document for the scheme amendment and structure plan, to ultimately facilitate consideration of relevant environmental issues by the City of Busselton and various state government agencies and authorities. It is consistent with the requirements for environmental reporting as outlined in the Western Australian Planning Commission's (WAPC's) Structure Plan Framework (WAPC 2015b).

Environmental Assessment and Management Strategy

Abbey South Structure Plan Area

2 Planning and Environmental Assessment Concept

2.1 Existing zoning and reservations

The northern portion of the site is currently zoned 'rural' under the City of Busselton Local Planning Scheme No. 21 (LPS No. 21), while the southern portion of the site is currently zoned 'conservation', as shown in **Plate 1**. The site is also identified as part of a number of 'special control areas', including landscape value, wetland and floodway and require protection or consideration of these values.



Plate 1: City of Busselton Local Planning Scheme (No. 21) Zones and Reserves

2.2 Leeuwin-Naturaliste Sub-regional Strategy

The Department of Planning, Lands and Heritage (DPLH), on behalf of the Western Australian Planning Commission (WAPC) released the Leeuwin-Naturaliste Sub-regional Strategy in December 2021, providing guidance to the City of Busselton and the Shire of Augusta-Margaret River on strategic issues, as well as support for the preparation of new local planning strategies and local planning schemes (DPLH 2021).

The site is identified within the Leeuwin-Naturaliste Sub-regional Strategy (DPLH 2021) as the 'Abbey Planning Investigation Area', which is subjected to further planning investigations to consider its suitability for a possible change of use to future tourism, aged care, mixed use and/or medium density residential.

Environmental Assessment and Management Strategy

Abbey South Structure Plan Area



The strategy identified the following key considerations for the Abbey Planning Investigation Area:

- Biodiversity value protection
- Bushfire risk
- Drainage
- Landscape value protection
- Protection of significant environmental values
- Utility services capacity
- Water source impact (groundwater and surface water)
- Biodiversity values (adjacent wetlands to south)
- Provision of land for employment generating activities
- Transition/Interface with adjacent tourist uses (caravan park to west, boutique uses to east).

In accordance with the key considerations mentioned above, DPLH undertook detailed investigations within the area in 2021. WAPC resolved to amend the strategy as follows:

- The following lots amended to 'Urban':
 - Lot 12 on Diagram 43998
 - Lot 14 on Diagram 96590
 - Lot 15 on Diagram 96590
 - Lot 402 on Deposited Plan 252489
 - Northern portion of Lot 4 on Diagram 46285
- The following lot amended to 'Open Space Investigation':
 - Southern portion of Lot 4 on Diagram 46285

The above lots are inclusive of the site, providing strategic support for the proposed land use change.

A summary of how the 'key' planning issues related to the environmental matters, including the 'Open Space Investigation' area, have been addressed as part of the structure plan is provided in **Section 5** and **Section 6**.

2.3 Future land use planning processes

2.3.1 Proposed local planning scheme amendment

Requests to amend the City of Busselton LPS No. 21 will be lodged with the respective state and local authorities, in order to appropriately rezone the site to be consistent with the structure plan and enable future urban development.

As part of the scheme amendment process, the City of Busselton will refer the amendment to the Environmental Protection Authority (EPA) pursuant to Section 48A of the Environmental Protection Act 1986 (EP Act) to determine whether environmental assessment under Part IV of the EP Act will be required. The EPA will advise the City of Busselton if any environmental factors or potential significant impacts are identified as requiring assessment and advice or recommendations may be provided regarding future development within the site. This is undertaken prior to the scheme

Environmental Assessment and Management Strategy

Abbey South Structure Plan Area



amendment request being advertised to the public. The environmental factors and objectives considered by the EPA are discussed further in **Section 5**.

Following receipt of input from the EPA, the scheme amendment will be sent to the Western Australian Planning Commission (WAPC) pursuant to the Planning and Development Act 2005, who will similarly advise on if the amendment can be advertised. Following this, the scheme amendment will be publicly advertised with a decision on the scheme amendment made subsequently. This is considered further in **Section 2.4**.

2.3.2 Structure Plan

Following amendment to the City of Busselton LPS No. 21, a structure plan/s would typically be prepared. Based on the scale of the site and land ownership, the scheme amendment and structure plan stages will be addressed concurrently for the site, through the same documentation and plan. The purpose of a structure plan is to address planning scheme provisions and to provide a more detailed layout of the proposed urban land use and would include identification of features such as residential development cells, local reserves and the local road network. This has already been prepared and is considered as part of this document.

The EPA is not involved in the assessment of structure plans, given they are not able to be referred to the EPA for assessment under either Section 38 or Section 48A of the EP Act where a scheme amendment has been considered.

2.3.3 Subdivision and development

Following approval of the structure plan, the structure plan area will be subdivided and developed for urban land uses. The subdivision application process will need to address the requirements of any relevant local scheme provisions or other requirements included within the approved structure plan. Once issued, subdivision approval/s would include a range of conditions, some of which may relate to environmental matters, which will need to be implemented as part of the subdivision and development process, before titles for subdivided lots are issued. Other components of development may be progressed through development approval, for example forward bulk earthworks or other non-subdivisional works.

It is anticipated that all environmental impacts associated with implementation of urban subdivision and development works across the site will be considered by the EPA under Section 48A of the EP Act at the City of Busselton LPS No. 21 scheme amendment stages.

Environmental Assessment and Management Strategy

Abbey South Structure Plan Area



2.4 Future environmental assessment processes

2.4.1 *Environmental Protection Act 1986 – Section 48*

All amendments to regional and local planning schemes (such as the City of Busselton LPS No. 21) are required to be referred to the EPA by the responsible authority under Section 48A of the EP Act. The EPA then makes one of the following determinations on the proposed scheme amendment:

- **The proposed scheme amendment should not be assessed by the EPA,** on the basis that it is considered unlikely to result in significant environmental impacts. In making this determination, the EPA may choose to also provide informal advice in relation to how environmental factors are expected to be addressed as part of future stages of the planning and development process.
- **The proposed scheme amendment should be assessed by the EPA,** on the basis that it is considered likely to result in significant environmental impacts. An environmental impact assessment process is then undertaken, and the Minister for Environment may then choose to issue a Ministerial Statement allowing the scheme to be implemented.
- **The proposed scheme amendment is by its nature incapable of being made environmentally acceptable.**

The structure plan considered by this EAMS is intended to support a scheme amendment process for the City of Busselton LPS No. 21 to establish an ‘urban development’ zone over the site, to address the recommendations of the Leeuwin-Naturaliste Sub-regional Strategy and to support implementation of the structure plan. As such, it is expected that it will be referred to the EPA pursuant to Section 48A of the EP Act by the responsible authority (City of Busselton) to the EPA.

2.4.2 *Environmental Protection Act 1986 – Section 38*

Section 38 of the EP Act enables any person to refer a proposal likely to have a significant impact on the environment to the EPA, who then decide whether or not to assess the proposal.

Section 48I outlines that any proposal likely to have a significant impact on the environment, but which is within an area and for a land use that is subject to an assessed scheme (i.e. a scheme for which a determination has been made by the EPA under Section 48A), is not required to be referred to the EPA under Section 38 of the EP Act.

Given the environmental impacts associated with implementation of urban subdivision and development works across the site will be considered by the EPA under Section 48A of the EP Act (at the City of Busselton LPS No. 21 scheme amendment stage), it is not anticipated that the implementation of urban development works within the site will be referred under Section 38 of the EP Act. However, this only applies to proposed works which are consistent with those considered through the Section 48A process and where their potential environmental impacts were considered by the EPA. The EPA may choose to defer assessment of environmental factors to subsequent stages of the planning process, which would mean Section 48I would not apply in such instances.

Environmental Assessment and Management Strategy

Abbey South Structure Plan Area

2.4.3 *Environment Protection and Biodiversity Conservation Act 1999*

Any proposed action which is likely to result in significant impacts to Matters of National Environmental Significance (MNES) listed under the Commonwealth Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) is required to be referred to the Commonwealth Department of Agriculture, Fisheries and Forestry (DAFF) to determine whether it requires assessment under the EPBC Act.

The site is not considered to contain occurrences or habitat for MNES, and maximises retention of scattered remnant trees across the site. Referral pursuant to the EPBC Act is unlikely to be required.

In any case, the timing of EPBC Act referrals is not directly linked to the state planning processes. In an urban development context, EPBC Act referrals are typically undertaken once the development layout has been determined (for example, after the approval of the structure plan) such that the impacts to MNES can be quantified. As such, it is expected that if any EPBC Act referral is determined to be required to enable implementation of the structure plan, this would likely be made at future stages of the land use planning process, subsequent to finalisation of the structure plan process.

2.5 Future offset requirements

Under separate State and Commonwealth environmental policy frameworks, if a potential impact to an environmental value cannot be suitably mitigated through avoidance, minimisation and/or rehabilitation measures such that a significant residual impact remains, then environmental offsets may be required to counterbalance the proposed environmental impacts. This principle is applied to the environmental assessment process administered under both State and Commonwealth environmental protection legislation (the EP Act and EPBC Act, respectively).

With regard to environmental matters afforded protection under the State EP Act and in the context of local scheme amendments to be progressed across the site, the structure plan (considered in detail in **Section 5**) provides suitable mitigation of potential impacts through impact avoidance and minimisation measures, such that there will be no significant residual impacts for each of the relevant environmental factors. As such, no offsets are considered likely to be required for environmental matters protected under the EP Act.

With regard to MNES afforded protection under the Commonwealth EPBC Act, the structure plan provides mitigation of potential impacts through impact avoidance and minimisation measures. MNES are unlikely to be impacted by development of the site, and offsets are unlikely to be required.

Environmental Assessment and Management Strategy

Abbey South Structure Plan Area



3 Existing Environment

In order to understand the environmental values within or nearby to the site and consider appropriate management responses, Emerge Associates have reviewed a range of information sources, including local and regional reports, databases, mapping and site-specific investigations. The outcomes of these investigations are discussed in the following sections.

3.1 Climate

The climate of the site is described as Mediterranean, which is described as having hot, dry summers and moderately wet, mild winters. Since 1970, there has been an approximate 16% decline in the April to October rainfall within the southwest of Australia, with the May to July rainfall seeing the largest decrease at 20% (CSIRO-BoM 2020). In conjunction with this, Australia's climate has warmed by approximately 1°C since 1910, for both surface air temperature and sea surface temperature (CSIRO-BoM 2020).

Temperature and rainfall records are available from the Bureau of Meteorology (BoM). The Busselton Aero (site 009603) is the closest recording weather station, located approximately 16 km south-east of the site. Based on the weather data collected from 1997 to 2022, the local area experiences an average of 692.4 mm of annual rainfall. The temperature data recorded indicates an average maximum temperature of 30.2°C in January, and an average minimum temperature 7.0°C in July, as detailed within **Plate 2 (BoM 2022)**.

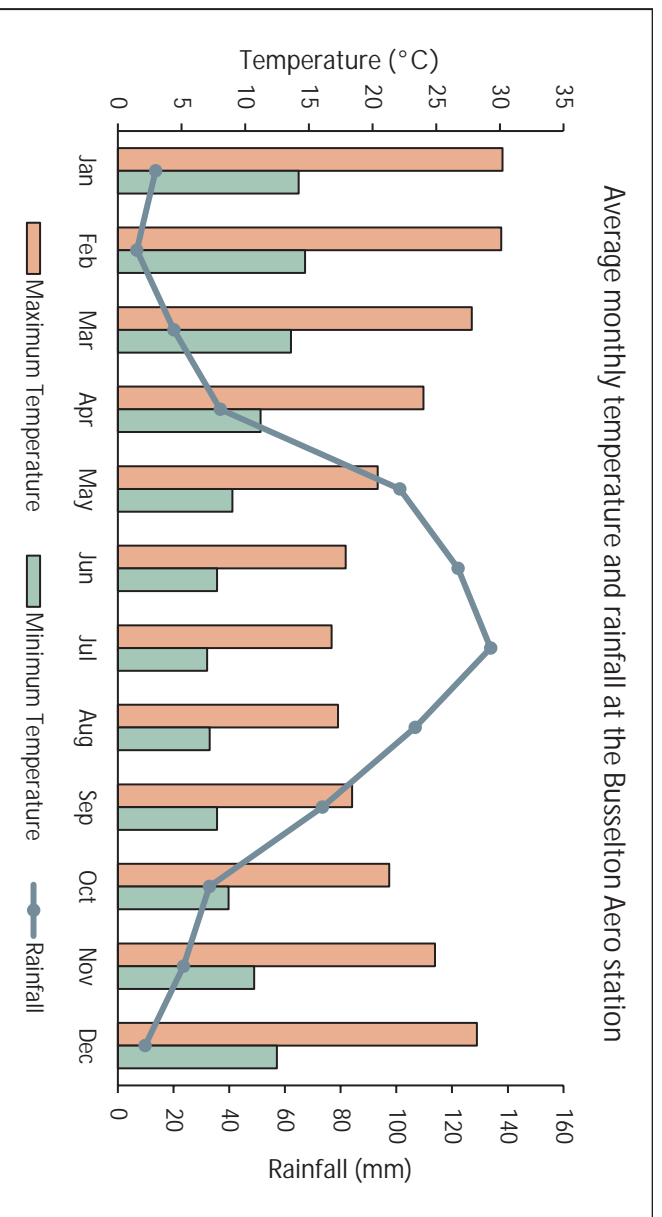


Plate 2: Average monthly temperature and rainfall at the Busselton Aero station (station number 009603) (BoM 2022)

Environmental Assessment and Management Strategy

Abbey South Structure Plan Area



3.2 Landform and soils

3.2.1 Topography

Elevation generally ranges from 2 m Australian height datum (mAHD) within the southern portion of the site to 3 mAHD within the northern portion of the site. An exception to these elevations is a depression associated with a portion of the site mapped as floodway (discussed further in **Section 0**) within the southern portion of the site and has elevations of around 1 mAHD. The topographic contours are shown within **Figure 1**.

3.2.2 Landform, soils and geology

Landform and soils influence vegetation types at a regional and local scale. The site occurs on the Swan Coastal Plain, which is the geomorphic unit that characterises much of the coast along the south-west of Western Australia.

An analysis of resource mapping supplied by the Department of Primary Industries and Regional Development (DPIRD 2022) indicates that the site is underlain by the Quindalup South System and the Vasse System. The Quindalup South System expands across the majority of the site and is described as coastal dunes of the Swan Coastal Plain, with calcareous deep sands and yellow sands. The Vasse System occupies the south-western portion of the site and is described as poorly drained estuarine flats, of the Swan Coastal Plain, which contains tidal flat soil, saline wet soil and pale deep sand.

A closer analysis of regional soil mapping prepared at a scale of 1:50 000 indicates that two soil units occur within the site. This mapping has been prepared as part of a series of geological maps published by the Geological Survey of Western Australia (Jordan 1986; Belford 1987; Leonhard 1991) and also outlines the expected broad level capability of soil and rock units to accommodate various land uses. The soils mapped within the site are shown in **Figure 2** and include:

- Calcareous Sand (S13) across the majority of the site, which is described as 'white, medium-grained, rounded quartz and shell debris; well sorted'. This soil unit is noted as having a variable thickness, dependent upon degree of estuarine and marine modification, and can sometimes occur over limestone (LS7),
- Clayey Peaty Sand (SpC1), in the south-western and north-eastern portions of the site, which is described as 'grey to black quartz sand with variable organic content; minor clays'. This soil unit is noted as being subject to seasonal flooding owing to the higher water table.

The soil and landform profiles over the site were further confirmed through the installation of five groundwater monitoring bores in June 2021 (shown in **Figure 2**). The bores were installed across the site to depths ranging between 5 m below ground level (mBGL) to 7 mBGL. The bore logs indicate that topsoil is generally comprised of coarse calcareous sand with depths ranging between 3 m to 7 m. This layer was either the final depth of the monitoring bore or was underlain with one of the following:

- Clayey sand with a thickness of 1 m extending from 5 mBGL to 6 mBGL, or;

Environmental Assessment and Management Strategy

Abbey South Structure Plan Area



- Sandy clay extending to depths between 3 mBGL to 4 mBGL, further overlying clay and rock that extends to depths of approximately 5 mBGL.

The bore logs suggest that the soils in the northern portion of the site are sandy and moving south, sandy clay soils become more prominent at shallower depths. This is detailed further within the Local Water Management Strategy (LWMS) (Emerge Associates 2022b).

3.2.3 Acid Sulfate Soils

Acid sulfate soils (ASS) is the name commonly given to naturally occurring soils and sediment containing iron sulphide materials. In their natural state ASS are generally present in waterlogged anoxic conditions and do not present any risk to the environment. When oxidised, ASS produce sulphuric acid, which can pose risks to the surrounding environment, infrastructure and human health.

ASS risk mapping (DWER 2017a) indicates that the northern two-thirds of the site is mapped as having a 'moderate to low' risk of ASS within 3 m of the natural soil surface, whilst the southern third of the site (which roughly aligns with areas identified as wetland features, discussed further in **Section 3.4.3**) and the north-eastern corner is mapped as having a 'high to moderate' risk of ASS within 3 m of the natural surface. The ASS risk mapping applicable to the site is shown in **Figure 3**.

3.2.4 Land capability

The Busselton Margaret River Augusta Land Capability Study is a broad-scale assessment completed to determine the general capacity of land in the broader region to sustain agricultural land uses such as grazing, viticulture, horticulture/market gardening, orchard crops and forestry (Lantzke 1990). It has been reviewed as part of understanding the suitability of the land for the proposed future development.

The Quindalup/Vasse coast land system within the site lists the following land use capabilities:

- They do not support good pasture due to low fertility and poor moisture availability.
- Generally unsuitable for horticulture and forestry due to their exposure to salt spray, low-ground water quality, low fertility and poor moisture availability.
- There are few areas suitable for soaks.

Of the soil types identified within the site, the Quindalup Flats (Quindalup South System) has minor to moderate physical limitations for housing, whilst the Quindalup Wet Flats (Vasse System) has moderate to major limitations. Neither of these soil types, however, are capable to support agricultural activities including grazing, market gardens, vineyards, orchards and forestry. There is high representation of the moderate to high capability land throughout the broader area, and development of the site would not decrease available agricultural land to any significant extent.

Environmental Assessment and Management Strategy

Abbey South Structure Plan Area

3.3 Biodiversity and natural area assets

3.3.1 Flora and vegetation

Vegetation can be described and mapped at different scales or units in order to illustrate general patterns in its distribution. At a continental scale the Interim Biogeographic Regionalisation of Australia (IBRA) identifies the Swan Coastal Plain (Environment Australia 2000).

At a finer scale, native vegetation within the site and adjacent land can be classified based on regional vegetation associations. Vegetation complex mapping undertaken by Department of Biodiversity, Conservation and Attractions (DBCA 2021b) identifies the Quindalup Complex over the majority of the site and the surrounding land to the north, east and west. The land to the south as well as the southern portion of the site, however, has been mapped as the Vasse Complex. Each complex has been described below, and illustrated on **Plate 3**:

- Quindalup Complex (55): Coastal dune complex consisting mainly of two alliances - the strand and fore-dune alliance and the mobile and stable dune alliance. Local variations include the low closed forest of *Melaleuca lanceolata* (Rottnest Teatree) - *Callitris preissii* (Rottnest Island Pine), the closed scrub of *Acacia rostellifera* (Summer-scented Wattle) and the low closed *Agonis flexuosa* (Peppermint) forest of Geographe Bay.
- Vasse Complex (57): Mixture of the closed scrub of *Melaleuca* species fringing woodland of *Eucalyptus rudis* (Flooded Gum) - *Melaleuca* species and open forest of *Eucalyptus gomphocephala* (Tuart) - *Eucalyptus marginata* (Jarrah) - *Corymbia calophylla* (Marri). Will include areas dominated by *Tecticornia* and *Sarcocornia* species (Sampfire) near Mandurah and south of the Capel River.



Plate 3: Vegetation Complexes (DBCA 2021b)

Environmental Assessment and Management Strategy

Abbey South Structure Plan Area



Studies have indicated that the loss of biodiversity caused by habitat fragmentation is significantly greater once a habitat type falls below 30% of its original extent (Miles 2001). The Environmental Protection Authority's (EPA) (2008) Guidance Statement No. 33 Environmental Guidance for Planning and Development identified a standard level of native vegetation retention of at least 30% of the pre-clearing extent of the vegetation complex in a bioregion. Within the south-west, the Quindalup Complex has 60.49% of its pre-European extent remaining, whilst the Vasse complex has 31.40% of its pre-European extent remaining (Government of Western Australia 2019).

3.3.1.1 Vegetation condition

Based on a review of publicly available aerial photography, the site has been cleared of a majority of native vegetation since at least 1970 (Landgate 2022). It has been used for general agricultural purposes, such as grazing, for a number of years, and more recently commercial operations have commenced within the north-eastern portion of the site, including an ice factory and fresh food market.

No site-specific flora and vegetation surveys have been undertaken within the site. However, environmental scientists from Emerge Associates have completed numerous site visits including November 2020, November 2021, December 2021 and July 2022, and observed the ecological values within the site. The observations based on aerial photography were supported by the site observations, with the site predominantly cleared of native vegetation, an only number of scattered remnant paddock trees (predominantly *Agonis flexuosa* (peppermint), and scattered *Eucalyptus rudis* (flooded gum)) remaining over paddock grasses. This is consistent with the native vegetation mapping for Western Australia (DPIRD 2020), which identified only small areas of native vegetation in the north-eastern and south-eastern portion of the site, associated with denser clumps of vegetation along existing fence lines (which align with areas of peppermint trees). The DPIRD mapping identified native vegetation immediately north of the site (within Caves Road reserve), and along the southern boundary.

Examples of the vegetation values within the site are illustrated within **Plate 4**, **Plate 5**, and **Plate 6**.

Environmental Assessment and Management Strategy

Abbey South Structure Plan Area

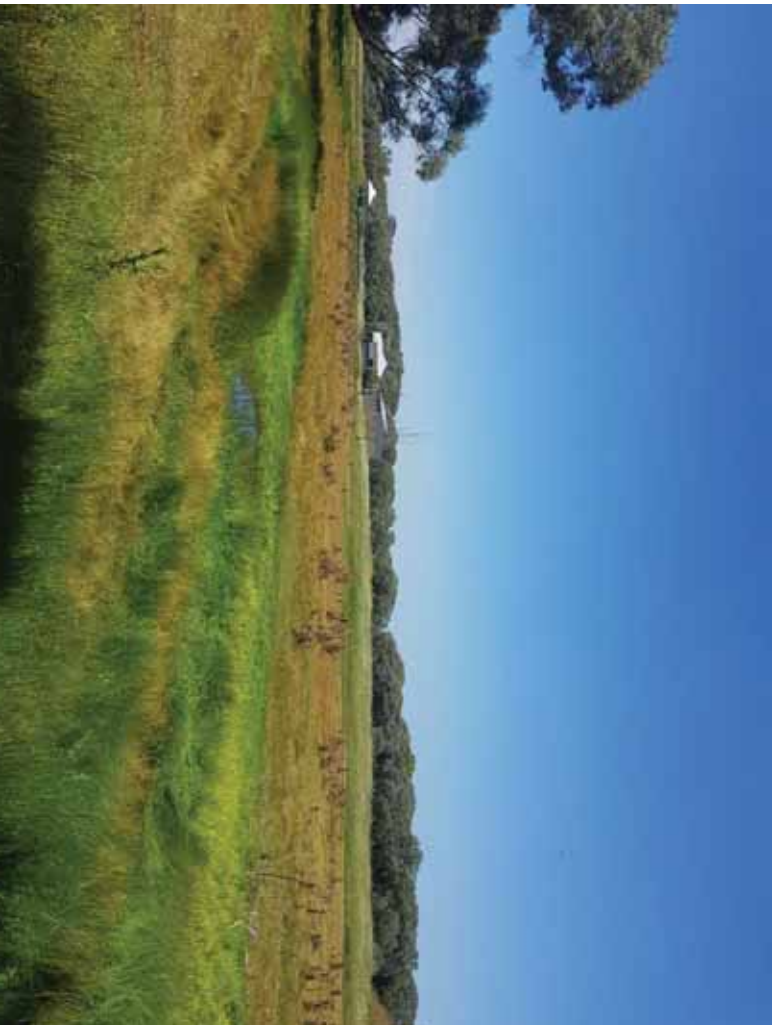


Plate 4: Paddock grass extending through the south-western portion of the site (associated with the floodway area). Trees in background are located outside the site, adjacent to the southern boundary



Plate 5: Paddock grasses and paddock trees (*Agonis flexuosa*), found across the majority of the site

Environmental Assessment and Management Strategy

Abbey South Structure Plan Area



Plate 6: Existing commercial uses (The Shed Markets), currently established within the north-eastern corner of the site

3.3.1.2 Threatened and priority ecological communities

An ecological community is a naturally occurring group of native plants, animals and other organisms that are interacting in a unique habitat. An ecological community's structure, composition and distribution are influenced by environmental factors such as soil type, position in the landscape, altitude, climate and water availability (DBCAs 2020). 'Threatened ecological communities' (TECs) are ecological communities that are recognised as rare or under threat and therefore warrant special protection.

Selected TECs are afforded statutory protection at a federal level under the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act). TECs listed under the EPBC Act are assigned a conservation status. Any action likely to have a significant impact on a community listed under the EPBC Act requires Ministerial approval.

TECs are also listed within Western Australia under the Biodiversity Conservation Act 2016 (BC Act) and the Biodiversity Conservation Regulations 2018 (BC Regulations). Their significance is also acknowledged through other state environmental approval processes such as 'environmental impact assessment' pursuant to Part IV of the Environmental Protection Act 1986 (EP Act) and the Environmental Protection (Clearing of Native Vegetation) Regulations 2004.

Environmental Assessment and Management Strategy

Abbey South Structure Plan Area



A plant community that is under consideration for listing as a TEC in Western Australia, but does not yet meet survey criteria or has not been adequately defined, may be listed as a 'priority ecological community' (PEC). Listing as a PEC is similarly considered during state approval processes.

A review of the publicly available datasets (NatureMap (DBCA 2021a), Locate SLIP (Landgate 2022), Protected Matters Search Tool (PMST) (DCCCEW 2022) indicates a number of threatened ecological communities (TECs), priority ecological communities (PECs), may occur in the general area, and are outlined in **Table 1**.

Table 1: Summary of threatened and priority ecological communities with potential to occur in general area

Community based on database search	Conservation status	
	State	Federal
Banksia Woodlands of the Swan Coastal Plain	• Priority 3	• Endangered
Clay Pans of the Swan Coastal Plain (Is a composite of four communities, with 'Dense shrublands on clay flats' found in general area)	Vulnerable (Dense shrublands on clay flats)	Critically Endangered
Quindalup Eucalyptus gomphocephala and/or Agonis flexuosa woodlands	Priority 3	-
Subtropical and Temperate Coastal Saltmarsh	Priority 3	Vulnerable
Tuart (Eucalyptus gomphocephala) Woodlands and Forest of the Swan Coastal Plain	Priority 3	Critically Endangered

No detailed flora and vegetation surveys have been completed, however based on the detailed site observations (discussed above), none of these values are likely to be present given the highly disturbed nature of the site, with the site dominated by paddock grasses with occasional Agonis flexuosa and eucalypts (Eucalyptus rudis) present as paddock trees.

3.3.1.3 Threatened and priority flora

Certain flora species that are considered to be rare or under threat warrant special protection under federal and/or state legislation. At a federal level, flora species may be listed as 'threatened' pursuant to the EPBC Act. Threatened flora species listed under the EPBC Act are assigned a conservation status according to attributes such as population size and geographic distribution. Any action likely to have a significant impact on a taxon listed under the EPBC Act requires Ministerial approval.

At a state level, plant species may also be classed as 'threatened' under the BC Act. Similarly, it is an offence to 'take' or 'disturb' threatened flora listed under the BC Act without Ministerial approval.

Flora species that do not currently meet the criteria for listing as threatened but are potentially rare or threatened may be added to the DBCA's Priority Flora List. These species are classified into 'priority' levels based on threat. Whilst priority species are not under direct statutory protection, they are considered during State approval processes.

Environmental Assessment and Management Strategy

Abbey South Structure Plan Area



A review of the publicly available datasets (NatureMap (DBCA 2021a), Locate SLIP (Landgate 2022), Protected Matters Search Tool (PMST (DCCEEW 2022) indicates a number of threatened flora (TF) or priority flora (PF) may occur in the general area, with a list provided in **Appendix B**.

No detailed flora and vegetation surveys have been completed, however based on the detailed site observations, none of these values are likely to be present given the highly disturbed nature of the site, with the site dominated by paddock grasses and scattered paddock trees.

3.3.2 Terrestrial fauna

No site-specific fauna surveys have been undertaken within the site, and consideration of fauna values have been based on the habitat that may be present within the site, which is usually closely linked with native vegetation extent and condition. As discussed in **Section 3.3.1**, the site has been historically cleared of native vegetation and is composed of paddock grasses with scattered paddock trees.

Fauna species that are considered to be rare or under threat warrant special protection under state and/or federal legislation. At a federal level, fauna species may be listed as 'threatened' pursuant to the EPBC Act and any action likely to have a significant impact on a listed threatened species requires approval from the federal Minister for the Environment.

At a state level, fauna species are listed as 'threatened' under section sections 13, 19 and 26(2) of the BC Act. It is an offence to 'take' or 'disturb' threatened fauna without Ministerial approval. In addition to this, the Department of Biodiversity Conservation and Attractions (DBCA) maintains a list of priority fauna species which, while not considered threatened under the BC Act and therefore not protected directly, involve some concern over their long-term survival.

To understand the extent of significant fauna species that are likely to occur within the local area, searches were undertaken of the DBCA's NatureMap database (DBCA 2021a) and the federal Department of Climate Change, Energy, the Environment and Water (DCCEEW) Protected Matters Search Tool (DCCEEW 2022), with the outcomes outlined in **Appendix B**. It is important to note that these searches do not take into account the types and condition of fauna habitat occurring on the site but are based on the proximity of the site to known occurrence of significant species. The following species of conservation significance were identified as potentially occurring within the vicinity of the site:

- Baudin's Black-Cockatoo (*Calyptorhynchus baudinii*) (state and federally listed).
- Carnaby's Black-Cockatoo (*Calyptorhynchus latirostris*) (state and federally listed).
- Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksii naso*) (state and federally listed).
- Western Ringtail Possum (*Pseudocheirus occidentalis*) (state and federally listed).

With regard to black cockatoos, the site is not mapped as an area with known roosting habitat for the three black cockatoo species (DBCA 2019c), nor is the site mapped as an area with known breeding habitat (DBCA 2019b). This was further supported by the outcomes documented within the 2019 Great Cocky Count Survey Report (DBCA 2019a). During the detailed site visit, Emerge Associates identified that the scattered paddocks trees within the site are predominantly Agonis

Environmental Assessment and Management Strategy

Abbey South Structure Plan Area



flexuosa and would not provide important habitat for the three black cockatoo species. In particular, Agonis flexuosa is a low priority foraging plant and is not known to support roosting or breeding.

For western ringtail possum, while it is acknowledged that the site is within the 'core habitat' area defined within the federal government's referral guidelines, this is largely based on acknowledging that suitable habitat could occur and potential impacts to this species should be considered. Emerge Associates have considered the federal government referral guidelines as well as the detailed conservation advice and recovery plan (DPAW 2017) for this species in understanding the habitat values provided by the site, and potential impacts on this species. The scattered paddock trees may provide some foraging habitat for western ringtail possum, however the scattered trees are not considered to be important or critical habitat (as defined by the recovery plan (DPAW 2017)) due to the lack of canopy connectivity and connection to other areas of remnant vegetation adjacent to the site, a key habitat requirement for western ringtail possum. Without this connection, possums would need to transit through open areas where they are at risk of predation, and is therefore not a preference. It is anticipated that development of the site would improve the habitat values provided by the site for this species, and is discussed further in **Section 5.4**.

The site is considered to have overall low biodiversity value from a fauna perspective due to the lack of native vegetation within the site, when compared to surrounding remnant vegetation within the Caves Road reserve to the north, and areas of intact native vegetation within the Locke Nature Reserve further to the west. This is primarily due to the lack of understorey vegetation and connectivity between the scattered trees.

3.3.3 Conservation reserves

3.3.3.1 DBCA managed lands

DBCA has tenure of or interests in numerous areas of land across the state for a range of purposes. Tenure categories include national parks, nature reserves, conservation parks, marine parks, marine nature reserves, marine management areas, section 5(1)(g) reserves, state forest and timber reserves. These areas are mapped within the Legislated Lands and Waters (DBCA 2022c) and Lands of Interest (DBCA 2022b) datasets. The Legislated Lands and Waters (DBCA 2022c) dataset includes lands subject to the following legislation: the Conservation and Land Management Act 1984, Swan and Canning Rivers Management Act 2006 and lands identified under the Land Administration Act 1997. The Lands of Interest (DBCA 2022b) dataset includes all other lands of which DBCA is recognised as the manager but is not vested under any act. These lands comprise of crown land and freehold land which DBCA has been acknowledged by the Department of Planning, Lands and Heritage (DPLH) as the responsible agency.

No DBCA managed lands have been identified within the site. The Locke Nature Reserve is located approximately 230 m west of the site, whilst the Ngari Capes Marine Park is located approximately 450 m north of the site.

Environmental Assessment and Management Strategy

Abbey South Structure Plan Area



3.3.3.2 City of Busselton managed lands

There is no City of Busselton managed conservation land identified within the site or immediately adjacent.

3.3.4 Ecological linkages

Ecological linkages are linear landscape elements that allow the movement of fauna, flora and genetic material between areas of remnant habitat. This exchange of genetic material between vegetation remnants improves the viability of those remnants by allowing greater access to breeding partners and food sources, refuge from disturbances such as fire and maintenance of genetic diversity of plant communities and populations. Ecological linkages are ideally continuous or near-continuous as the more fractured a linkage is, the less ease flora and fauna have in moving within the corridor (Alan Tingay and Associates 1998).

The Perth Biodiversity Project, supported by the Western Australia Local Government Association (WALGA), have identified and mapped regional ecological linkages within the Perth Metropolitan Region (WALGA and PBP 2004). This study was extended beyond the Perth Metropolitan Region through the South West Biodiversity Project, resulting in the identification and mapping of the South West regional ecological linkages (Molloy et al. 2009).

There are no mapped ecological linkages within the site, however, ecological linkage no. 65 is identified to the south of the site, associated with the Broadwater Nature Reserve Swamp (DEC 2009).

3.3.5 Environmentally Sensitive Areas

'Environmentally sensitive areas' (ESAs) are prescribed under the Environmental Protection (Clearing of Native Vegetation) Regulations 2004 and have been identified to protect native vegetation values of areas surrounding significant, threatened or scheduled flora, vegetation communities or ecosystems. Exemptions under the Environmental Protection (Clearing of Native Vegetation) Regulations 2004 do not apply within ESAs. However, exemptions under Schedule 6 of the Environmental Protection Act 1986 (EP Act) still apply, including any clearing in accordance with a subdivision approval under the Planning and Development Act 2005 (a recognised exemption under the Schedule 6 of the EP Act).

No ESAs are mapped within the site. An ESA is situated approximately 180 m west of the site (DWER 2021), associated with a conservation category wetland feature.

3.4 Hydrology

3.4.1 Groundwater

The site is within the Busselton-Capel groundwater management area and the Dunsborough-Vasse subarea. The Water Register (DWER 2022c) indicates that the site is underlain by a multi-layered system, which includes following aquifers:

Environmental Assessment and Management Strategy

Abbey South Structure Plan Area

- Superficial Swan – unconfined
- Leederville – confined
- Sue Coal Measures – confined

The Water Register indicates that the Superficial Swan and Leederville aquifers are fully allocated, whilst the Sue Coal Measure has water allocation available.

Emerge Associates undertook monthly groundwater monitoring at the five monitoring bores across the site, between July 2021 and November 2021, and July 2022 and November 2022. The results are summarised in **Table 2** and indicate that the maximum groundwater level (MGL) within the site occurred across different months (between August to October) and ranged from 1.19 mBGL in the north-eastern portion of site to 1.54 mBGL in the lower central section of the site. The highest groundwater levels occurred in 2021 compared to 2022. The monitoring bore locations and indicative groundwater levels are shown in **Figure 4**.

Table 2: Annual winter peak (mBGL) collected between August and November 2021 and August and November 2022

Bore ID	Depth to groundwater (mBGL)									
	July		August		September		October		November	
	2021	2022	2021	2022	2021	2022	2021	2022	2021	2022
MW1	2.26	1.95	1.49	1.78	1.77	1.9	1.32	2.05	1.55	2.15
MW2	1.74	1.83	1.52	1.46	1.19	1.458	1.29	1.67	2.04	1.74
MW3	1.82	2.16	1.54	1.84	1.69	1.907	1.77	2.08	2.44	2.19
Error! Reference source not found: MW4	2.41		2.10		2.19		1.25		1.99	
		2.7		2.73		2.833		2.47		2.57
MW5	1.60	1.99	1.26	1.58	1.39	1.627	1.79	1.81	1.74	1.9

* **Bold** values indicate the groundwater level monitoring event where the annual winter peak was recorded.

Groundwater quality sampling undertaken in August 2021 and September 2022 by Emerge Associates as part of the groundwater monitoring program indicate that the nutrient concentrations recorded are not inconsistent with what would be expected for historical agricultural land in the region. This is further detailed within the LWMs (Emerge Associates 2022b).

3.4.2 Surface water

A review of the publicly available flood mapping database and subsequent information provided by DWER (Seewraj 2021) indicates that a 1% annual exceedance probability (AEP) event floodway and flood fringe is located within the south-western corner of the site, as shown in **Figure 4**. This floodway connects to the Broadwater Nature Reserve Swamp (BNRS) floodway immediately south of the site. According to flood mapping the flood height of the adjacent floodway is approximately 1.65 mAHD in a 1% AEP event (WAWA 1987).

Environmental Assessment and Management Strategy

Abbey South Structure Plan Area



The Buayangup Main Drain (BMD) and Sub A drain located between Florence Road and the coastal outlet is located approximately 180 m west of the site, as shown in **Figure 4**. This drain is highly modified in the downstream reach and discharges north to Geographie Bay, which is 400 m north of the site. The Buayangup drainage system is managed by Water Corporation and provides rural drainage from upstream catchments, safely catering and maintaining flood water conveyance up to the 5% AEP event.

The BNRS is located immediately south of the site and positioned between the BMD and the Vasse Diversion Drain (VDD), which is approximately 6 km to the east of the site. It acts as a large regional surface water retention area prior to discharging to the VDD. This area to the south is subject to flooding, and in a 1% AEP rainfall event flood levels are likely to peak at 1.66 mAHD in the BNRS (JDA 2017).

3.4.3 Wetlands

A review of the Geomorphic Wetlands of the Swan Coastal Plain dataset (DBCA 2022a) indicates that a number of multiple use wetlands (MUWs) are identified within the site. This includes three MUWs in the southern and south-western portions of the site (unique feature identification (UFI) #39, #63, #13195); and one MUW (UFI #64) within the north-eastern portion of the site. The location of the MUWs area shown in **Plate 7**.



Plate 7: Geomorphic Wetlands (DBCA 2022a)

No conservation category wetlands (CCWs) are present within the site or within close proximity. A CCW is located west of Buayangup Drain, however is more than 225 m from the site.

Environmental Assessment and Management Strategy

Abbey South Structure Plan Area



The presence of a wetland can indicate that groundwater may be close to the surface at different periods of the year. As part of the site visit, and based on discussions with the landowners, it appears that waterlogging may occur in areas identified as a MUW (particularly in winter).

3.4.4 Public drinking water source area

Public drinking water source areas (PDWSAs) are proclaimed by the DWER to protect identified drinking water sources, including surface water and groundwater sources (DoW 2009). They are proclaimed under the Metropolitan Water Supply, Sewerage and Drainage Act 1909 or the Country Areas Water Supply Act 1947 as Water Reserves, Catchment Areas or Underground Water Pollution Control Areas. PDWSAs provide the population with the majority of its drinking water supplies and can be vulnerable to contamination from a range of land uses. Once an area is identified as a PDWSA, consideration needs to be given to the intended land use and associated activities to ensure that they are appropriate in meeting the water protection quality objectives of the area.

The site is not within a PDWSA (DWER 2022b).

3.5 Coastal processes

The site is situated approximately 400 m south of Geographe Bay and coastal hazard risk mapping prepared by the City of Busselton (2022) indicates that it could be subjected to coastal hazards, such as erosion and inundation based on a sea level rise of 0.9 m. The northern portion of the site is identified within the 2120 erosion hazard line, and the Coastal Hazard Risk Management and Adaption Plan (CHRMAP) (City of Busselton 2022) notes that storm surge inundation could be as high as 2.5 mAHD based on present sea levels. With the combined effects of climate change and sea level rise, it is expected that the sites vulnerability to these coastal processes will increase in the future, and the City's CHRMAP requires a minimum finished floor of 2.7 mAHD to be achieved.

A review of Coastal Risk Australia (NGIS 2022) indicates that the southern portion of the site may also be inundated during high tide events as a result of a similar sea level rise (0.84 m based on Coastal Risk Australia modelling) by 2100. The area of inundation is predicted to occur within the existing floodway and flood fringe, as depicted in **Figure 4**.

3.6 Heritage

3.6.1 Aboriginal heritage

The Aboriginal Heritage Inquiry System (AHIS) is maintained pursuant to Section 38 of the Aboriginal Heritage Act 1972 by the Department of Planning, Lands and Heritage (DPLH), and contains information on registered Aboriginal heritages sites and other heritage places throughout Western Australia. In accordance with the Aboriginal Heritage Due Diligence Guidelines (DAA 2013), a search of the AHIS online database (DPLH 2022) was undertaken.

A portion of an 'Other Heritage Place' (ID 5337) is mapped as extending into the western portion of the site, as shown on **Figure 5**. This feature is described as 'skeletal material/burial' and is likely to be

Environmental Assessment and Management Strategy

Abbey South Structure Plan Area



associated with the drain further to the west (supported by information provided in the Buayanyup River Action Plan (Geographic Catchment Council 2010)) where the Aboriginal site is described as being associated with the drain.

3.6.2 Non-Indigenous heritage

In order to determine the actual or potential presence of sites or features of non-indigenous heritage significance within the site, a review of readily available information at a federal, state and local government level was undertaken to determine if any of the following occur within the site:

- World Heritage Sites.
- National Heritage Places.
- Commonwealth Heritage Places.
- Sites listed in the State Register of Heritage Places.
- Sites listed in the City of Busselton Heritage Register.

A desktop search of the State Heritage Office database, which includes state and local lists (Heritage Council of WA 2021), the Australian Heritage Database, which includes the National and Commonwealth Heritage Lists (Environment 2019) and the City of Busselton Heritage Register (City of Busselton 2014) indicates that there are no heritage sites listed within the site. The Newtown House (associated with Amelia Park Lodge) is located immediately south of the site, as shown in **Figure 5**. This feature is identified as having local heritage value and will not be impacted by development within the site.

3.7 Other land use considerations

3.7.1 Historic and existing land uses

As outlined previously, based on a review of publicly available aerial photography, the site has been cleared of a majority of native vegetation since at least 1970 (Landgate 2022). It has been used for general agricultural purposes, such as grazing, for a number of years, and more recently commercial operations have commenced within the north-eastern portion of the site, including an ice factory and fresh food market.

3.7.2 Potential site contamination

Consideration of the potential for contamination has been undertaken in accordance with Assessment and management of contaminated sites: Contaminated sites guidelines (DER 2014) and included the following:

- A review of the DWER Contaminated Sites Database (DWER 2022a). The site or nearby was not identified as being 'contaminated – remediation required', 'contaminated – restricted use' or 'remediated for restricted use'.
- A detailed review of available historic aerial photography, to understand if potentially contaminating activities could have occurred within the site, such as intensive agriculture, market gardens, landfilling or other activities considered a risk of contamination.

Environmental Assessment and Management Strategy

Abbey South Structure Plan Area



- A review of previous and existing land uses within the site, based on information from the landowner.

The historic and current ongoing agricultural (grazing) land use present across the site is not identified as a potentially contaminating land use, and therefore in accordance with Assessment and management of contaminated sites: Contaminated sites guidelines (DER 2014), is not considered to represent any significant risk of potential for contamination within the site.

A review of the Department of Defence Unexploded Ordnance (UXO) search tool (Department of Defence 2022) did not identify any potential UXO occurrences within the local area.

3.7.3 Mosquitos and nuisance insects

Mosquitos and other nuisance insects (midges, etc.) are a concern for local governments and health authorities, given they can spread disease (such as Ross River virus with mosquitos), cause nuisance to the community, and affect both health and lifestyle.

Given the presence of a constructed waterbody within the southern portion of the site and a seasonal natural waterbody further to the south, and the potential presence for standing water, a preliminary assessment under the Department of Health (DoH) Chironomid midge and mosquito risk assessment guide for constructed waterbodies (Department of Health 2007) has been undertaken for the site. The assessment indicates that:

- For the existing waterbody within the south-western portion of the site, it has been identified as achieving a 'medium risk' rating, which can be described as 'increased probability of midge or mosquito breeding so as to create a problem. Requires improved monitoring and ongoing maintenance in order to prevent problems from occurring'.
- While the assessment guide is not specifically applicable to determining risk for a natural water feature, risk for the water feature to the south has been considered and it is likely to have a 'medium' risk rating as well. The existing strip of vegetation between the water feature to the south and the site is likely to provide a barrier to mosquito and midge movement based on prevailing south-westerly winds.

The existing waterbody is likely to be removed as part of the proposed development, and standing water within the site will be managed through the implementation of the LWMS (Emerge Associates 2022b), discussed further in **Section 4**.

3.8 Surrounding land uses

Land uses surrounding the site include residential development (i.e. public open space, footpaths, roads, dwellings, commercial enterprises) and rural pursuits/farmland (i.e. grazing, tourist accommodation, conservation land). A review of the surrounding land uses and outcomes from the site visits identified the following land uses and features:

- Caves Road is located immediately north of the site, with land zoned 'residential' under the City of Busselton LPS No.21 and Geographie Bay further north.

Environmental Assessment and Management Strategy

Abbey South Structure Plan Area

- Bussell Highway is located immediately to the east of the site. Land zoned 'residential' under the City of Bussellton LPS No. 21 is located further to the east.
- Land zoned 'conservation' under the City of Bussellton LPS No. 21 is located to the south of the site, and is associated with the BNRS. The zoning for this area also includes 'special control areas', addressing landscape value, wetland and floodway.
- An RAC holiday/caravan park is located immediately to the west of the site, with Buanyanup Drain further to the west. A large area of remnant vegetation exists further to the west and is reserved 'recreation' under the City of Bussellton LPS No. 21 and is associated with Locke Nature Reserve.

Caves Road and Bussell Highway are regional distributor roads, and identified as an 'other significant freight/traffic route' in Schedule 2 South West of State Planning Policy 5.4 Road and Rail Noise (SPP 5.4) (WAPC 2019b). The purpose of SPP 5.4 is to minimise the adverse impact of road and rail noise on noise-sensitive land use and/or development within the specified trigger distance of strategic freight and major traffic routes and other significant freight and traffic routes. In accordance with SPP 5.4, consideration of noise for sensitive land uses is required within 200 m of the road carriageway edge. The location of these roads in relation to the site and areas where considerations subject to SPP 5.4 (and in particular potential noise impacts) will apply are shown in **Plate 8**.

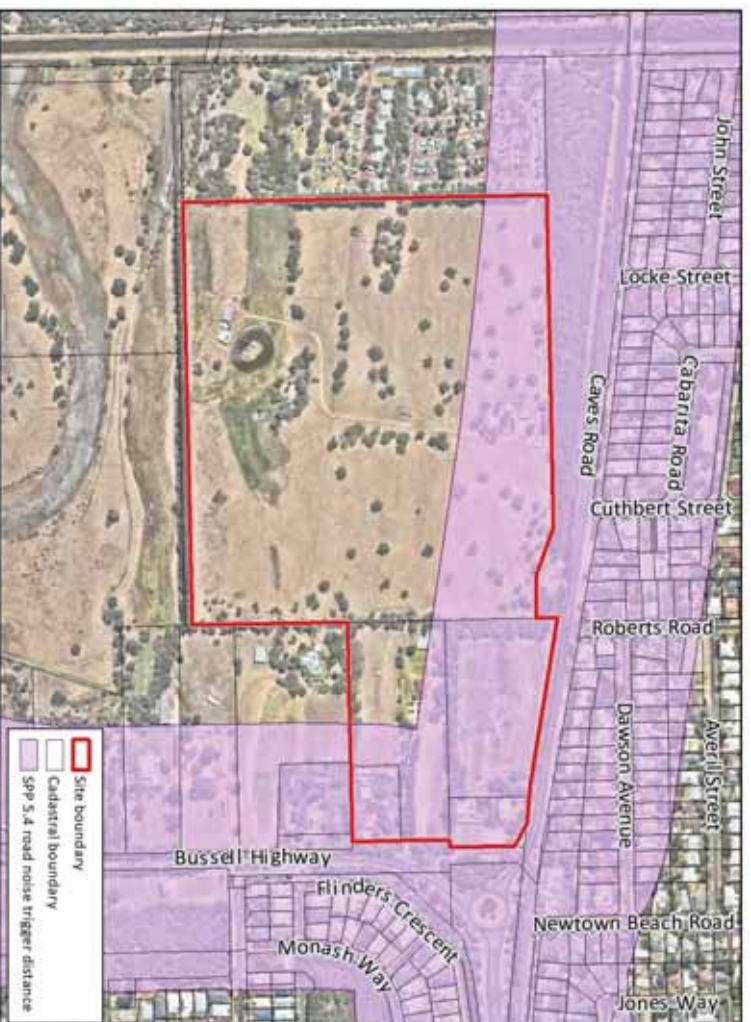


Plate 8: SPP 5.4 'other significant freight/traffic routes' 200 m trigger distance

3.9 Bushfire hazard

The entire site is designated as a 'bushfire prone area' in the state Map of Bush Fire Prone Areas (OBRM 2021) and is shown in **Plate 9**.

Environmental Assessment and Management Strategy

Abbey South Structure Plan Area



A Bushfire Management Plan (BMP) (Emerge Associates 2022a) has been prepared to support the proposed scheme amendment and structure plan and considers the potential mitigation and management of bushfire risks in accordance with State Planning Policy 3.7 Planning in Bushfire Prone Areas (SPP 3.7) (WAPC 2015a) and the Guidelines for Planning in Bushfire Prone Areas Version 1.4 (the Guidelines) (DPLH & WAPC 2021).

In accordance with SPP 3.7 and the Guidelines, existing bushfire hazards within and nearby to the site have been identified and then classified pursuant to Australian Standard 3959:2018 Construction of buildings in bushfire prone areas (AS 3959), in order to understand the current bushfire risk to the site. Areas of bushfire hazard include:

- Vegetation within the site, namely:
 - Woodland vegetation, associated with remnant vegetation along the boundary between Lot 4 and Lot 12, within the north-eastern portion of the site.
 - Scrub vegetation, associated with vegetation adjacent to Caves Road in Lot 12.
 - Grassland vegetation, identified across the majority of the site, associated with existing cleared paddocks with scattered paddock trees.
- Vegetation external to the site, namely:
 - Existing forest vegetation associated with existing remnant vegetation to the north of the site within Caves Road reserve.
 - Scrub vegetation associated with remnant vegetation within the RAC Busseton Holiday Park, and situated to the south-west of the site.
 - Grassland vegetation to the south and south-east, associated with cleared land which is regularly grazed and/or subject to inundation.

Bushfire hazard level mapping completed for the site in accordance with the Guidelines indicates it is largely subject to a 'Moderate' bushfire hazard, associated with the areas of paddock areas (identified as grassland) (Emerge Associates 2022a). A small patch of an 'Extreme' bushfire hazard is situated within the north-eastern portion, associated with the woodland vegetation along the boundary between Lot 4 and Lot 12. This is shown in **Figure 6**.

Environmental Assessment and Management Strategy

Abbey South Structure Plan Area

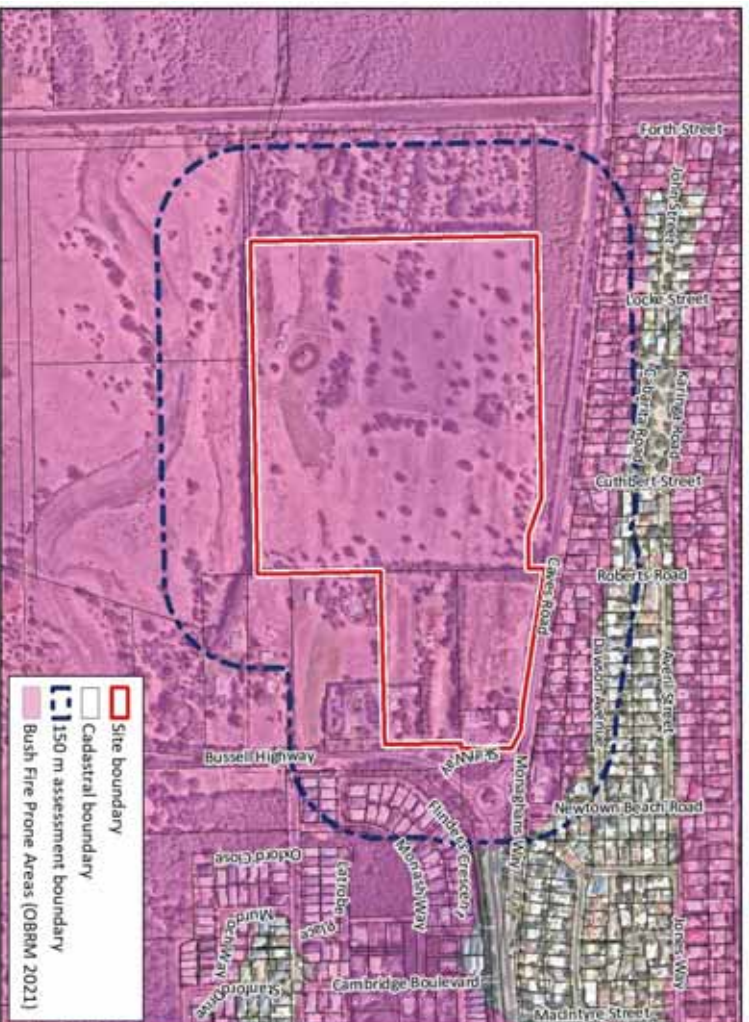


Plate 9: Areas within and surrounding the site identified as 'bushfire prone areas' (as indicated in purple) under the state-wide Map of Bush Fire Prone Areas (OBRM 2021).

Environmental Assessment and Management Strategy

Abbey South Structure Plan Area

4 Environmental Factors Considered by the EPA

4.1 Environmental principles

The five principles of environmental protection in Western Australia are set out in Section 4A of the EP Act. The manner in which these principles have been considered within the scheme amendment and structure plan and will be addressed through future planning (subdivision) and development stages is presented in **Table 3**. Further detail on the environmental values within the site and proposed management are considered in the sections further below.

Table 3: EP Act Principles

Principle	Consideration
<p>1. The precautionary principle</p> <p>Where there are threats of serious or irreversible damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation. In application of this precautionary principle, decisions should be guided by:</p> <ol style="list-style-type: none"> careful evaluation to avoid, where practicable, serious or irreversible damage to the environment; and an assessment of the risk-weighted consequences of various options. 	<p>The proponent has addressed the precautionary principle by developing a suitable understanding of the environmental values of the site (flora, vegetation, fauna, wetlands, surface water, groundwater, noise and geotechnical conditions) such that decisions regarding the structure plan and its design can be made without the risk of any potentially unknown environmental values being impacted.</p> <p>The structure plan (provided within Appendix A) has been informed by and responds to the outcomes of site investigations, through the adoption of an impact-avoidance approach to mitigate potential environmental impacts. This reduces the risk of significant environmental impacts occurring, which reduces any potential environmental risks associated with future implementation of the structure plan.</p>
<p>2. The principle of intergenerational equity</p> <p>The present generation should ensure that the health, diversity and productivity of the environment is maintained and enhanced for the benefit of future generations.</p>	<p>Environmental values within the site are currently located within a number of privately owned land parcels, which are not accessible to the public, nor are these environmental values currently managed or actively enhanced.</p> <p>Whilst implementation of the structure plan may result in some environmental impacts, significant impact avoidance measures have been incorporated into the structure plan layout, through the proposed public open space network. As such, implementation of the structure plan will allow for the proposed public open space areas (containing environmental values) to be transferred into public land tenure and ownership, and managed in the long-term. This will ensure that environmental values within the site will be accessible to the public and will be maintained and enhanced in the long-term for the benefit of future generations.</p>
<p>3. The principle of the conservation of biological diversity and ecological integrity</p> <p>Conservation of biological diversity and ecological integrity should be a fundamental consideration.</p>	<p>The site has been historically cleared to support agricultural land uses, however the remaining values, namely remnant scattered trees and the floodway feature (i.e. the areas offering potential values of conservation significance) are being retained within public open space providing opportunities for preservation and enhancement, responding to this principle. The future retention of environmental values within the site will support the improvement of biological diversity and ecological integrity.</p>

Environmental Assessment and Management Strategy

Abbey South Structure Plan Area

Table 3: EP Act Principles (continued)

Principle		Consideration
<p>4. Principles relating to improved valuation, pricing and incentive mechanisms</p> <p>a. Environmental factors should be included in the valuation of assets and services.</p> <p>b. The polluter pays principles – those who generate pollution and waste should bear the cost of containment, avoidance and abatement.</p> <p>c. The users of goods and services should pay prices based on the full life-cycle costs of providing goods and services, including the use of natural resources and assets and the ultimate disposal of any waste.</p> <p>d. Environmental goals, having been established, should be pursued in the most cost-effective way, by establishing incentive structure, including market mechanisms, which enable those best placed to maximise benefits and/or minimise costs to develop their own solution and responses to environmental problems.</p>		<p>Smaller, isolated and more disturbed areas of environmental values are typically less ecologically viable and can be more difficult to maintain or restore in the long-term, and ongoing management costs become increasingly higher, which is generally not practical for land management authorities. In some situations, these areas are suitable to support multiple uses, whereby some environmental characteristics can be retained (for example mature trees) while also allowing other recreational activities or drainage functions. The public open space network has been located to maximise existing tree retention, and through a central corridor of public open space, also provide an opportunity to increase movement of ecological values across the landscape between areas of existing remnant vegetation and/or landscape value (e.g. the floodway).</p> <p>Use and disposal of goods, services and waste will be managed in accordance with existing state and local arrangements, with waste minimisation measures being explored by the City of Busselton. The site minimises the requirement for use of natural resources, such as fill, with the majority of the site achieving the required minimum finished floor level of 2.7 mAHD to meet coastal hazard responses (which also addresses flooding risks).</p>
<p>5. The principle of waste minimisation</p> <p>All reasonable and practicable measures should be taken to minimise the generation of waste and its discharge into the environment.</p>		<p>Future implementation of urban development across the site will take all reasonable and practical measures to minimise the generation of waste and its discharge into the environment.</p>

4.2 Key environmental factors

The EPA policy framework (EPA 2021) considers 13 environmental factors, relating to five themes: sea, land, water, air and people. For each of these factors, the EPA has identified an environmental objective aimed towards ensuring the objects and principles of the EP Act are achieved. **Table 4** outlines each of these environmental factors, the EPA's stated objective and a scoping assessment of whether each of the listed environmental factors are applicable to the scheme amendment and structure plan.

The environmental factors determined to be applicable to the site are discussed in detail in **Section 5**. Other relevant matters not addressed through the factors, such as bushfire are also addressed in **Section 5**. Investigations utilised to support the understanding of values within the site and nearby have included a Local Water Management Strategy (LWMS) (Emerge Associates 2022b) and a Bushfire Management Plan (BMP) (Emerge Associates 2022a).

Environmental Assessment and Management Strategy

Abbey South Structure Plan Area

Table 4: EPA factors applicable to the site. Shaded green cells indicate factors relevant for further assessment.

Factor (or part of factor) considered further in Section 5					
Theme	Factor	Definition of factor	Objective	Can the proposed future development meet the EPA objective?	EAMS section
Sea	Benthic Communities and Habitats	Benthic communities are biological communities that live in or on the seabed.	To protect benthic communities and habitats so that biological diversity and ecological integrity are maintained.	The site is situated approximately 400 m inland from the coast and does not contain or interact with the marine environment. This is not an applicable factor for the site or any associated future urban development.	Not applicable
	Coastal Processes	Coastal processes relate to 'any action of natural forces on the coastal environment'.	To maintain the geophysical processes that shape coastal morphology so that the environmental values of the coast are protected.	In response to the sea level rising projections, the City of Busselton has developed an adaptation plan to accommodate the potential coastal inundation impact of a 0.2% annual exceedance (AEP) storm event (which is equivalent to a 1:500 year average recurrence interval (ARI)). The adaptation plan is detailed within the CHRMAP (City of Busselton 2022) and provides coastal development planning requirements that need to be implemented in future development. This includes meeting a minimum finished floor level of 2.7 mAHD within the site, which is achievable based on existing topographic contours and with minimal additional fill likely to be required. Therefore, the proposed future development can meet the EPA objective.	Section 5.1
	Marine Environmental Quality	Relates to coastal waters and estuaries and the level of contaminants in water, sediments or biota or to changes in the physical or chemical properties of waters and sediments relative to a natural state.	To maintain the quality of water, sediment and biota so that environmental values are protected.	The site is situated approximately 400 m inland from the coast and does not contain or interact with the marine environment. This is not an applicable factor for the structure plan or any associated future urban development of the site.	Not applicable
	Marine Fauna	It is described as 'animals that live in the ocean or rely on the ocean for all or part of their lives'.	To protect marine fauna so that biological diversity and ecological integrity are maintained.	The site is situated approximately 400 m inland from the coast and does not contain or interact with the marine environment. This is not an applicable factor for the structure plan or any associated future urban development of the site.	Not applicable

Environmental Assessment and Management Strategy

Abbey South Structure Plan Area

Table 4: EPA factors applicable to the site. Shaded green cells indicate factors relevant for further assessment. (continued)

Factor (or part of factor) considered further in Section 5					
Theme	Factor	Definition of factor	Objective	Can the proposed future development meet the EPA objective?	EAMS section
Land	Flora and Vegetation	Flora is defined as native vascular plants, while vegetation relates to groupings of different flora patterned across the landscape.	To protect flora and vegetation so that biological diversity and ecological integrity are maintained.	The site is predominantly cleared of native vegetation, with only a small number of scattered paddock trees remaining over paddock grasses. No TF, PF, TECs or PECS are likely to occur within the site. Public open space areas have been located to maximise the retention of existing trees. Overall, the proposed development of the site will be able to contribute to improving the flora and vegetation values within the site given the proposed public open space network, which will provide an opportunity to increase the composition of plant species and vegetation structure, improving biological diversity and ecological integrity. Therefore, the proposed future development can meet the EPA objective.	Section 5.2
	Landforms	Relate to 'the distinctive, recognisable physical features of the earth's surface having a characteristic shape produced by natural processes. A landform is defined by the combination of its geology (composition) and morphology (form)'.	To maintain the variety and integrity of significant physical landforms so that environmental values are protected.	No significant landforms have been identified within the site. The function of soils will be maintained as part of the proposed future development of the site through the standard planning and development process. This will include the use of appropriate fill material (if/where it is required). Therefore, the proposed future development can meet the EPA objective.	Not applicable
	Subterranean Fauna	This relates to fauna which live their entire lives (obligate) below the surface of the earth and include stygofauna (aquatic/living in groundwater) and troglofauna (air-breathing/living in caves and voids).	To protect subterranean fauna so that biological diversity and ecological integrity are maintained.	It is unlikely that the site supports any significant habitat values for subterranean fauna, given the key known habitat types (such as calcretes, fractured rock aquifers and karst limestone) do not occur. Whilst there is some uncertainty as to the specific occurrence of subterranean fauna, the risk of any significant impacts to subterranean fauna as a result of any future urban development is low, due to the proposed groundwater management strategy, as discussed in relation to the inland waters factor. Therefore, the proposed future development can meet the EPA objective.	Not applicable

Environmental Assessment and Management Strategy

Abbey South Structure Plan Area

Table 4: EPA factors applicable to the site. Shaded green cells indicate factors relevant for further assessment. (continued)

Factor (or part of factor) considered further in Section 5					
Theme	Factor	Definition of factor	Objective	Can the proposed future development meet the EPA objective?	EAMS section
Land (continued from above)	Terrestrial Environmental Quality	Relates to 'the chemical, physical, biological and aesthetic characteristics of soils'	To maintain the quality of land and soils so that environmental values are protected.	Regional ASS risk mapping (DWER 2017b) identifies the southern portion a 'high to moderate' risk of ASS within 3 m of the natural surface, while the northern portion of the site has a 'moderate to low risk'. The extent of ASS which is encountered and potentially disturbed, and any management requirements, will be largely dependent upon the future extent of excavation below the natural soil surface and any potential dewatering activities associated with development of the site. For the purposes of the proposed scheme amendment and structure plan, ASS is not considered to pose a significant constraint to the change in land use. Furthermore, any future ASS considerations can be identified and suitably managed at future planning stages in accordance with the WAPC's <i>Acid Sulfate Soils Planning Guidelines</i> (2008a). Therefore, the proposed future development can meet the EPA objective.	Section 5.3
	Terrestrial Fauna	It relates to animals living on land or using land (including aquatic systems) for all or part of their lives.	To protect terrestrial fauna so that biological diversity and ecological integrity are maintained.	<p>Overall, the site is considered to have low biodiversity value from a fauna perspective due to the lack of intact native vegetation and connected canopy within the site, particularly when compared to surrounding remnant vegetation within Caves Road to the north and Locke Nature Reserve to the west. It is unlikely that the site would contain any habitat critical to the survival of any terrestrial fauna species or any species of conservation significance based on relevant conservation advice and recovery plans, particularly those mentioned in Section 3.3.2.</p> <p>As outlined above, public open space has been located to maximise the retention of existing trees, and the proposed development of the site will be able to contribute to improving the fauna and fauna habitat values within the site given the proposed public open space network, which will provide an opportunity to increase connection across the site to existing vegetated areas/areas of environmental value, to support movement and use by native fauna (particularly western ringtail possum). Therefore, the proposed future development can meet the EPA objective.</p>	Section 5.4

Environmental Assessment and Management Strategy

Abbey South Structure Plan Area

Table 4: EPA factors applicable to the site. Shaded green cells indicate factors relevant for further assessment. (continued)

Factor (or part of factor) considered further in Section 5					
Theme	Factor	Definition of factor	Objective	Can the proposed future development meet the EPA objective?	EAMS section
Water	Inland Waters	Inland waters are described as 'the occurrence, distribution, connectivity, movement, and quantity (hydrological regimes) of inland water including its chemical, physical, biological and aesthetic characteristics (quality)'. It includes groundwater and surface water.	To maintain the hydrological regimes and quality of groundwater and surface water so that environmental values are protected.	The existing floodway has been accommodated with the public open space network and is fully retained, while the flood fringe is proposed to be developed in accordance with DWER requirements. The quality of surface water and groundwater will be managed in accordance with the Better Urban Water Management (BUWM) Framework (WAPC 2008c), as detailed in the LWMS (Emerge Associates 2022b) and includes maintenance of the post development environment in accordance with the pre-development environment (e.g. volume of surface water entering and leaving the site), and the integration of water quality management measures into the future design of the built form, road network and public open space (e.g. water sensitive urban design). While wetland features have been identified within the site, these features do not require any specific protection and can be managed through the maintaining hydrological function as per the BUWM Framework. Therefore, the proposed future development can meet the EPA objective.	Section 5.5
Air	Air Quality	Air quality relates to 'the chemical, physical, biological and aesthetic characteristics of air'. The EPA defines 'air' as all the air above the ground up to and including the stratosphere.	To maintain air quality and minimise emissions so that environmental values are protected.	The proposed future development of the site is unlikely to introduce land uses that would detrimentally impact air quality, or impact air quality differently to typical residential development already present in the broader area. In addition, the development of the site does not propose any sensitive land uses to be established in proximity to any existing operations whose emissions significantly impact air quality. As such, this is not an applicable factor for the proposed residential development of the site. Therefore, the proposed future development can meet the EPA objective.	Not applicable
	Greenhouse Gas Emissions	Relates to six categories of greenhouse gases namely carbon dioxide (CO ₂), methane (CH ₄), nitrous oxide (N ₂ O), sulphur hexafluoride (SF ₆), hydro fluorocarbons (HFCs) and perfluorocarbons (PFCs) and their production.	To protect the environment and to prevent, control and abate pollution and environmental harm.	Future development of the site is expected to produce a similar amount of greenhouse gas emissions to the existing residential development north of the site. Only limited clearing of vegetation (i.e. largely associated with removal of pasture grass and a low number of remnant trees) will be required and additional plants/trees will be introduced within public open space, to assist with sequestration of greenhouse gases. Therefore, the proposed future development can meet the EPA objective.	Not applicable

Environmental Assessment and Management Strategy

Abbey South Structure Plan Area

Table 4: EPA factors applicable to the site. Shaded green cells indicate factors relevant for further assessment. (continued)

Factor (or part of factor) considered further in Section 5					
Theme	Factor	Definition of factor	Objective	Can the proposed future development meet the EPA objective?	EAMS section
People	Social Surroundings	<p>Social surroundings are referenced within the EP Act, and relate to a person's 'aesthetic, cultural, economic and social surroundings to the extent that those surroundings directly affect or are affected by [their] physical or biological surroundings'.</p> <p>Social surroundings include a range of considerations such as Aboriginal heritage and culture, natural and historic heritage (such as State register of Heritage Places), Amenity (visual, noise, odour dust and similar e.g. nuisance insects) and economic benefits.</p>	To protect social surroundings from significant harm.	<p><u>Aboriginal heritage</u> A portion of an 'Other Heritage Place' (ID 5337) is mapped as extending into the western portion of the site. It is unlikely that Section 18 approval pursuant to the <i>Aboriginal Heritage Act 1972</i> (AHA) (or new legislation, once in effect) will be required given the 'Other Heritage Place' status of the site and that available information indicates this value is associated with Buayanyup Drain further to the west.</p> <p>Under the <i>Aboriginal Heritage Act 1972</i>, all Aboriginal sites are protected whether they are known or not. Therefore, as part of future ground disturbing activities, if Aboriginal artefacts or sites (not previously identified) are uncovered, works will need to cease and a suitably qualified expert be brought in to survey the potential site, with additional consent pursuant to the <i>Aboriginal Heritage Act 1972</i> sought if necessary. This can be managed throughout the standard development process.</p> <p>Any requirements pursuant to new legislation or processes will be considered if/as these come into effect, and where required implemented, as part of the future development process. No further consideration required in this EAMS.</p> <p><u>Non-indigenous heritage</u> No non-Indigenous heritage sites were identified within the site. Immediately south of the site is Newtown House, which has historic and aesthetic significance. It is understood that the current land use will not be impacted. No further consideration required in this EAMS.</p> <p><u>Road and rail noise</u> Given the site is adjacent to existing residential development that has already been developed for residential purposes next to Bussell Highway, it is considered that traffic noise does not present a fatal flaw to the rezoning of the site to 'urban development'. As discussed further in Section 5.6, it will be possible to manage noise impacts through the 'deemed-to-satisfy' pathway under SPP 5.4 and the associated implementation guidelines, which provides outlines of separation distances and associated quiet house design treatments.</p>	<p>Section 5.6 with regard to amenity impacts associated with noise.</p> <p>No other social surrounding elements require detailed consideration in this EAMS.</p>

Environmental Assessment and Management Strategy

Abbey South Structure Plan Area

Table 4: EPA factors applicable to the site. Shaded green cells indicate factors relevant for further assessment. (continued)

Factor (or part of factor) considered further in Section 5					
Theme	Factor	Definition of factor	Objective	Can the proposed future development meet the EPA objective?	EAMS section
People (continued from above)	Social Surroundings (continued from above)	(continued from above)	(continued from above)	<p><u>Amenity</u> The site is located within a 'landscape value' area under the City of Busselton LPS No. 21, within which the City seeks to determine if the proposed development is compatible (as far as practicable) with the existing scenic and rural character and whether it will materially affect wildlife refuge, wetlands, coastal environment of Aboriginal sites. The development within the site is unlikely to significantly change the scenic character of the area given existing vegetation external to the site (which mostly blocks existing views into the site) will be maintained. The proposed public open space network will contribute to improved amenity as well as opportunity for the broader community to recreate within the site and connect to the existing path and trail network associated with Buayanyup Drain to the west, and coastal areas to the north. No further consideration required in this EAMS.</p> <p><u>Mosquito and nuisance insects</u> The site is located near large existing waterbodies, and may be subject to impacts from nearby nuisance (mosquito and midge etc.) populations, particularly from the south (associated with the BRNS). Existing vegetation adjacent to the southern boundary of the site will be not be impacted by the development within the site, and provides a barrier to mosquito and nuisance insect movement based on prevailing winds, as per the Department of Health Mosquito Management Manual. The development is unlikely to increase areas of stagnant water which provides the potential for mosquitoes to breed, with drainage infrastructure designed to remove and infiltrate water as quickly as possible. The management of mosquitoes can be managed through the subdivision and development process. No further consideration required in this EAMS.</p> <p>Overall, the EPA objective with regard to this factor can be achieved. Road noise is further considered in in Section 5.6.</p>	<p>Section 5.6 with regard to amenity impacts associated with noise.</p> <p>No other social surrounding elements require detailed consideration in this EAMS.</p>
	Human Health	Human health is described as 'a state of complete physical, mental, and social well-being and not merely the absence of disease or infirmity'	To protect human health from significant harm.	This factor is specific to the consideration of radiation in relation to human health, as other health considerations are managed through the other factors. Radiation is not a relevant consideration for development of or within the site. Therefore, the proposed future development can meet the EPA objective.	Not applicable

5 Impact Assessment and Management Approach

This section outlines spatial layout considerations that should be accommodated within the structure plan to respond to the relevant environmental attributes and values within the site, as well as any environmental management requirements that will need to be accommodated within future planning and development stages.

Only those environmental values and attributes that require specific consideration based on their presence within the site, and/or the applicable legislation and policy requirements have been included in this section (as summarised in **Table 4**).

5.1 Coastal Processes

5.1.1 Policy framework, site context and management objectives

In the context of environmental impact assessment, the EPA's objective for coastal processes is 'to maintain the geophysical processes that shape coastal morphology so that the environmental values of the coast are protected' (EPA 2016d). The City of Busselton CHRMAP (City of Busselton 2022) (which was recently adopted by Council) seeks to 'guide the identification of appropriate areas for the sustainable use of the coast for housing, tourism, recreation, ocean access, commercial and other activities', whilst protecting, conserving and enhancing coastal zone values.

The CHRMAP for the City of Busselton has been prepared based on a sea level rise of 0.9 m by the year 2120, in accordance with State Coastal Planning Policy (SPP 2.6) (WAPC 2013). Specific to the site, and as outlined within **Section 3.5**, the northern portion of the site is within the 2120 coastal erosion hazard line, and the floodway area may be subject to inundation due to storm surge. A finished level of 2.7 mAHD for all buildings is required in order to meet the requirements of the CHRMAP (City of Busselton 2022), and City of Busselton have also identified the need to engage with Water Corporation after 2040 to ensure the continued maintenance and improvement of the eastern bank of the Buayanyup Drain (to address storm surge/inundation considerations to the east, which includes the site).

The objective for future management of coastal processes within the site will be principally focused around ensuring finished floor levels for buildings meet the minimum 2.7 mAHD, and the flooding associated with future storm surge can be accommodated within the floodway.

5.1.2 Structure plan layout considerations for coastal processes

The structure plan has responded to coastal processes by ensuring the floodway is maintained, with it fully accommodated within areas of public open space. As outlined above, the City of Busselton have already identified the potential risk of inundation as a result of sea level rise and/or storm surge and working with the Water Corporation to ensure Buayanyup Drain is maintained and improved through to 2120.

No other spatial response is required for future development (particularly built form), with the coastal process response to be accommodated through modification of the landform, and ensuring a minimum floor level of 2.7 mAHD is achieved.

Environmental Assessment and Management Strategy

Abbey South Structure Plan Area



5.1.3 Future coastal management requirements

As part of the future development within the site, the City of Busseton have identified a minimum finished floor level (FFL) of 2.7 MAHD to mitigate against the predicted inundation risk. Recently the City of Busseton adopted the recommendations of the CHRMAP (City of Busseton 2022), which includes:

- Defining a 'Coastal Management Area' based on the coastal hazard erosion lines. This will ensure adaptation recommendations are addressed at all levels within the City of Busseton, particularly within the planning process.
- That the adaptation pathways for each of the management areas (as outlined within the CHRMAP) are implemented. For the site, this includes achieving minimum finished floor levels of 2.7 MAHD, and investing (with State agencies) in storm surge event protection along Buanyanyup Drain.

Protection of the floodway and application of finished floor level requirements will be able to be accommodated as part of engineering approvals through the standard subdivision process, with a number of model subdivision conditions (WAPC and DPLH 2021) able to be applied, namely D3 and D4 which requires:

- D3 Engineering drawings and specifications are to be submitted and approved, and works undertaken in accordance with the approved engineering drawings and specifications and approved plan of subdivision, for the filling and/or draining of the land, including ensuring that stormwater is contained on-site, or appropriately treated and connected to the local drainage system. Engineering drawings and specifications are to be in accordance with an approved Urban Water Management Plan (UWMP) for the site, or where no UWMP exists, to the satisfaction of the Western Australian Planning Commission. (Local Government)
- D4 The land being filled, stabilised, drained and/or graded as required to ensure that:
- a) lots can accommodate their intended development; and
 - b) finished ground levels at the boundaries of the lot(s) the subject of this approval match or otherwise coordinate with the existing and/or proposed finished ground levels of the land abutting; and
 - c) stormwater is contained on-site, or appropriately treated and connected to the local drainage system. (Local Government).

Environmental Assessment and Management Strategy

Abbey South Structure Plan Area



5.2 Flora and vegetation

5.2.1 Policy framework, site context and management objectives

In the context of environmental impact assessment, the EPA objective for flora and vegetation is 'to protect flora and vegetation so that biological diversity and ecological integrity are maintained' (EPA 2016e). Where a proposal may potentially impact upon flora and vegetation values, the following mitigation hierarchy should be applied to minimise potential impacts:

1. **Avoid** impacts
2. **Minimise** impacts
3. **Offset** impacts.

The site is largely cleared of native vegetation and is composed of cleared paddocks with scattered remnant native trees (predominantly peppermint trees). The vegetation within the site is unlikely to contain conservation significant values (e.g. TF, PF, TEC or PEC) given the highly disturbed nature of the site.

The objective for future management of flora and vegetation within the site will be principally focused around maximising the retention of remnant trees in public open space areas.

5.2.2 Structure plan layout considerations for flora and vegetation

Avoidance and minimisation of impacts to flora and vegetation values has been achieved through the strategic location of public open space areas and wider road reserves, to align with areas of existing remnant native trees. Existing trees are proposed to be retained wherever possible.

The spatial layout also proposes either hard edges (in the form of perimeter roads) or a public open space interface (shown in **Figure 7** and **Appendix A**), providing for a clear delineated management boundary between higher value remnant native vegetation values surrounding the site.

5.2.3 Future flora and vegetation management requirements

The remnant vegetation proposed to be retained within the public open space areas (as shown in **Figure 7**) will be protected and enhanced as part of future development, to improve the biodiversity values of the area and contribute to ecological linkages across the landscape. This will include identification and protection of the remnant trees as part of the subdivision process.

The specific design of the public open space areas, including plant species and possible revegetation, will be confirmed as part of future detailed design through the subdivision process, as will any management measures to ensure protection of this vegetation as part of construction activities. No conservation areas are proposed within this development.

It is expected that a number of future subdivision approval conditions will ensure protection of the remnant vegetation proposed for retention, including model subdivision condition EN1, EN2, and EN7 (WAPC and DPLH 2021), which requires:

EN1 - Prior to the commencement of subdivisional works a foreshore/ environmental/ bushland/tree/wetland/wildlife protection [DELETE AS APPLICABLE] management plan for [INSERT VALUE] is to be prepared and approved to ensure the protection and management of the sites environmental assets

Environmental Assessment and Management Strategy

Abbey South Structure Plan Area



with satisfactory arrangements being made for the implementation of the approved plan.

Department of Water and Environmental Regulation) OR (Local Government) OR (Department of Biodiversity, Conservation and Attractions) [DELETE AS APPLICABLE]

EN2 - Prior to the commencement of subdivisional works, measures being taken to ensure the identification and protection of any vegetation on the site worthy of retention that is not impacted by subdivisional works, prior to commencement of subdivisional works. (Local Government)

EN7 - Prior to subdivisional works in the foreshore/waterway area, a plan is to be submitted and approved, detailing the waterway crossing and indicating how design and construction will minimise detrimental impacts on the waterway form and function. The waterway crossing plan is to be implemented as part of the subdivisional works. (Department of Water and Environmental Regulation)

5.3 Acid sulfate soils

5.3.1 Policy framework, site context and management objectives

In the context of environmental impact assessment, the EPA's objective for ASS is 'to maintain the quality of land and soils so that environmental values are protected' (EPA 2016b). The application of the mitigation hierarchy should be applied to avoid or minimise impacts to terrestrial environmental quality where possible.

The DWER, through the WAPC, ensures ASS are adequately managed during the land use planning and development process. The objective of the DWER's ASS policy framework is to manage ASS appropriately to prevent the release of metals, nutrients and acidity into the soil and groundwater system that may adversely affect the natural and built environment and human health.

The regional mapping produced by DWER indicates that the northern two-thirds of the site is located within an area identified as 'moderate – low' risk of ASS occurring within 3 m of the natural soil surface, while the southern third of the site is identified as having a 'high to moderate' risk of ASS.

The principal management objective for ASS within the site is to ensure that any future development that may disturb ASS is appropriately managed to avoid impacts on the environment.

5.3.2 Structure plan layout considerations for acid sulfate soils

ASS management does not require any spatial consideration within the structure plan, and any ASS risk can be appropriately managed through future development planning.

5.3.3 Future acid sulfate soils management requirements

ASS is only likely to be a consideration if excavation (primarily for services, and in particular sewer) extends below the permanent groundwater table. It is possible, depending upon the extent of cut and fill within the site and location of services, that excavation could occur below the permanent groundwater table and if this is the case, additional ASS investigations may be required and could include the preparation of an Acid Sulfate Soils and Dewatering Management Plan. This is a well-established process which appropriately manages ASS risk.

Environmental Assessment and Management Strategy

Abbey South Structure Plan Area

Where a 'high to moderate' risk of ASS is identified in the regional mapping, the WAPC will apply a standard subdivision condition (model subdivision condition EN8 (WAPC and DPLH 2021)), which states:

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

The requirement for further ASS management will be confirmed in accordance with any subdivision conditions and/or as part of future development once detailed design has progressed.

5.4 Native fauna

5.4.1 Policy framework, site context and management objectives

In the context of environmental impact assessment, the EPA's objective for terrestrial fauna is 'to protect fauna so that biological diversity and ecological integrity are maintained' (EPA 2016c). The application of the mitigation hierarchy should be applied to avoid or minimise impacts to terrestrial fauna where possible.

The EPBC Act also provides protection for listed 'threatened' species, including western ringtail possums and black cockatoos, which may potentially use habitat within the site. Any proposed action which is considered likely to result in a 'significant' impact upon these species, which are identified as Matters of National Environmental Significance (MNES), should be referred to the Commonwealth Department of Agriculture, Fisheries and Forestry (DAFF).

The scattered paddock trees within the site are unlikely to provide important or significant habitat for conservation significant species such as western ringtail possum or the three black cockatoo species based on conservation advice and recovery plans for these species. The vegetation within the site would not support roosting or breeding by black cockatoos and is only considered low quality foraging habitat. Due to the lack of canopy connection and connection to other contiguous areas of remnant native vegetation (without having to cross large open areas by ground movement), western ringtail possums are also unlikely to use the site and it would not meet important or critical habitat requirements.

The management objective for fauna within the site will be principally focused on maximising retention of existing vegetation values within public open space areas and ensuring development works are undertaken in a manner that minimises harm to native fauna.

5.4.2 Structure plan layout considerations for terrestrial fauna

Spatial consideration has been given to fauna habitat, through the strategic location of public open space and wider road reserves to maximise the retention of existing remnant native trees. (See **Figure 7**). Intersection of existing native vegetation within the Caves Road reserve has been minimised, with a single connection to Caves Road through the more intact vegetation located in accordance with the

Environmental Assessment and Management Strategy

Abbey South Structure Plan Area



existing driveway in the central northern portion of the site. A second connection to Caves Road is located in areas subject to historic disturbance and ongoing vegetation management (to reduce vegetation near existing powerlines).

5.4.3 Future terrestrial fauna management requirements

The location of the proposed public open space areas within the site maximises the retention of the existing paddock trees, particularly larger groupings of trees, rather than all the individual trees scattered throughout the site. The proposed public open space network, and planting of these areas will improve the presence of refuge habitat for fauna species (particularly western ringtail possum), and improve vegetation connectivity and an ability for fauna to move across the landscape between patches of intact native vegetation to the north, and the nature reserve to the south.

Existing trees will be modified or removed as part of the proposed development and fauna may be disturbed as part of this process. Management of fauna as part of the detailed design and construction for the proposed development will be based on minimising harm to fauna (particularly the western ringtail possums) and can be addressed through the preparation and implementation of a fauna management plan as part of subdivision. Measures to be implemented may include:

- Bunting/flagging of trees to be retained so that it is clear which trees are to be avoided.
- Undertaking preclearing inspections of tree/vegetation proposed for removal/modification. This may include a trapping and relocation program for western ringtail possums.
- Using a fauna spotter during demolition and clearing works to avoid impacts to fauna wherever possible and to rescue trans-locatable fauna that are disturbed during clearing works to assist them to disperse safely or capture them for later translocation as appropriate.
- Application of correct fauna handling procedures to reduce stress on any captured animals.

It is likely that this will be a condition of future subdivision approval, based on application of model subdivision condition EN1 (WAPC and DPLH 2021), which requires:

EN1 - Prior to the commencement of subdivisional works a foreshore/ environmental/ bushland/ tree/wetland/wildlife protection [DELETE AS APPLICABLE] management plan for [INSERT VALUE] is to be prepared and approved to ensure the protection and management of the sites environmental assets with satisfactory arrangements being made for the implementation of the approved plan. (Department of Water and Environmental Regulation) OR (Local Government) OR (Department of Biodiversity, Conservation and Attractions) [DELETE AS APPLICABLE]

5.5 Hydrology

5.5.1 Policy framework, site context and management objectives

In the context of environmental impact assessment, the EPA's objective for inland waters is 'to maintain the hydrological regimes and quality of groundwater and surface water so that environmental values are protected' (EPA 2018).

In addition, the State Water Strategy for Western Australia (Government of WA 2003) and Better Urban Water Management (WAPC 2008b) endorses the promotion of integrated water cycle management and application of water sensitive urban design (WSUD) principles to provide

Environmental Assessment and Management Strategy

Abbey South Structure Plan Area



improvements in the management of stormwater, and to increase the efficient use of other existing water supplies. The mapped floodway within the southern portion of the site is a key feature that needs to be managed, to ensure downstream users are not detrimentally impacted. A number of MUWs are identified within the site, however the presence of a MUW would not preclude development within the site and do not require any specific protection or spatial consideration. The hydrological function of the MUW will need to be considered/maintained as development progresses.

Based on the values identified the principal management objective for hydrology in the site will be to ensure that the floodway is maintained and that groundwater and surface water is appropriately infiltrated and treated to not impact on the broader area, based on WSUD.

5.5.2 Structure plan layout considerations for hydrology

5.5.2.1 Floodway

The floodway within the southern portion of the site has been fully accommodated and integrated within an area of public open space. This area is proposed to perform an important drainage function, however, will also remain predominantly as useable and unrestricted open space.

5.5.2.2 Surface water and groundwater

In accordance with the LWMMS (Emerge Associates 2022b) that has been prepared for the site, the structure plan has accommodated flood mitigation, flow management and treatment of surface water by providing appropriately sized road reserves to convey, treat and store stormwater, as well as a public open space areas of a suitable size to accommodate required bioretention areas and flood storage areas, to manage water quality and to enable the predevelopment hydrology conditions to be maintained (particularly downstream).

5.5.3 Future management requirements

The LWMMS provides a framework for the future delivery of a best practice approach to integrated water cycle management utilising water sensitive urban design (WSUD) principles and provides for the management of groundwater and surface water within the site. It has been prepared in accordance with relevant DWER requirements and considers the site-specific values. The LWMMS will be a key document guiding future development and can be referred to for further detail, particularly with regard to determined water management criteria and water quality management objectives.

The LWMMS (Emerge Associates 2022b) proposes water supply and conservation, stormwater management and groundwater management strategies to ensure water values are managed appropriately within the site. These strategies have been summarised below.

5.5.3.1 Floodway

The floodway will be fully accommodated with the public open space and will provide a conveyance function as well as maintain hydraulic connectivity to southern BNRS. The stormwater management network will be designed to maintain clearance between bioretention retention areas and maximum flood levels to ensure they are able to infiltrate and provide appropriate drainage. The design lot

Environmental Assessment and Management Strategy

Abbey South Structure Plan Area



levels adjacent to the floodway will be such that finished floor levels are at least 500 mm above the maximum flood level to ensure protection from flooding during major rainfall events.

5.5.3.2 Surface water and groundwater

Water supply and conservation

The overall approach to water supply is to utilise scheme water provided via Busselton Water and implement best practise water conservation measures (e.g. water efficient fixtures, use of WSUD measures, and planting of water wise species) to reduce water demand. Non-potable water for irrigation at lot scale will also be provided by scheme water within private lots and potentially rainwater tanks if installed by lot owner. The key approach for public open space will be to retain as many trees as possible, to minimise water use and provide amenity. The public open space areas will be either unirrigated or temporarily supplied (e.g. by watercart) during an establishment period; no ongoing permanent irrigation of public open space areas is proposed (unless a non-potable water supply source is secured).

Stormwater management

The principle behind the stormwater management strategy within the site is to ensure that the pre-development 1% AEP peak flow rate and volume discharging offsite is not exceeded post-development.

Stormwater management will involve the following:

- Manage runoff from the small rainfall event (i.e. first 15 mm) within the site at source of as close as practicably possible either within lots, through the use of roadside swales and/or bioretention areas. Treatment will occur via contact with vegetation and the underlying soil profile.
- The majority of catchments will either have a public open space area that will contain a bioretention area and a food storage area and catchments with no public open space will contain a vegetated swale that will be designed to treat the first 15 mm and retain/detail runoff up to the 1% AEP event.
- Ensure the major rainfall event (1% AEP) peak flow rates and volumes do not exceed the pre-development environment and hydraulic connectivity to the BNRS is maintained.
- Finished floor levels must be a minimum of 2.7 mAHD (to meet coastal process requirements) and/or at least 500 mm above the adjacent 1% AEP flood level.
- Finished floor levels must have at least 500 mm clearance above the major event top water levels in onsite retention and detention structures.
- Reduce nutrients loads by applying appropriate non-structural measures, such as vegetated roadside swales or a vegetated bio retention area where treatment will occur via contact with vegetation and the underlying soil profile.

Stormwater management infrastructure proposed within the site includes:

- Pit and pipe network within road reserves
- Flush kerbing
- Vegetated swales
- Bioretention areas

Environmental Assessment and Management Strategy

Abbey South Structure Plan Area



- Flood storage areas.

Groundwater Management

Groundwater management will involve providing suitable separation between finished floor levels and groundwater and minimising risk of nutrient enrichment, and will be based on the following:

- The invert level of bioretention area and flood storage areas will have a minimum of 300 mm clearance above the maximum groundwater level.
- Providing adequate consideration of future sea level rise and the influence it will have on groundwater levels beneath the site.
- Minimising the risk of nutrient enrichment to downstream surface water bodies from groundwater sources through the treatment of stormwater within the bioretention areas and swales via filtration and adsorption of pollutants/nutrients.

5.5.3.3 Overall

The WAPC typically apply a standard condition on subdivision approval (model subdivision condition D2 (WAPC and DPLH 2021)), requiring the preparation of an Urban Water Management Plan (UWMP) which states:

Prior to the commencement of subdivisional works, an urban water management plan is to be prepared and approved, in consultation with the Department of Water and Environmental Regulation, consistent with any approved Local Water Management Strategy. (Local Government).

Generally, an UWMP will address the following considerations specific to subdivision and development stages in close consideration of the engineering design:

- The detailed drainage design based on civil designs
- Imported fill specifications and requirements
- Implementation of water conservation strategies
- Non-structural water quality improvement measures
- Management and maintenance requirements
- Construction period management strategy
- Monitoring and evaluation program.

5.6 Acoustic impacts – Bussell Highway and Caves Road

5.6.1 Policy framework, site context and management objectives

In the context of environmental impact assessment, the EPA's objective for social surroundings (which includes consideration of impacts to amenity from factors such as noise) is 'to protect social surroundings from significant harm' and includes the 'ability for people to live and recreate within their surroundings without any unreasonable interference with their health, welfare, convenience and comfort' (EPA 2016a).

While social surrounds encompass a number of different considerations, specific to the site, impacts from road noise are the key consideration that has the potential to cause harm. SPP 5.4 (WAPC 2019b) recognises that excessive noise has the potential to affect the health and amenity of a

Environmental Assessment and Management Strategy

Abbey South Structure Plan Area

community as a whole, as well as the wellbeing of individuals. The policy aims to protect people from unreasonable levels of transport noise by establishing a standardised set of criteria to be used in the assessment of development proposals. Under SPP 5.4, new noise sensitive land uses (which includes residential development) within the trigger distance of an existing transport corridor is required to meet the criteria outlined in **Table 5**.

Table 5: Noise targets as outlined within SPP 5.4

Proposal type	New/upgrade	Noise targets		Indoor (L_{Aeq} dB)
		Outdoor (Day (L_{Aeq} (Day) dB) (6 am -10 pm))	Night (L_{Aeq} (Night) dB) (10 pm – 6 am))	
Noise sensitive land-use and/or development	New noise sensitive land use and/or development within the trigger distance of an existing/proposed transport corridor.	55	50	L_{Aeq} (Night) dB) 40 (living and work areas) L_{Aeq} (Night) dB) 35 (bedrooms)

Where the targets are exceeded, an assessment is required to determine the likely level of transport noise and management/mitigation required.

The application of SPP 5.4 is to consider anticipated traffic volumes for the next 20 years from when the noise assessment is undertaken. In the application of the noise targets, the objective is to achieve:

- Indoor noise levels specified in Table 2-1 in noise-sensitive areas (e.g. bedrooms and living rooms of houses and school classrooms); and
- A reasonable degree of acoustic amenity for outdoor living areas on each residential lot. For non-residential noise-sensitive developments, for example schools and childcare centres, the design of outdoor areas should take into consideration the noise target.

The site is located adjacent to Caves Road and Bussell Highway, which is identified as an 'other significant freight/traffic route' in SPP 5.4 (DPLH 2019), and where development is located within the 200 m trigger value road noise impacts on sensitive land uses and/or development should be considered. This means noise will be a relevant consideration for future development in the northern and eastern portion of the site.

The principle management objective for acoustic impacts is to protect future residents from unreasonable levels of transport noise.

5.6.2 Structure plan layout considerations for management of acoustic impacts

The Road and Rail Noise Guidelines (WAPC 2019a) provides a conservative exposure noise forecast table, which enables proponents to undertake a simple initial screening assessment to estimate the potential risk of noise impacts on future residents. Based on the type of road (other significant freight/traffic route), the location of the road (rural), the speed limit of the road (60-80 km/hr) and number of lanes adjacent to the site (1-2 lanes), the Road and Rail Noise Guidelines (WAPC 2019a) indicates that noise impacts from Caves Road and Bussell Highway are likely to require management up to 40 m from the road carriageway. Noise impacts can be managed as per the standard planning

Environmental Assessment and Management Strategy

Abbey South Structure Plan Area



and development process, including use of setbacks and quiet house design, with the implementation guidelines indicating the following:

- Within 0 – 20 m of the road carriage way, noise target could be exceeded between 3-7 dB, and quiet house design package B could apply; and
- Within 20 – 40 m of the road carriage way, the noise target could be exceeded by between 1-3 dB, and quiet house design package A could apply.

Therefore, while noise impacts are possible within the noise trigger area identified in **Figure 7**, these can be addressed through 'deemed-to-comply' construction design considerations (e.g. quiet house design) which will reduce noise levels to acceptable levels. On this basis no specific spatial response is proposed within the structure plan, and management of noise can be resolved in further detail at the time of subdivision.

5.6.3 Future acoustic management requirements

Given the site is adjacent to existing residential development that has already been developed for residential purposes next to Caves Road and Bussell Highway, traffic noise is considered to be able to be managed through the typical urban/residential development process.

It is highly likely that road noise impacts can be managed through the 'deemed-to-comply' pathway of SPP 5.4 and the associated implementation guidelines, which provides detail on separation distances and associated quiet house design treatments (briefly considered above).

It is expected that future subdivision approval conditions will ensure appropriate management of noise in accordance the relevant standards, including model subdivision condition T24 (WAPC and DPLH 2021), which requires:

T24 – A notification, pursuant to Section 165 of the Planning and Development Act 2005 is to be placed on the certificate(s) of title of the proposed lot(s). Notice of this notification is to be included on the diagram or plan of survey (deposited plan). The notification is to state as follows:

This lot is situated in the vicinity of a transport corridor and is currently affected, or may in the future be affected by transport noise. Additional planning and building requirements may apply to development on this land to achieve an acceptable level of noise reduction. (Western Australian Planning Commission)

Noise impacts from Caves Road and Bussell Highway can be managed through a 'deemed-to-comply' pathway, and if required a detailed acoustic assessment can be undertaken to support subdivision when more detailed site-specific information (e.g. proposed final development layout, finished lot levels) is available.

Environmental Assessment and Management Strategy

Abbey South Structure Plan Area



5.7 Bushfire management

5.7.1 Policy framework, site context and management objectives

State Planning Policy 3.7 Planning in Bushfire Prone Areas (SPP 3.7) (WAPC 2015a) stipulates that any development proposal which occurs partly or wholly within a designated bushfire prone area is required to be accompanied by a bushfire management plan (BMP). The preparation of a BMP is required to incorporate the following tasks:

- Classification of existing vegetation and effective slope within the site and surrounding 150 m, in accordance with AS 3959 (Standards Australia 2018).
- Assessment of bushfire hazard levels within the site and surrounding 150 m, in accordance with the Guidelines (DPLH & WAPC 2021).
- Completion of an indicative Bushfire Attack Level (BAL) assessment and preparation of an associated BAL contour plan.
- Assessment of the structure plan design against the bushfire protection criteria, in accordance with the Guidelines (DPLH & WAPC 2021).

Policy objective 5.4 of SPP 3.7 specifies that development is required to:

“...achieve an appropriate balance between bushfire risk management measures and biodiversity conservation values, environmental protection and biodiversity management and landscape amenity.”

This policy objective ensures that future development appropriately considers the bushfire risks, and provides appropriate separation from any identified risks without negatively impacting existing environmental values.

Bushfire hazards have been identified external to the site (discussed in **Section 3.9** and the BMP (Emerge Associates 2022a)), and for the purposes of the assessment to support the scheme amendment and structure plan process, it has been assumed any hazards identified external to the site will remain in the long-term. Grassland vegetation to the south-east of the site, however, is considered a temporary hazard, associated with existing rural lots likely to be subject to future residential development. Proposed public open space areas within the site have been assumed to be a bushfire hazard and have been identified as classified vegetation (and therefore effectively means ‘no management’ is assumed for the purposes of the bushfire assessment), following consultation with the City of Busselton.

The principal management objective for the bushfire risk to the site is to ensure that the risk to future people, property and infrastructure is appropriately minimised without negatively impacting on environmental values within or surrounding the site.

5.7.2 Structure plan layout considerations for bushfire management

In accordance with the BMP (Emerge Associates 2022a) prepared for the site, the structure plan has provided an appropriate spatial response to bushfire risk through:

- Ensuring future development areas will be able to accommodate the separation necessary to enable habitable buildings to achieve a bushfire attack level (BAL) rating of BAL-29 or less

Environmental Assessment and Management Strategy

Abbey South Structure Plan Area



- without requiring clearing or modification of remnant native vegetation in areas surrounding the site. This has been achieved through the location of proposed roads between future lots and areas of bushfire hazard and/or providing lots of an appropriate size to accommodate necessary separation. Areas within the site assessed as being subject to BAL-FZ and BAL-40 (and able to support a habitable building) are shown in **Figure 7**.
- An integrated internal road network that connects with the existing external public road network and provides access to multiple destinations, supporting appropriate emergency evacuation and response.

5.7.3 Future bushfire management requirements

The BMP (Emerge Associates 2022a) demonstrates that SPP 3.7 and the bushfire protection criteria (outlined within the Guidelines (DPLH & WAPC 2021)) can be satisfied through an ‘acceptable solution’ approach without compromising environmental values within or nearby to the site. No fuel load management of remnant native vegetation outside the site has been assumed as part of addressing bushfire risk.

Going forward and based on satisfying the bushfire protection criteria, detailed design and construction will need to consider the following:

- Providing appropriate separation between bushfire hazards and future habitable buildings to achieve a bushfire attack level (BAL) rating of BAL-29 or less, with portions of the site likely to be subject to BAL-LOW. This is through the use of perimeter public roads and in-lot setbacks.
- Providing access to multiple destinations via Caves Road and Bussell Highway. A number of no-through roads are currently proposed as part of managing site constraints (floodway, vegetation retention, land ownership) and temporary staging of development, however all are less than 200 m in length and able to meet the acceptable solution. The western-most development cell currently only has a single road access in and out, however this will be addressed through provision of an emergency access way (or similar) at future stages as part of designing around retained trees and drainage features.
- Meeting water supply requirements through a reticulated water scheme and provision of hydrants.

A revised BMP may be required to support future subdivision applications, particularly if vegetation management assumptions are different, or the development layout is different to that assessed as part of the BMP. The BMP will need to respond to the subdivision design (and/or stage of development). It is likely that the WAPC will include a number of standard conditions on the subdivision approval, including F1, F2 and F3 (WAPC and DPLH 2021) which states:

F1 - Information is to be provided to demonstrate that the measures contained in the bushfire management plan [NAME/DATE] that address the following [LIST AS REQUIRED] have been implemented during subdivisional works. This information should include a notice of ‘Certification by Bushfire Consultant’.

F2 – Notification, pursuant to Section 165 of the Planning and Development Act 2005, is to be placed on the certificate(s) of title of the proposed lot(s) with a Bushfire Attack Level (BAL) rating of 12.5 or above, advising of the existence of a hazard or other factor. Notice of this notification is to be included on the diagram or plan of survey (deposited plan). The notification is to state as follows:

Environmental Assessment and Management Strategy

Abbey South Structure Plan Area



“This land is within a bushfire prone area as designated by an Order made by the Fire and Emergency Services Commissioner and is/ may be subject to a Bushfire Management Plan [RENAME/DELETE AS APPLICABLE]. Additional planning and building requirements may apply to development on this land” (Western Australian Planning Commission)

F3 – A plan is to be provided to identify areas of the proposed lot(s) that have been assessed as BAL-40 or BAL-Flame Zone.

A restrictive covenant to the benefit of the local government, pursuant to section 129BA of the Transfer of Land Act 1893, is to be placed on the certificate(s) of title of the proposed lot(s) advising of the existence of a restriction on the use of the land within areas that have been assessed as BAL-40 or BAL-Flame Zone. Notice of this restriction is to be included on the diagram or plan of survey (deposited plan). The restrictive covenant is to state as follows:

“No habitable buildings are to be built within areas identified as BAL-40 or BAL-Flame Zone”. (Local Government)

6 Implementation Framework

The structure plan for the site has been prepared to be consistent with Leeuwin-Naturaliste Sub-regional Strategy (DPLH 2021) and can address the key issues identified for the strategy as they relate to the environment. A summary of the key environmental planning considerations (as detailed previously in **Section 2.2**) and how the proposed structure plan addresses these is outlined below:

- Biodiversity value protection – which the design approach for the structure plan seeking to maximise retention of existing remnant native trees, the main biodiversity value within the site.
- Bushfire risk – with no management of vegetation external to the site assumed in order to meet the requirements of SPP 3.7.
- Drainage – the floodway has been fully accommodated within public open space, and sufficient areas have been provided to manage minor and major rainfall events and match pre-development flow rates.
- Landscape value protection – Existing vegetation around the perimeter of the site will be largely maintained, meaning views of the site are unlikely to be significantly different compared to the current/existing views, and the public open space areas will provide for green corridors across the site, providing continuity/connection with the natural elements.
- Water source impact (groundwater and surface water) – the floodway has been accommodated within the site, and surface water and groundwater will be treated (via WSUD features) to improve water quality leaving the site.
- Biodiversity values (adjacent wetlands to south) – a management interface between the site and the BNRS to the south has been accommodated through the proposed perimeter roads and public open space network, minimising potential for incursion of weeds and edge effects. The public open space corridor through the centre of the site provides a landscape connection for vegetation and fauna values to move between existing areas of vegetation and/or the wetland, while the hydrological connectivity has been maintained through the water management approach.

As previously discussed in **Section 2.2**, the southern portion of the site is identified as an ‘Open Space Investigation’ area and aligns with the current conservation zoning under the City of Busselton LPS No. 21. The investigations through the EAMS and LWMS indicate that the key environmental value associated with the ‘Open Space Investigation’ area is the floodway. This value has been fully accommodated within the public open space network (summarised above), with the hydrological function able to be maintained in accordance with the LWMS. No other environmental values are present within the southern portion of the site that would prevent urban development from being supported.

A summary of how the scheme amendment and structure plan responds to the environmental values and attributes within the site (based on the EPA factors) is provided in **Table 6**. The table also outlines the future management likely to be required as part of the subdivision and development process, and how the values can be managed within the existing development framework.

Environmental Assessment and Management Strategy

Abbey South Structure Plan Area

Table 6: Environmental management framework implementation table

Factor	Structure plan phase	Subdivision phase	Part of development works
Coastal processes	<ul style="list-style-type: none"> • Identification of coastal processes that may impact the site, including consideration of the City of Bussetton CHRMAP. • Spatial provision for the floodway, which may be subject to storm surge inundation as part of sea-level rise. 	<ul style="list-style-type: none"> • Preparation of an Urban Water Management Plan (UWMP). • Preparation of earthwork plans and engineering drawings, addressing finished floor levels. • Spatial provision for the floodway. 	<ul style="list-style-type: none"> • Implementation of the UWMP. • Design and implementation of drainage reserves/management features as per the requirements of the UWMP. • Implementation of earthworks and engineering drawings.
Flora and vegetation	<ul style="list-style-type: none"> • Assessment of flora and vegetation values present within the site and identification of conservation significant values. • Spatial provision public open space to maximise retention of remnant paddock trees. 	<ul style="list-style-type: none"> • Undertake detailed analysis of final subdivision layout and engineering design to determine tree retention opportunities. • Provision for public open space areas and wider road reserves to retain trees where possible. • Preparation of vegetation / tree management plan to ensure values are protected and to satisfy subdivision conditions. 	<ul style="list-style-type: none"> • Ensure trees proposed for retention (in public open space) are protected, accommodate these as part of construction and landscaping works.
Terrestrial environmental quality	<ul style="list-style-type: none"> • Consider ASS risk mapping as prepared by DWER. No spatial response in structure plan required. • Consider presence of contamination from historic land uses. No spatial response required. 	<ul style="list-style-type: none"> • If required, completion of the ASS self-assessment form (as prepared by the DPLH). • If required, preparation of an Acid Sulfate Soil and Dewatering Management Plan. 	<ul style="list-style-type: none"> • If required, implementation of an Acid Sulfate Soil and Dewatering Management Plan.
Fauna	<ul style="list-style-type: none"> • Assessment of fauna habitat and preliminary consideration of habitat retention opportunities. • Spatial provision public open space to maximise retention of remnant paddock trees. 	<ul style="list-style-type: none"> • Undertake detailed analysis of final subdivision layout and engineering design to determine further potential tree retention opportunities. • Provision for public open space and wider road reserves, to retain trees where possible. • Preparation of vegetation / fauna management plan(s) to ensure values are protected and to satisfy subdivision conditions. 	<ul style="list-style-type: none"> • Ensure trees proposed for retention are protected, accommodate these as part of construction and landscaping works. • Implement pre-clearance checks and/or management plan requirements to ensure fauna is managed appropriately to minimise harm. • If required, obtain and implement licences pursuant to the Biodiversity Conservation Act 2016 to disturb/relocate fauna prior to works commencing.

Environmental Assessment and Management Strategy

Abbey South Structure Plan Area

Table 6: Environmental management framework implementation table (continued)

Factor	Structure plan phase	Subdivision phase	Part of development works
Inland waters	<ul style="list-style-type: none"> Preparation of a Local Water Management Strategy (LWMS). Spatial provision for floodway, bioretention areas, stormwater conveyance and flood storage areas to accommodate stormwater, groundwater and flood events. 	<ul style="list-style-type: none"> Preparation of an Urban Water Management Plan (UWMP). Spatial provision for floodway, bioretention areas and flood storage areas. 	<ul style="list-style-type: none"> Implementation of the UWMP. Design and implementation of drainage reserves/ management features as per the requirements of the UWMP.
Social surroundings	<ul style="list-style-type: none"> Noise impacts Understand presence of land uses that require setbacks to sensitive land uses and consider future development requirements. Caves Road and Bussell Highway are located adjacent to the northern and eastern boundary of the site respectively and require consideration pursuant to SPP 5.4. 	<ul style="list-style-type: none"> Noise impacts Where required, demonstrate appropriate separation is provided between the future habitable buildings and Caves Road and Bussell Highway to achieve appropriate quiet house design responses. This may include preparation of an acoustic assessment / noise management plan, where the 'deemed-to-comply' pathway is not achievable or considered appropriate. Spatial provision to address noise impacts, including lots of an appropriate depth to accommodate quiet house design or similar. 	<ul style="list-style-type: none"> Noise impacts Where required, implementation of the recommendations of an acoustic assessment / noise management plan. As part of building licence (by future lot owners) ensure buildings are constructed to appropriate requirements (e.g. quiet house design).
Bushfire risk	<ul style="list-style-type: none"> Preparation of a BMP in accordance with SPP 3.7 and the Guidelines. Provision for road reserves and appropriately sized development areas to accommodate setbacks to achieve BAL-29 or less from identified bushfire risk. Provision for a road network that connects the site to the existing public road network and provides access to multiple destinations. 	<ul style="list-style-type: none"> Provision for separation between habitable buildings and identified bushfire hazards, including through use of road reserves and/or appropriately sized lots. No management should be assumed in areas of retained vegetation external to the site. This also applies to public open space unless agreed with the City of Busselton. Provision for an appropriate road network that provides access to multiple destinations. If required, prepare an updated BMP to support the subdivision application. 	<ul style="list-style-type: none"> Demonstrate compliance with an BMP in accordance with SPP 3.7 and the Guidelines. Where identified as low threat in the BMP, design, implement and maintain public areas to achieve low threat in accordance with Section 2.2.3.2 of AS 3959. As part of building licence (by future lot owners) ensure buildings are constructed to appropriate BAL requirements.

7 Conclusions

Various landowners are progressing a scheme amendment and structure plan for Lots 4, 12 and 402 Caves Road, and Lots 14 and 15 Bussell Highway, Abbey to support residential development within the site. This is in accordance with the Leeuwin-Naturaliste Sub-regional Strategy (DPLH 2021) which indicates urban/residential land uses could be supported subject to resolution of managing particular considerations, including (but not limited to) biodiversity values, bushfire risk, landscape values, nearby wetland features and the 'Open Space Investigation' area. This EAMS been prepared to inform and support the proposed scheme amendment and structure plan by assessing the potential environmental impacts that could arise from the land use change and subsequent development of the site. The environmental attributes and values identified within the site and adjacent land have been outlined in **Section 3** of this document and consideration of potential impacts on environmental values have been outlined within **Section 4** and **Section 5**.

Overall, the proposed scheme amendment is unlikely to result in development that would significantly impact environmental attributes or values, or nearby land uses as the proposed residential development can be suitably managed through the standard planning and development process. In particular:

- **Coastal:** A finished level of 2.7 mAHd for all buildings is required in order to meet the requirements of the City of Busselton's CHRMAP. This can be achieved with minimal additional fill required across the majority of the site.
- **Acid sulfate soils:** it is possible that future investigations and management will be required at subdivision, particularly if services are likely to be installed below the permanent groundwater table. This can be managed through the standard subdivision approval process.
- **Flora, vegetation and fauna:** The site has been historically cleared of native vegetation with only pasture and scattered remnant trees remaining. The management of vegetation and fauna values as part of future development of the site can be appropriately managed through the standard subdivision process. The proposed structure plan proposes areas of public open space in locations to maximise retention of existing trees, and to provide green linkages across the site and between areas of remnant vegetation or nature reserve outside the site. The proposed urban development will provide an opportunity to increase the composition of plant species and vegetation structure, improving biological diversity and ecological integrity as well as vegetation connection (supporting fauna movement and flora dispersion).
- **Hydrology:** The 1% AEP floodway has been accommodated within public open space, while flood fringe areas will be subject to minor filling to ensure the minimum floor level (based on 1% AEP flooding with development of the flood fringe) is achieved. Water management within the site will ensure the first 15 mm of stormwater is treated and retained within the development so that the pre-development discharge rate and volumes are not exceeded, and water quality is improved. Separation to groundwater is able to be achieved based on the proposed minimum 2.7 mAHd lot finished floor levels (and includes that required for managing coastal processes). Future development will be supported by Urban Water Management Plan(s) as per the standard subdivision process.
- **Heritage:** A portion of an 'Other Heritage Place' (ID 5337) is mapped as extending into the western portion of the site. As it is an 'other heritage site' and not considered to be 'a site' as

Environmental Assessment and Management Strategy

Abbey South Structure Plan Area



defined by the Aboriginal Heritage Act 1972, no specific approval is required under the existing enacted Aboriginal heritage legislation.

- **Road noise:** Consideration of noise has been undertaken in accordance with SPP 5.4, and indicates that noise impacts can be addressed through the 'deemed-to-satisfy' pathway. This can be managed through the standard subdivision process, and through the application of quiet house design.
- **Bushfire management:** Bushfire hazards (classified vegetation) that have the potential to impact the site are associated with forest vegetation immediately to the north of the site (within the Caves Road reserve), grassland vegetation within rural landholdings to the south-east (considered to be temporary hazards) and within the Broadwater Nature Reserve Swamp to the south, as well as future public open space areas (which as per consultation with the City of Busselton has been assumed to be a bushfire hazard). The proposed structure plan layout accommodates required setbacks to achieve a bushfire attack level (BAL) rating of BAL-29 or less (as per State Planning Policy 3.7 Planning in Bushfire Prone Areas) to identified bushfire hazards through the proposed road or through development cells that can accommodate in-lot setbacks. Development within the site is not reliant on vegetation modification or management external to the site, or management within public open space areas.

The key environmental planning considerations associated with the Leeuwin-Naturaliste Sub-regional Strategy have been addressed appropriately through the proposed structure plan. The environmental value associated with the 'Open Space Investigation' area is the floodway feature, which has been fully accommodated within public open space and hydrological function managed through implementation of the LWMs, with the remainder of the 'Open Space Investigation' area able to support urban development.

Overall, the environmental attributes and values of the site can be appropriately accommodated through the future planning processes. There are no significant environmental issues or constraints within the site to the extent that it would preclude the entire site from being rezoned to support urban development.

Environmental Assessment and Management Strategy

Abbey South Structure Plan Area

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Abbey South Structure Plan Area



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8.2 Online references

The online resources that have been utilised in the preparation of this report are referenced in **Section 8.1**, with access date information provided in **Table R1**.

Table R 1: Access dates for online references

Reference	Date accessed	Website or dataset name
(BoM 2022)	21 July 2022	Summary Statistics Bussetton Aero
(DPIRD 2022)	21 July 2022	Soil Landscape Mapping – Systems (DPIRD-064)
(DWER 2017a)	21 July 2022	Acid Sulfate Soil Risk Map, Swan Coastal Plain (DWER-055)
(DBCA 2021b)	21 July 2022	Vegetation Complexes Swan Coastal Plain (DBCA-046)
(DBCA 2021a)	27 February 2021	NatureMap
(DPIRD 2020)	21 July 2022	Native Vegetation Extent (DPIRD-005)
(Landgate 2022)	22 July 2022	Map Viewer Plus
(DOCCEFW 2022)	05 August 2022	Protected Matters Search Tool
(DWER 2021)	22 July 2022	Clearing Regulations – Environmentally Sensitive Areas (DWER-046)
(DEC 2009)	22 July 2022	South West Regional Ecological Linkages Axis Lines
(DBCA 2022c)	22 July 2022	Legislated Lands and Waters (DBCA-011)
(DBCA 2022b)	22 July 2022	Lands of Interest (DBCA-012)
(DBCA 2022a)	22 July 2022	Geomorphic Wetlands, Swan Coastal Plain (DBCA-019)
(DWER 2022b)	22 July 2022	Public Drinking Water Source Areas (DWER-033)
(DWER 2022a)	22 July 2022	Contaminated Sites Database
(Department of Defence 2022)	22 July 2022	Unexploded Ordnance
(DPLH 2022)	22 July 2022	Aboriginal Heritage Inquiry System
(DWER 2022c)	22 July 2022	Water Register
(DBCA 2019c)	25 July 2022	Black Cockatoo Roosting Sites - Buffered (DBCA-064)
(DBCA 2019b)	25 July 2022	Black Cockatoo Breeding Sites - Buffered (DBCA-063)
(NGIS 2022)	01 August 2022	Coastal Risk Australia 2100

Environmental Assessment and Management Strategy

Abbey South Structure Plan Area



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Figures



Figure 1: Site Location and Topography

Figure 2: Soils and Geology

Figure 3: Acid Sulfate Soil Risk Mapping

Figure 4: Existing Hydrological Features

Figure 5: Aboriginal and Non-Indigenous Heritage Values

Figure 6: Bushfire Hazard Level

Figure 7: Key Management Considerations

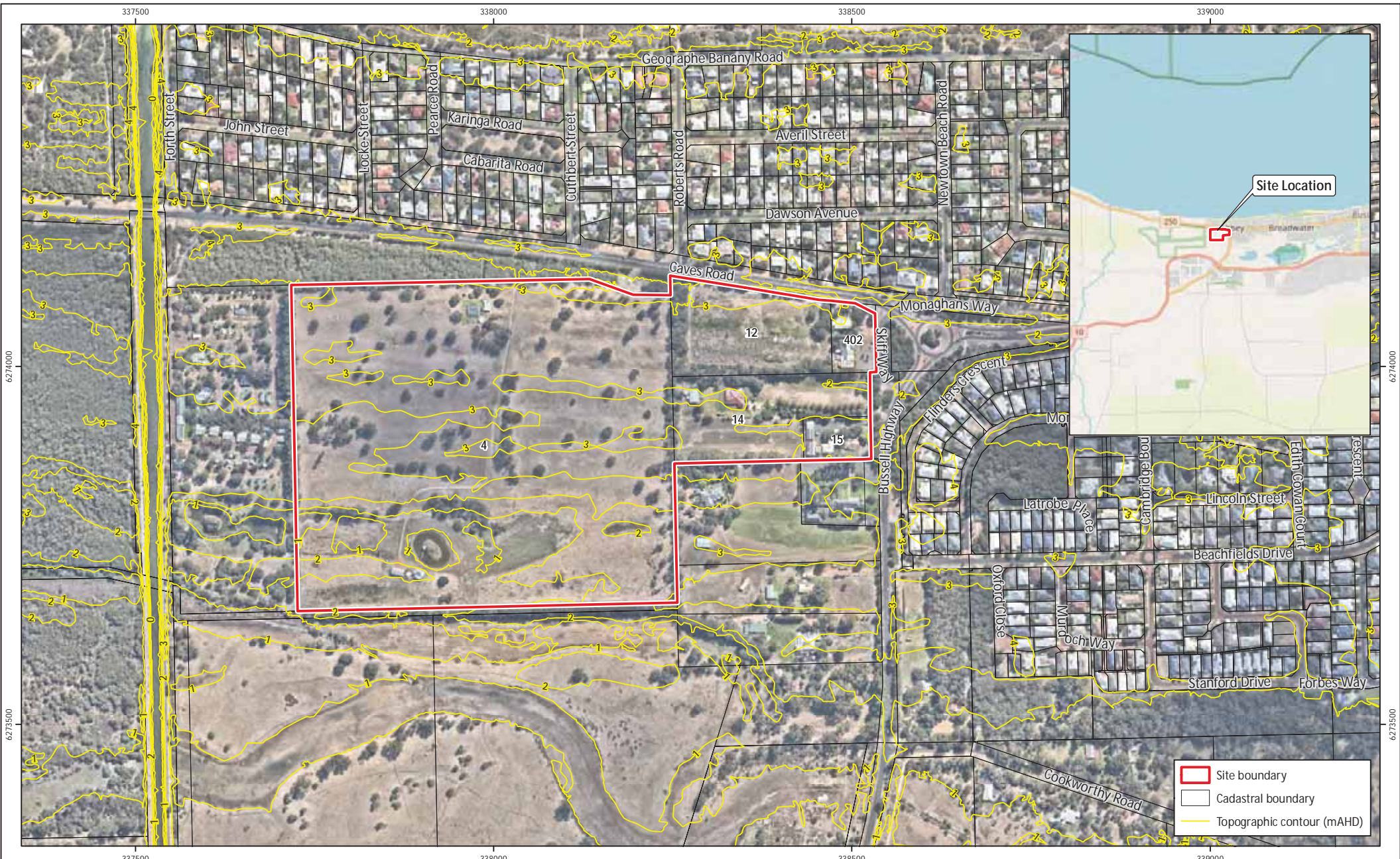
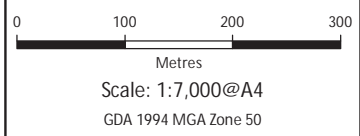


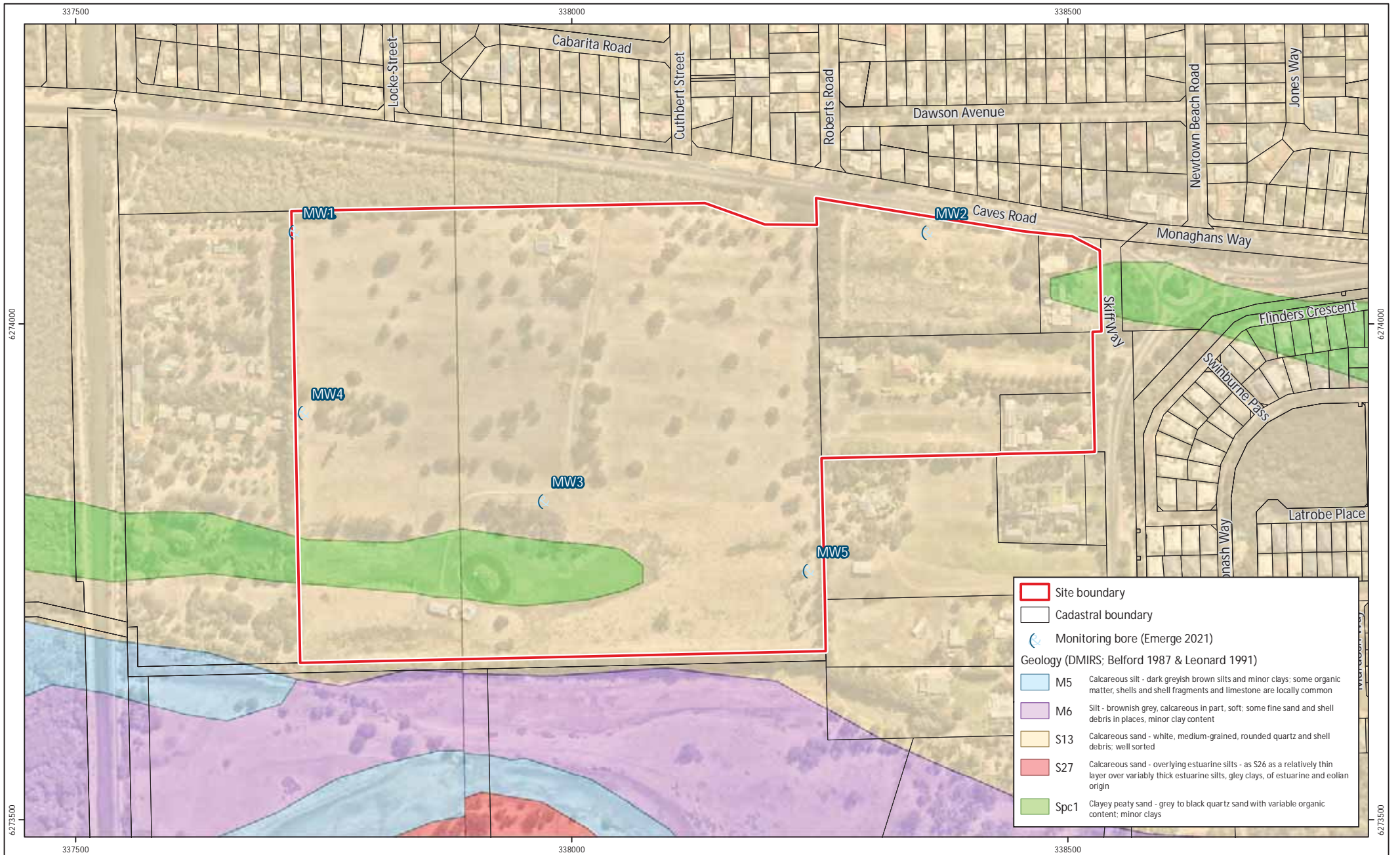
Figure 1: Site Location and Topographic Contours

Project: Environmental Assessment and Management Strategy
 Abbey South Structure Plan Area
 Client: Various Landowners

Plan Number:
 EP20-141(04)-F43
 Drawn: GAR
 Date: 25/07/2022
 Checked: SJB
 Approved: KK
 Date: 05/08/2022



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Site boundary
 Cadastral boundary
 Monitoring bore (Emerge 2021)

Geology (DMIRS; Belford 1987 & Leonard 1991)

- M5 Calcareous silt - dark greyish brown silts and minor clays; some organic matter, shells and shell fragments and limestone are locally common
- M6 Silt - brownish grey, calcareous in part, soft; some fine sand and shell debris in places, minor clay content
- S13 Calcareous sand - white, medium-grained, rounded quartz and shell debris; well sorted
- S27 Calcareous sand - overlying estuarine silts - as S26 as a relatively thin layer over variably thick estuarine silts, gley clays, of estuarine and eolian origin
- Spc1 Clayey peaty sand - grey to black quartz sand with variable organic content; minor clays

Figure 2: Soils and Geology

Project: Environmental Assessment and Management Strategy
 Abbey South Structure Plan Area
Client: Various Landowners

Plan Number:
 EP20-141(04)-F45
Drawn: GAR
Date: 25/07/2022
Checked: SJB
Approved: KK
Date: 05/08/2022



0 100 200
 Metres
 Scale: 1:5,000@A4
 GDA 1994 MGA Zone 50



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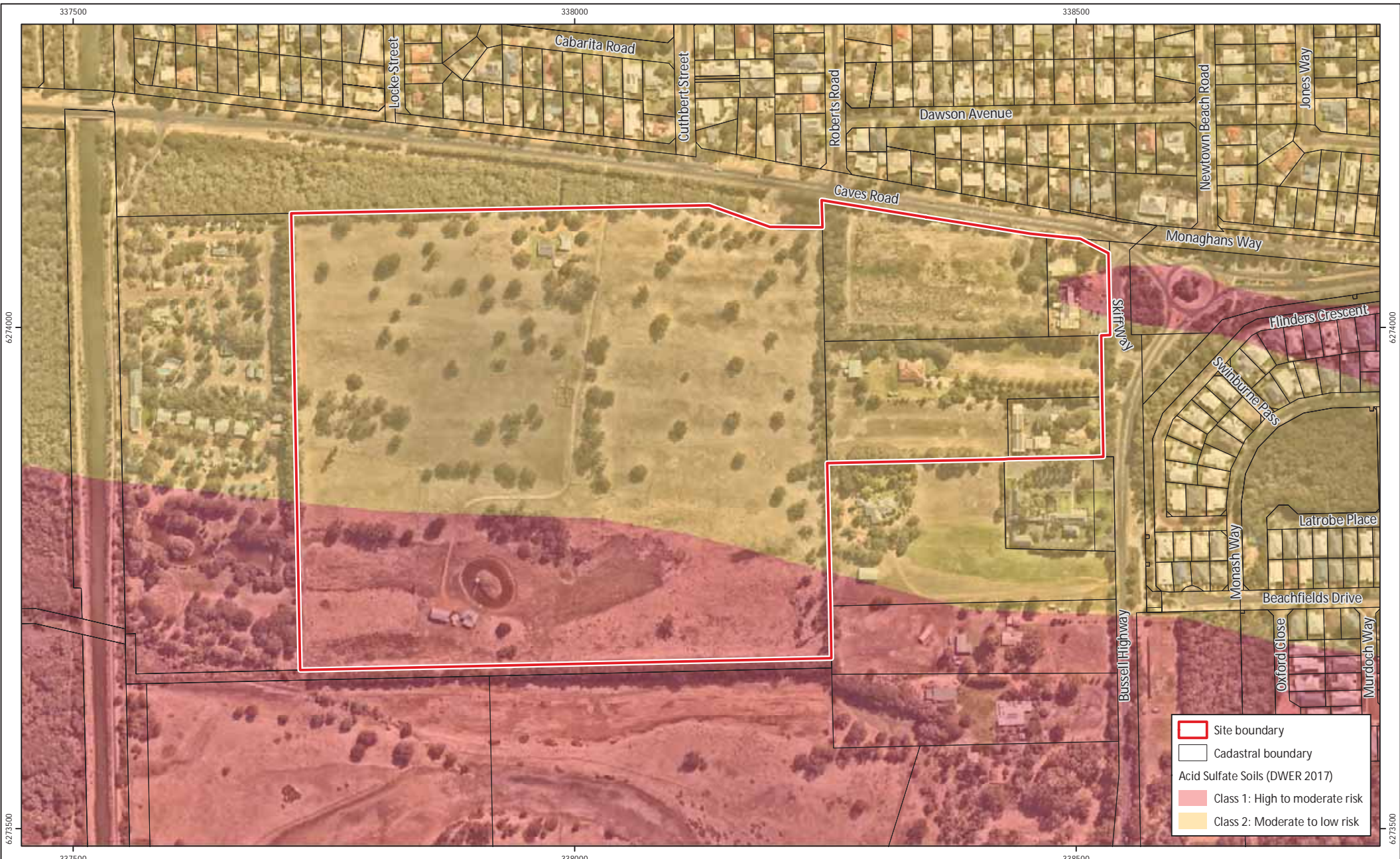
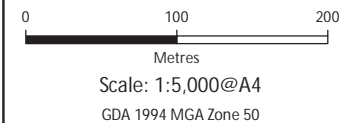


Figure 3: Acid Sulfate Soil Risk Mapping

Project: Environmental Assessment and Management Strategy
 Abbey South Structure Plan Area
Client: Various Landowners

Plan Number:
 EP20-141(04)-F46
Drawn: GAR
Date: 25/07/2022
Checked: SJB
Approved: KK
Date: 05/08/2022



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Figure 4: Existing Hydrological Features

Project: Environmental Assessment and Management Strategy
 Abbey South Structure Plan Area
Client: Various Landowners

Plan Number:
 EP20-141(04)-F49
Drawn: GAR
Date: 25/07/2022
Checked: SJB
Approved: KK
Date: 05/08/2022

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 Scale: 1:5,000@A4
 GDA 1994 MGA Zone 50



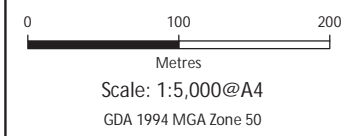
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Figure 5: Aboriginal and Non-Indigenous Heritage Values

Project:	Environmental Assessment and Management Strategy Abbey South Structure Plan Area
Client:	Various Landowners

Plan Number:
EP20-141(04)-F51
Drawn: GAR
Date: 25/07/2022
Checked: SJB
Approved: KK
Date: 05/08/2022



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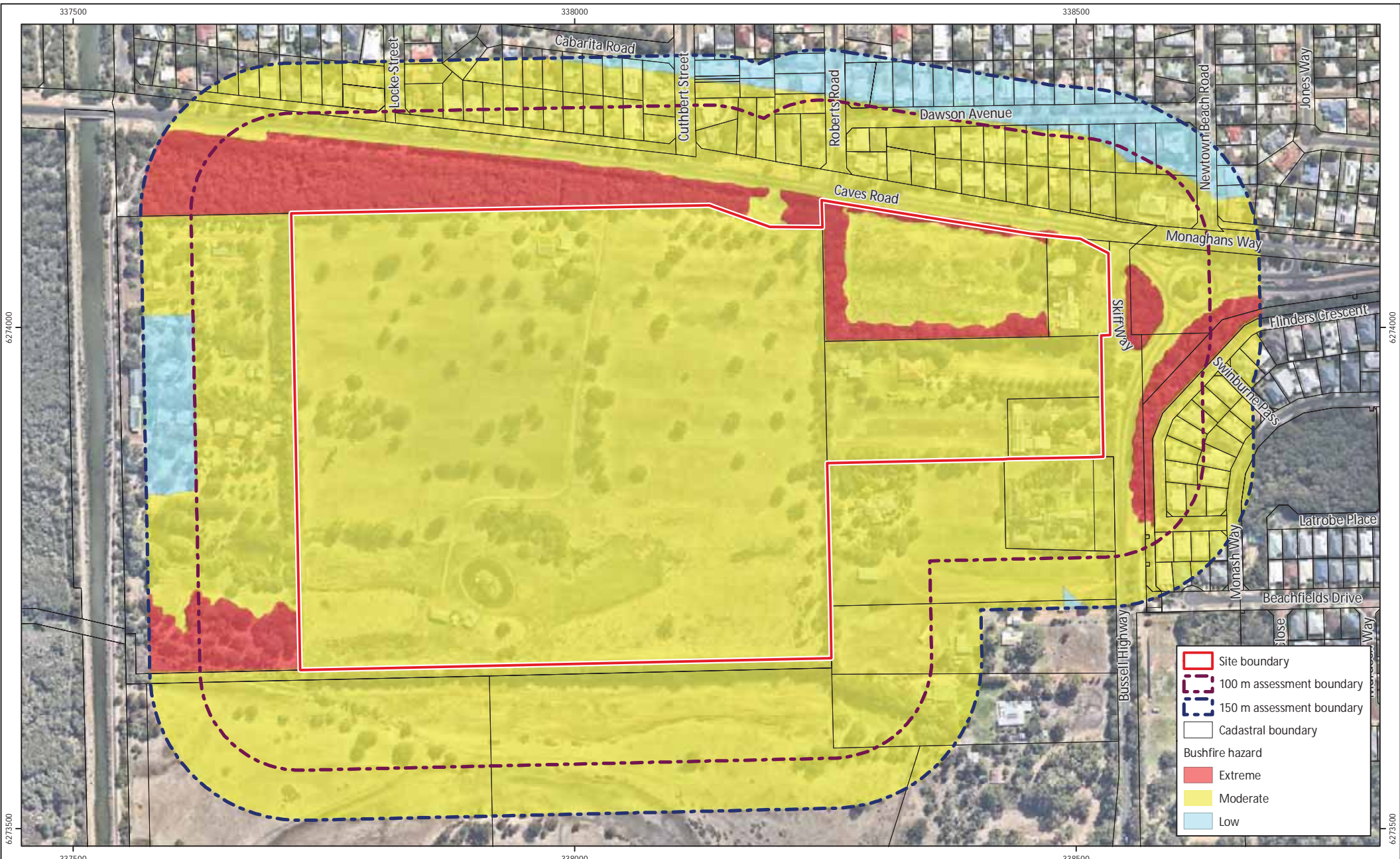
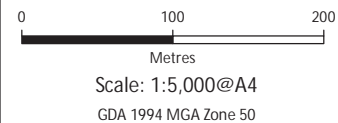


Figure 6: Bushfire Hazard Level

Project: Environmental Assessment and Management Strategy
Abbey South Structure Plan Area
Client: Various Landowners

Plan Number:
EP20-141(04)-F53
Drawn: GAR
Date: 25/07/2022
Checked: SJB
Approved: KK
Date: 05/08/2022



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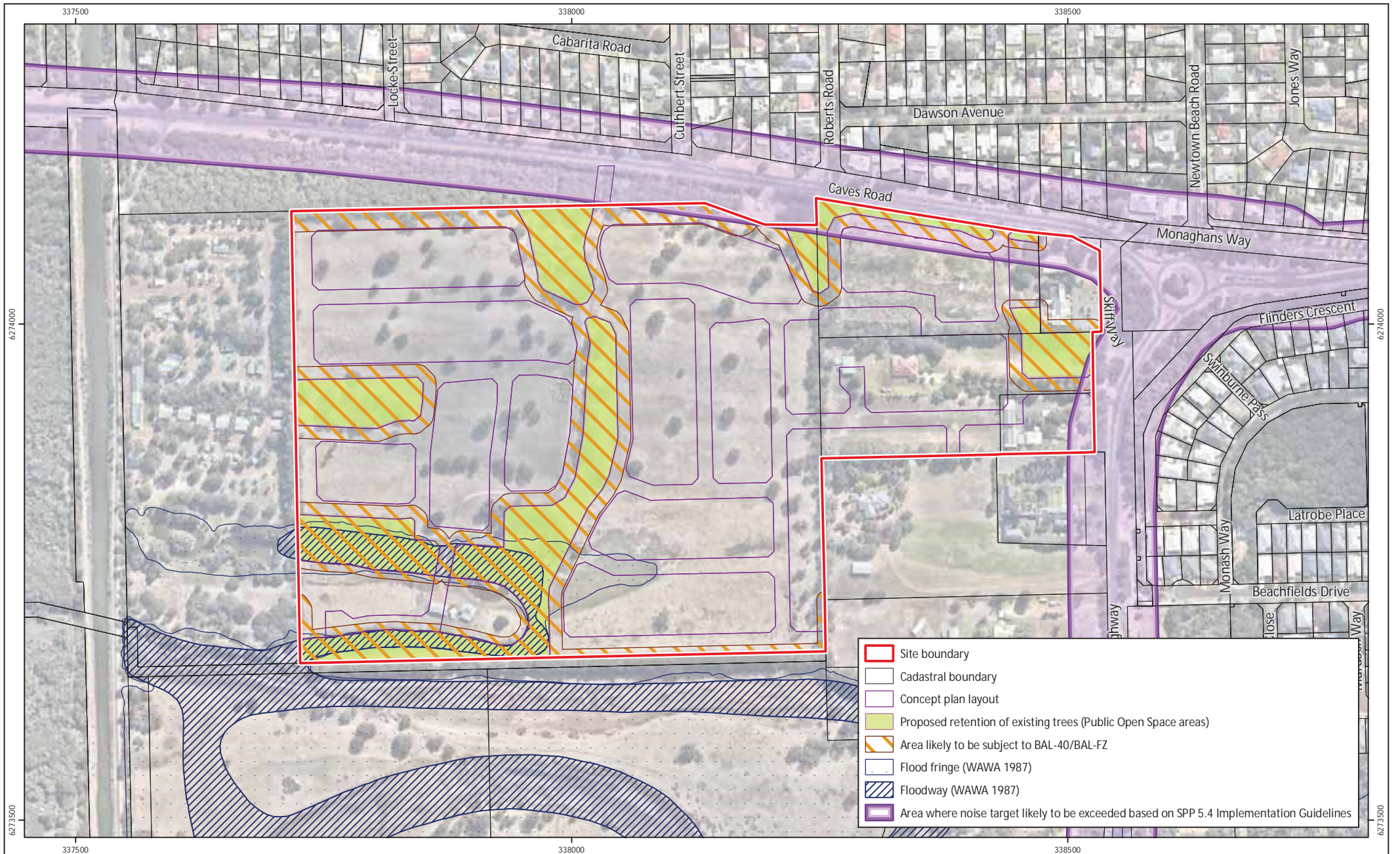


Figure 7: Key Management Considerations

Project: Environmental Assessment and Management Strategy
 Abbey South Structure Plan Area
Client: Various Landowners

Plan Number:
 EP20-141(04)-F55b
Drawn: GAR
Date: 07/12/2022
Checked: KK
Approved: KK
Date: 13/12/2022



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 Metres
 Scale: 1:5,000@A4
 GDA 1994 MGA Zone 50



Appendix A

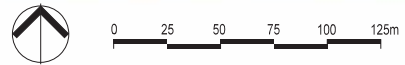
Structure Plan and Concept Plan (Rise Urban 2022)





DRAFT

LOCAL STRUCTURE PLAN
 LOTS 4 & 12 CAVES ROAD & LOTS 14, 15 & 402 BUSSELL HIGHWAY, ABBEY.



NOTE:
 Base Data supplied by Landgate / Denada Surveys
 Aerial Photo - Feb 2019
 Projection - BCG94
 Areas and dimensions shown are subject to final survey calculations.

Revision	Date	Item
A	29/6/22	Initial Issue

LEGEND

	STRUCTURE PLAN BOUNDARY		FLOODWAY
	RESIDENTIAL R10		PERIMETER ROAD
	RESIDENTIAL R20 - R40		ACCESS STREET B
	RESIDENTIAL R60		HIGHER ORDER CYCLE PATH
	RECREATION RESERVE		ACCESS STREET D (INDICATIVE ONLY)
	LOCAL CENTRE (R60)		

	FUTURE PEDESTRIAN / CYCLE CONNECTION TO BUAYANYUP DRAIN CYCLE PATH
	EMERGENCY SECONDARY EGRESS
	POS NUMBER
	ROUNDABOUT
	FULL MOVEMENT INTERSECTION
	LEFT IN / LEFT OUT INTERSECTION

-	: CLIENT
A3@1:2,500	: SCALE
15 December 2022	: DATE
IA Abbey-2-001	: PLAN No
B	: REVISION
C.L.	: PLANNER
B.L.	: DRAWN





© SMALL SCALE

Appendix B

List of conservation significant flora and fauna



Environmental Assessment and Management Strategy

Abbey South Structure Plan Area

Table B1: Threatened and priority flora potentially occurring within 5 km of the site based on relevant database searches

Threatened and priority flora species based on database searches	Conservation status		Habitat Likely to be present within the site
	Federal	State	
<i>Acacia flagelliformis</i>	-	Priority 4	Unlikely, area is grazed and free of vegetation apart from scattered paddock trees.
<i>Acacia semitrullata</i>	-	Priority 4	Unlikely, area is grazed and free of vegetation apart from scattered paddock trees.
<i>Banksia nivea</i> subsp. <i>uliginosa</i> (Swamp Honeypot)	Endangered	Threatened	Unlikely, area is grazed and free of vegetation apart from scattered paddock trees.
<i>Banksia squarrosa</i> subsp. <i>argillacea</i> (Whicher Range <i>Dryandra</i>)	Vulnerable	Threatened	Unlikely, area is grazed and free of vegetation apart from scattered paddock trees.
<i>Banksia sessilis</i>	-	Priority 4	Unlikely, area is grazed and free of vegetation apart from scattered paddock trees.
<i>Boronia captata</i> subsp. <i>Gracili</i>	-	Priority 3	Unlikely, area is grazed and free of vegetation apart from scattered paddock trees.
<i>Brachyscias verecundus</i> (Ironstone <i>Brachyscias</i>)	Critically endangered	Critically endangered	Unlikely, area is grazed and free of vegetation apart from scattered paddock trees.
<i>Caladenia busselliana</i>	Critically Endangered	Endangered	Unlikely, area is grazed and free of vegetation apart from scattered paddock trees.
<i>Caladenia huegeli</i>	Endangered	Threatened	Unlikely, area is grazed and free of vegetation apart from scattered paddock trees.
<i>Caladenia procera</i> (Carbunup King Spider Orchid)	Critically Endangered	Threatened	Unlikely, area is grazed and free of vegetation apart from scattered paddock trees.
<i>Caladenia viridescens</i>	Endangered	Threatened	Unlikely, area is grazed and free of vegetation apart from scattered paddock trees.
<i>Chamaelucium</i> sp. <i>S</i> coastal plain (R.D. Royce 4872)	Vulnerable	Threatened	Unlikely, area is grazed and free of vegetation apart from scattered paddock trees.
<i>Cyathochaeta teretifolia</i>	-	Priority 3	Unlikely, area is grazed and free of vegetation apart from scattered paddock trees.

Environmental Assessment and Management Strategy

Abbey South Structure Plan Area

Table B1: Threatened and priority flora potentially occurring within 5 km of the site based on relevant database searches (continued)

Threatened and priority flora species based on database searches	Conservation status		Habitat Likely to be present within the site
	Federal	State	
<i>Davlesia elongata</i> subsp. <i>elongata</i>	Vulnerable	-	Unlikely, area is grazed and free of vegetation apart from scattered paddock trees.
<i>Diuris micrantha</i>	Vulnerable	Threatened	Unlikely, area is grazed and free of vegetation apart from scattered paddock trees.
<i>Drakeaea elastica</i>	Endangered	Threatened	Unlikely, area is grazed and free of vegetation apart from scattered paddock trees.
<i>Drakeaea micrantha</i> (Dwarf Hammer-orchid)	Vulnerable	Threatened	Unlikely, area is grazed and free of vegetation apart from scattered paddock trees.
<i>Gastrolobium papilio</i> (Butterfly-leaved <i>Gastrolobium</i>)	Endangered	Threatened	Unlikely, area is grazed and free of vegetation apart from scattered paddock trees.
<i>Grevillea brachystylis</i> subsp. <i>Grandis</i> (Large-flowered Short-styled <i>Grevillea</i>)	Critically endangered	Threatened	Unlikely, area is grazed and free of vegetation apart from scattered paddock trees.
<i>Grevillea elongata</i>	Vulnerable	Threatened	Unlikely, area is grazed and free of vegetation apart from scattered paddock trees.
<i>Johnsonia inconspicua</i>	-	Priority 3	Unlikely, area is grazed and free of vegetation apart from scattered paddock trees.
<i>Lambertia echinata</i> subsp. <i>occidentalis</i> (Western Prickly Honeysockle)	Endangered	Threatened	Unlikely, area is grazed and free of vegetation apart from scattered paddock trees.
<i>Lepyrodia heleocharoides</i>	-	Priority 3	Unlikely, area is grazed and free of vegetation apart from scattered paddock trees.
<i>Petrophile latericola</i>	Endangered	Threatened	Unlikely, area is grazed and free of vegetation apart from scattered paddock trees.
<i>Pimelea ciliata</i> subsp. <i>longituba</i>	-	Priority 3	Unlikely, area is grazed and free of vegetation apart from scattered paddock trees.
<i>Pultenaea piniifolia</i>	-	Priority 3	Unlikely, area is grazed and free of vegetation apart from scattered paddock trees.

Environmental Assessment and Management Strategy

Abbey South Structure Plan Area



Table B1: Threatened and priority flora potentially occurring within 5 km of the site based on relevant database searches (continued)

Threatened and priority flora species based on database searches	Conservation status		Habitat Likely to be present within the site
	Federal	State	
<i>Synaphea</i> sp. Fairbridge Farm (D. Pappentus 696)	Critically endangered	Threatened	Unlikely, area is grazed and free of vegetation apart from scattered paddock trees.
<i>Tetralia australiensis</i>	Vulnerable	Threatened	Unlikely, area is grazed and free of vegetation apart from scattered paddock trees.
<i>Thysanotus glaucus</i>	-	Priority 4	Unlikely, area is grazed and free of vegetation apart from scattered paddock trees.
<i>Verticordia densiflora</i> var. <i>pedunculata</i>	Endangered	Threatened	Unlikely, area is grazed and free of vegetation apart from scattered paddock trees.
<i>Verticordia lehmannii</i>	-	Priority 4	Unlikely, area is grazed and free of vegetation apart from scattered paddock trees.
<i>Verticordia plumosa</i> var. <i>ananeotes</i>	Endangered	Threatened	Unlikely, area is grazed and free of vegetation apart from scattered paddock trees.
<i>Verticordia plumosa</i> var. <i>vassensis</i>	Endangered	Threatened	Unlikely, area is grazed and free of vegetation apart from scattered paddock trees.

Environmental Assessment and Management Strategy

Abbey South Structure Plan Area

Table B2: Threatened and priority fauna occurring within 10 km of the site based on relevant database searches.

Species	Common name	Scientific name	Conservation status		Habitat likely to be present within the site
			State	Federal	
Birds					
Amsterdam albatross		<i>Diomedea amsterdamensis</i>		Endangered	No
Australasian bittern		<i>Botaurus poiciloptilus</i>	Endangered	Endangered	Possible. May opportunistically fly over the site in search of prey.
Australian fairy tern		<i>Sterna nereis nereis</i>	Vulnerable	Vulnerable and migratory	Unlikely. May opportunistically fly over the site in search of prey.
Australian lesser noddy		<i>Anous tenuirostris</i>	Endangered	Vulnerable	Unlikely. May opportunistically fly over the site in search of prey.
Baudin's cockatoo		<i>Zanda baudinii</i>	Endangered	Endangered	Possible. <i>Agonis flexuosa</i> is low quality foraging habitat, and site unlikely to provide roosting or breeding habitat.
Black-browed albatross		<i>Thalassarche melanophris</i>	Vulnerable	Vulnerable and migratory	No
Blue petrel		<i>Halobaena caerulea</i>		Vulnerable	No
Carnell albatross		<i>Thalassarche impavida</i>	Vulnerable	Vulnerable and migratory	No
Carnaby's cockatoo		<i>Zanda latirostris</i>	Endangered	Endangered	Possible. <i>Agonis flexuosa</i> is low quality foraging habitat, and site unlikely to provide roosting or breeding habitat.
Curlew sandpiper		<i>Calidris ferruginea</i>	Critically endangered	Critically endangered and migratory	No
Eastern curlew		<i>Numenius madagascariensis</i>	Critically endangered	Critically endangered and migratory	No
Fairy prion (southern)		<i>Pachyptila turtur</i>	-	Vulnerable	No
Forest red-tailed black cockatoo		<i>Calyptorhynchus banksii naso</i>	Vulnerable	Vulnerable and migratory	Possible. <i>Agonis flexuosa</i> is low quality foraging habitat, and site unlikely to provide roosting or breeding habitat.
Greater sand plover		<i>Charadrius leschenaultia</i>	-	Vulnerable and migratory	No
Grey falcon		<i>Falco hypoleucos</i>	-	Vulnerable	No
Indian yellow-nose albatross		<i>Thalassarche carteri</i>	-	Vulnerable and Migratory	No
Lesser sand plover		<i>Charadrius mongolus</i>		Endangered and migratory	No

Environmental Assessment and Management Strategy

Abbey South Structure Plan Area

Table B2: Threatened and priority fauna occurring within 10 km of the site based on relevant database searches. (continued)

Species	Common name	Scientific name	Conservation status		Habitat likely to be present within the site
			State	Federal	
Birds (continued)					
Night parrot	Pezoporus occidentalis	Critically Endangered	Endangered	No	
Northern giant petrel	Macronectes halli		Vulnerable and Migratory	No	
Northern royal albatross	Diomedea sanfordi		Endangered and migratory	No	
Northern siberian bar-tailed godwit	Limosa lapponica menzbieri	Critically Endangered and Migratory	Critically Endangered	No	
Pacific swift	Apus pacificus	Migratory			Unlikely. May opportunistically fly over the site in search of prey.
Peregrine falcon	Falco peregrinus	Other specially protected species			Unlikely. May opportunistically fly over the site in search of prey.
Red knot	Calidris canutus	Endangered	Endangered and migratory	No	
Shy albatross	Thalassarche cauta	Vulnerable	Endangered and migratory	No	
Soft-plumaged petrel	Pterodroma mollis		Vulnerable	No	
Sooty albatross	Phoebastria fusca		Vulnerable and migratory	No	
Southern giant-petrel	Macronectes giganteus		Endangered and migratory	No	
Southern royal albatross	Diomedea epomophora	Vulnerable	Vulnerable and migratory	No	
Tristan albatross	Diomedea dabbenena	Critically Endangered	Endangered and migratory	No	
Wandering albatross	Calidris ruficollis	Vulnerable	Vulnerable and migratory	No	
White-capped albatross	Haliaeetus leucogaster	Vulnerable	Vulnerable and migratory	No	
Mammals					
Australian sea-lion	Neophoca cinerea	-	Endangered	No	
Blue whale	Balaenoptera musculus	-	Endangered	No	
Chuditch	Dasyurus geoffroii	Vulnerable	Vulnerable		Marginal, prefers larger intact areas of native vegetation.

Environmental Assessment and Management Strategy

Abbey South Structure Plan Area

Table B2: Threatened and priority fauna occurring within 10 km of the site based on relevant database searches. (continued)

Species Common name	Scientific name	Conservation status		Habitat likely to be present within the site
		State	Federal	
Mammals (continued)				
Quenda	Isodon fusciventer	Priority 4		Unlikely, as there is no lower dense vegetation on site.
Southern right whale	Eubalaena australis		Endangered	No
South-western brush-tailed phascogale	Phascogale tapoatafa wambenger	Critically endangered		Unlikely, tree hollows suitable for habitat does not exist on site.
Western false pipistelle	Falsirellus mackenziei	Priority 4		Unlikely, hollow logs suitable for habitat does not exist on site.
Western ringtail possum	Pseudochirus occidentalis	Critically endangered	Critically endangered	Marginal, associated with remnant paddock trees which is not likely to be critical habitat due to lack of canopy connection.
Fish				
Southern bluefin tuna	Thunnus maccoyii	Vulnerable	Conservation Dependent	No
Balston's pygmy perch	Nannatherina balstoni		Vulnerable	Unlikely, floodway is ephemeral.
Eastern school shark	Galeorhinus galeus		Conservation Dependent	No
Scalloped hammerhead	Sphyrna lewini		Conservation Dependent	No
Whale shark	Rhincodon typus		Vulnerable	No
Great white shark	Carcharodon carcharias		Vulnerable	No
Freshwater sawfish	Pristis pristis		Vulnerable	No
Grey nurse shark	Carcharias taurus		Vulnerable	No
Reptile				
Loggerhead Turtle	Caretta caretta		Endangered	Unlikely, floodway is ephemeral.
Leatherback Turtle	Dermochelys coriacea		Endangered	Unlikely, floodway is ephemeral.
Flatback Turtle	Natorator depressus		Vulnerable	Unlikely, floodway is ephemeral.
Green Turtle	Chelonia mydas		Vulnerable	Unlikely, floodway is ephemeral.
Invertebrate/other				
Carters freshwater mussel	Westralunio carteri	Vulnerable	Vulnerable	Unlikely, floodway is ephemeral.
Dunnsborough Burrowing Crayfish	Engaewa reducta		Critically Endangered	Unlikely, floodway is ephemeral.

Local Water Management Strategy

Abbey South Structure Plan Area

Project No: EP20-141(03)

Prepared for the Abbey Landowners Group
June 2024

Local Water Management Strategy

Lots 4 & 12 Caves Road, Abbey



Document Control

Doc name: Local Water Management Strategy
Lots 4 & 12 Caves Road, Abbey

Doc no.: EP20-141(03)—009B All

Version	Date	Author	Reviewer
1	July 2022	April Irwin	All
	Send for review to client		
A	August 2022	April Irwin	All
	For agency submission		
B	December 2022	April Irwin	All
	For agency submission		
C	June 2023	Benjamin Brash	BPB
	Updated from agency comments		
D	July 2023	Benjamin Brash	BPB
	Updated from agency comments		
E	June 2024	Ben Brash	BPB
	Updated from agency comments and structure plan		

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Local Water Management Strategy

Lots 4 & 12 Caves Road, Abbey



Executive Summary

The Landowner Group (the proponent) is progressing with a residential development of Lot 4 & Lot 12 Caves Road & Lots 14, 15 & 402 Bussell Highway, Abbey (herein referred to as 'the site').

The site is approximately 30.5ha in size and is located within the City of Busselton. It is bounded by Caves Road to the north, Bussell Highway to the east, an RAC holiday park to the west and existing agricultural areas to the south. The location of the site is shown in **Figure 1**.

Emerge Associates (Emerge) have been engaged by the proponent to prepare a local water management strategy (LWMS) for the development that meets the requirements of Better Urban Water Management (WAPC 2008), and expectations of the relevant State and Local agencies including Department of Water and Environmental Management (DWER) and the City of Busselton.

In summary, environmental investigations undertaken across the site indicate that:

- Historically the site has been used for general agricultural purposes (i.e. cattle grazing) and in minor part for commercial operations (i.e. ice factory and fresh food market).
- The majority of the site has now been cleared leaving small pockets of native vegetation remaining.
- The mean annual rainfall is 807 mm, with the heaviest rainfall months occurring between May and August.
- Topography of the site ranges from 2 metres Australian Height Datum (AHD) within the southern portion of the site to 3 m AHD in the northern and south-eastern portion of the site, with the exception of a depression within the southern portion of the site, which has elevations of approximately 1 m AHD.
- The site is split between two soil type systems; the northern/upper part of the site is within the Quindalup South System, whilst the southern/lower portion of the site is mapped as occurring within the Vasse System.
- The installation of monitoring bores across the site described the subsurface conditions beneath the site as mostly sand to depths up to 5 m below ground level (BGL) to 7 m BGL. The presence of clay starts to become more prominent in the deeper soil profile closer to Broadwater Nature Reserve Swamp (BNRS). Sandy clay was found extending to depths between 3 m BGL to 4 m BGL, further overlying clay and rock extending to depths of approximately 5 m BGL.
- The northern two-thirds of the site is mapped as having a 'moderate to low' risk of acid sulfate soils (ASS) occurring within 3 m of the natural soil surface, whilst the southern third of the site (which approximately aligns with areas identified as a wetland feature) is mapped as a 'high to moderate' risk of ASS occurring within 3 m of the natural soil surface.
- The site is located within a sewerage sensitive area (SSA/feature type 'E' and 'F') due to being within 2 km of coastal embankments and within 1 km of significant wetlands, respectively.
- The remaining native vegetation onsite includes individual paddock trees, predominantly Agonis flexuosa (peppermint), Eucalyptus rudis in lower lying areas or planted eucalypts.
- Four multiple use wetlands (MUWs) have been identified within the site.
- A floodway and flood fringe area is located within the lower south-western portion of the site, which is connected to the BNRS, located approximately 100 m south of the site.

Local Water Management Strategy

Lots 4 & 12 Caves Road, Abbey



- Flood mapping of the BNRS indicates that the 1% annual exceedance probability (AEP) flood elevation at the southern end of the site is 1.65 m AHD.
- According to coastal risk inundation mapping, the floodway and flood fringe within the site are predicted to undergo further inundation of 0.84 m under the highest tide in 2100, resulting in a future flood elevation of up to 2.49 m AHD.
- Results from the pre-development surface runoff modelling of the site indicate that the 1% AEP peak flow rate leaving the site along the southern boundary is 1.1 m³/s, and that the total volume discharging from the site in this same event is 3,082 m³.
- The annual winter peak groundwater level was recorded between August 2021 to November 2022 and ranged between 1.19 m BGL to 1.54 m BGL. The MGL beneath the site therefore ranges from 2.1 m AHD along the eastern boundary to 1.5 m AHD in the south eastern corner of the site.
- Analysis of groundwater quality samples collected in August 2021 and September 2022 found that total phosphorus (TP) ranged between 0.04 mg/L to 0.64 mg/L and total nitrogen (TN) ranged between 0.7 mg/L to 3.2 mg/L. It is noted that the nutrient concentrations recorded are not inconsistent with what would be expected for historical agricultural land in the region.

Water supply and conservation

There is no confirmed water supply to irrigate the site currently confirmed, however investigations are being undertaken to source a sustainable water supply. The site will implement best practise water conservation measures (e.g. water efficient fixtures, use of water sensitive urban design (WSUD) measures, and planting of water wise species) to reduce water demand. Non-potable water can potentially be provided by rainwater tanks if installed by lot owner. The key approach for public open space (POS) will be to retain as many trees as possible, to minimise water use and provide amenity. The surrounding POS areas will be either unirrigated or temporarily supplied (e.g. by watercart) during an establishment period; no ongoing permanent irrigation of POS areas is proposed, unless an alternative water supply can be secured.

Stormwater Management

Given the large size of lots (500 - 600 m²) and sandy soils, all residential lots will adopt soakwells to cater for the small rainfall events (first 15 mm). Lots will also have sufficient permeable area (through garden areas) to facilitate infiltration within lots. This is possible due to the high permeability of the sandy soils underlying the majority of the site and/or sand fill that will be imported to achieve the required finished floor levels, which will have a high capacity to infiltrate runoff.

The front of residential lots (20% of lot area) including driveways, footpaths and garden areas will direct the minor (20% AEP) and major (1% AEP) rainfall events towards estate drainage (i.e. swales, BRA, and FSA). The balance of the lot (remaining 80%) will fully retained up to the 1% AEP event based on the previously discussed large lot assumptions.

Runoff from road reserves and POS areas will be treated as close to source as possible using either vegetated roadside swales or a vegetated bio retention area (BRA) where treatment will occur via contact with vegetation and the underlying soil profile. The majority of catchments will either have a POS area that will contain a BRA and a flood storage area (FSA) and catchments with no POS will contain a vegetated swale that will be designed to treat the first 15 mm and retain/detain runoff up

Local Water Management Strategy

Lots 4 & 12 Caves Road, Abbey



to the 1% AEP event. This approach will ensure that the 1% AEP pre-development peak discharge rate and volume is not exceeded and hydraulic connectivity to the adjacent Broadwater Nature Reserve Swamp (BNRS) is maintained.

Groundwater Management

Groundwater management will include adequate clearance between inverts of storage infrastructure and maximum groundwater levels to facilitate infiltration and mitigate risk against potential future sea level rising influencing groundwater levels. Adopting a minimum finished floor level of 3.0 MAHD accommodates for adaptive development planning required by the City under the Coastal hazard Risk Management and Adaptation Plan (CoB 2021). Groundwater quality will be improved with a change in landuse and the use of WSUD measures.

The LWMs demonstrates that the concepts described above can be achieved by the spatial layout of the Structure Plan. It also provides guidance for future development/design stages to ensure that the water management criteria proposed can be achieved, and to ensure that an integrated water cycle management and best practice WSUD approach can be achieved by the implementation of the Structure Plan.

The design criteria and the manner in which the detailed designs achieve compliance with the design criteria are provided in **Section 4**.

Local Water Management Strategy

Lots 4 & 12 Caves Road, Abbey



Table E1: Water management criteria and compliance

Management Element	Criteria Number	Criteria Description	Manner in which compliance has been achieved	Responsibility for implementation	When implemented
Water Conservation	WC1	Utilise fit-for-purpose water sources throughout the development.	Residential lots will be connected to the local reticulated potable water supply network	Proponent	Detailed drainage design and implementation
			Installation of water efficient fittings and appliances within residential lots.	Lot owner	At point of sale
			Rainwater tanks may be implemented by lot owners	Lot owner	Following house construction
			Adoption of waterwise gardening practices by lot owners.	Lot owner	At point of sale
			Adoption of native waterwise species adapted to seasonal changes	Proponent	Landscape design and implementation
			Education regarding water conservation provided to lot purchasers	Proponent	At point of sale
	WC2	POS will be irrigated at no more than 7,500 kL/ha/year	During the temporary period of vegetation establishment, WWG measures will be implemented to ensure that no more than 7,500 kL/ha/year is used for irrigation.	Proponent	Landscape design and implementation
Stormwater Management	SW1	Manage runoff from the small rainfall event (i.e. first 15 mm) within the site at source or as close as practicably possible.	Lots will retain the first 15 mm of rainfall within pervious garden areas.	Lot owner	Building approval
			Runoff from the road reserve and POS will be retained and treated within vegetated BRAs and swales. Treatment will occur via vegetation and the underlying soil profile which will adsorb nutrients and pollutants prior to reaching groundwater.	Proponent	Detailed drainage and landscape design and implementation

Local Water Management Strategy

Lots 4 & 12 Caves Road, Abbey



Table E1: Water management criteria and compliance

Management Element	Criteria Number	Criteria Description	Manner in which compliance has been achieved	Responsibility for implementation	When implemented
Stormwater Management	SW2	Ensure the major rainfall event (1% AEP) peak flow rates and volumes do not exceed the pre-development environment.	The major storm (1% AEP) event will be retained within lots and infiltrate onsite and runoff from road reserves and POS will be retained in FSAs and swales. Part of the runoff generated across the site will be conveyed and discharged offsite along the southern boundary to ensure pre-development hydrology is not exceeded.	Proponent	Detailed drainage design and implementation
			The pre-development peak flow rate and volume exiting the site is 1.1 m ³ /s and 3,082 m ² has not been exceeded, and post-development modelling shows the peak flow rate and volume is 0.97 m ³ /s and 2,545 m ³ , respectively.	Proponent	Detailed drainage design and implementation
	SW3	Finished floor levels must be minimum of 2.7 mAHD (to meet coastal process requirements) and at least 500 mm above the adjacent 1% AEP flood level	In accordance with the 'Coastal Hazard Risk Management and Adaption Plan' (CoB 2021), all dwellings will achieve a FFL of 3.0 m AHD or at least 500 mm above the 1% AEP flood level, as shown in Table 6 .	Proponent	Detailed earthworks and drainage design and implementation
	SW4	Finished floor levels must have at least 500 mm clearance above the major event top water levels (TWLs) in onsite retention and detention structures.	All residential lots adjacent to retention and detention structures will provide a minimum of 500 mm clearance from the TWL. As shown in Table 6 , the minimum clearance achieves this criteria. Future civil designs to support UWMPs will confirm that lots will have sufficient clearance (> 500 mm) to major event TWLs within BRAs, FSAs and swales.	Proponent	Detailed earthworks and drainage design and implementation
	SW5	Reduce nutrient loads by applying appropriate non-structural measures.	Construction stage measures (e.g. silt fences, other temporary measures).	Proponent	Detailed earthworks, drainage and landscape design/implementation
Landscaping will adopt waterwise planting practices that will reduce the amount of fertiliser required.			Maintenance contractor/Lot owner	Landscape implementation	

Local Water Management Strategy

Lots 4 & 12 Caves Road, Abbey



Table E1: Water management criteria and compliance

Management Element	Criteria Number	Criteria Description	Manner in which compliance has been achieved	Responsibility for implementation	When implemented
Stormwater Management	SW5	Reduce nutrient loads by applying appropriate non-structural measures.	Education of lot owners regarding fertiliser use and waterwise gardening practices.	Proponent	Point of sale
			Street sweeping will occur to prevent sediments entering swales and the FSA.	Proponent then the City after handover	Post construction
			BRAs and swales will be vegetated and underlain by a 300 mm to 500 mm layer of soil suitable for nutrient removal.	Proponent	Landscape design and implementation
			Maintenance of nutrient stripping vegetation and removal of sediments within BRAs and swales.	Proponent	Landscape design and implementation
			Maintenance of POS, BRAs, swales and FSAs.	Maintenance contractor	Two years following construction
Groundwater	GW1	The invert level of drainage basins must have a minimum of 300 mm clearance above the maximum groundwater level.	Drainage basins will be designed to ensure the invert level provides a minimum of 300 mm clearance from the underlying MGL.	Proponent	Detailed earthworks and drainage design, and implementation
	GW2	Provide adequate consideration for the future sea level rise and the influence it will have on groundwater levels beneath the site.	The inverts of basins and swales have been designed to provide a 300 mm clearance from the MGL. This will provide adequate protection from potential sea level rises influencing the rise of groundwater levels. Where appropriate subsoils can be provided to facilitate the free drainage.	Proponent	Detailed earthworks and drainage design, and implementation
	GW3	Minimise the risk of nutrient enrichment to downstream surface water bodies from groundwater sources.	Change in landuse from agricultural to residential will reduce the total nutrient loads infiltrating into the underlying groundwater. Infiltration via BRAs and vegetated swales will also provide treatment via filtration and adsorption of pollutants/nutrients.	Proponent	Detailed earthworks, drainage and landscape design, and implementation

Local Water Management Strategy

Lots 4 & 12 Caves Road, Abbey



Table of Contents

1	Introduction	4
1.1	Background	4
1.2	Planning context	4
1.3	Purpose	4
1.4	Policy framework	4
1.5	Previous studies	5
1.5.1	Hydraulic Review and Breach Modelling of Buayanyup Drain	5
1.6	LWMS objectives	5
2	Proposed Development	7
3	Existing Environment	8
3.1	Sources of information	8
3.2	Historical and current land uses	8
3.3	Climate	8
3.4	Topography	8
3.5	Geotechnical conditions	9
3.5.1	Regional geology	9
3.5.2	Local geology and soils	9
3.5.3	Acid sulfate soils	9
3.6	Environmentally sensitive areas	9
3.7	Sewage sensitive areas	9
3.8	Flora and fauna	10
3.9	Surface water	10
3.9.1	Wetlands	10
3.9.2	Pre-development modelling	11
3.10	Groundwater	11
3.10.1	Groundwater resources	11
3.10.2	Groundwater levels	11
3.10.3	Groundwater quality	12
3.11	Climate change	13
3.12	Summary of existing environment	14
4	Design Criteria and Objectives	16
4.1	Integrated water cycle management	16
4.2	Water conservation	16
4.3	Stormwater management	17
4.4	Groundwater management	17
5	Water Conservation Strategy	18
5.1	Fit-for-purpose water use	18
5.1.1	Scheme water	18
5.1.2	Groundwater	18
5.1.3	Rainwater tanks	18
5.2	Water Conservation measures	18
5.2.1	Water efficient fixtures and appliances	18
5.2.2	Water wise gardens	19
5.3	Wastewater management	20
5.4	Water conservation criteria compliance summary	20
6	Stormwater Management Strategy	21

Local Water Management Strategy

Lots 4 & 12 Caves Road, Abbey



6.1	Lot drainage.....	21
6.2	Development drainage.....	21
6.2.1	Road drainage network.....	21
6.2.2	Vegetated swales.....	22
6.2.3	Bio-retention areas.....	22
6.2.4	Flood storage areas.....	23
6.2.5	Existing retained floodway.....	23
6.3	Stormwater management design.....	24
6.3.1	Small rainfall event.....	24
6.3.2	Flood storage.....	25
6.3.2.1	Imported fill.....	26
6.3.3	Maintaining pre-development peak flow rates.....	26
6.4	Non-structural stormwater management measures.....	27
6.5	Stormwater design criteria compliance.....	27
7	Groundwater Management.....	29
7.1	Groundwater level management.....	29
7.2	Groundwater quality management.....	30
7.3	Groundwater design criteria compliance.....	30
8	Subdivision and Urban Water Management Plans.....	31
8.1	Implementation of water conservation strategies.....	31
8.2	Modelling and configuration of drainage structures.....	31
8.3	Non-structural water quality improvement measures.....	32
8.4	Construction period management strategy.....	32
8.5	Management and maintenance requirements.....	32
8.6	Floodway management.....	32
9	Monitoring.....	33
9.1	Pre-development monitoring.....	33
9.2	Post-development monitoring.....	33
9.2.1	Condition monitoring.....	33
9.2.2	Groundwater monitoring.....	33
9.3	Post-development guideline values.....	34
9.4	Reporting.....	34
10	Implementation.....	35
10.1	Roles and responsibility.....	35
10.2	Funding.....	35
10.3	Review.....	35
11	References.....	36
11.1	General references.....	36
11.2	Online references.....	37

Local Water Management Strategy

Lots 4 & 12 Caves Road, Abbey



List of Tables

Table 1 : Measured groundwater levels	12
Table 2: Groundwater quality results	13
Table 3: Water conservation compliance summary	20
Table 4: Small event (first 15 mm) treatment requirements	24
Table 5: Stormwater flood storage requirements from the minor (20% AEP) and major (1% AEP) event	25
Table 6: Summary of clearances between storage structure 1% AEP TWLS and the FFL of adjacent lots	25
Table 6: Summary of clearances between storage structure 1% AEP TWLS and the FFL of adjacent lots (continued).....	26
Table 7: Summary of surface runoff modelling for minor and major peak flow rates and volumes.	27
Table 9: Stormwater management compliance summary	28
Table 9: Summary of clearances between the MGL and invert of storage structures	29
Table 11: Groundwater management compliance summary	30
Table 12: Groundwater monitoring program summary	34
Table 13: Water quality monitoring trigger values	34

List of Plates

Plate 1: Hydrograph of static water level (m BGL) for DWER monitoring bore BN165	12
Plate 2: Prediction inundation scenario – High (medium confidence) (NGIS 2022)	14

Figures

Figure 1: Site Locality	
Figure 2: Topography	
Figure 3: Soil Landscape Mapping	
Figure 4: Acid Sulfate Soil Mapping	
Figure 5: Sewage Sensitive Area	
Figure 6: Existing Hydrological Features	
Figure 7: Geomorphic Wetlands	
Figure 8: Stormwater Management Plan	
Figure 9: Inundation Plan: First 15 mm	
Figure 10: Inundation Plan: 20% AEP event	
Figure 11: Inundation Plan: 1% AEP event	

Appendices

Appendix A	
Local Structure Plan – Rise Urban	
Appendix B	
Modelling Assumptions Report – Emerge Associates	
Appendix C	
Educational material	
Appendix D	
Landscape Master Plan – Emerge Associates	

Local Water Management Strategy

Lots 4 & 12 Caves Road, Abbey



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Local Water Management Strategy

Lots 4 & 12 Caves Road, Abbey



Abbreviation Tables

Table A1: Abbreviations – Organisations

Organisations	
ANZECC	Australian and New Zealand Environment and Conservation Council
BoM	Bureau of Meteorology
DoW	Department of Water (now DWER)
DPLH	Department of Planning, Land and Heritage
DWER	Department of Water and Environmental Regulation
WAPC	Western Australia Planning Commission

Table A2: Abbreviations – General terms

General terms	
ASS	Acid sulfate soil
BMD	Buayanyup Main drain
BMP	Best management practices
BRA	Bio retention area
BUWM	Better urban water management
BNRS	Broadwater Nature Reserve Swamp
CCW	Conservation category wetland
ESA	Environmentally sensitive area
FFL	Finished floor level
FSA	Flood storage area
LSP	Local structure plan
LWMS	Local water management strategy
NWQMS	National water quality management strategy
POS	Public open space
MUW	Multiple use wetland
UFI	Unique feature identifier
UWMP	Urban water management plan
WEFA	Water efficient fixtures and appliances
WSUD	Water sensitive urban design
WWG	Water wise gardens

Local Water Management Strategy

Lots 4 & 12 Caves Road, Abbey



Table A4: Abbreviations – units of measurement

Units of measurement	
AEP	Annual exceedance probability
ha	Hectare
KL	Kilolitres
m	Metre
m ²	Square metre
m ³	Cubic metre
m ³ /s	Cubic metres per second
m AHD	m in relation to the Australian height datum
m BGL	m below ground level
mg/L	Milligrams per litre
mm	Millimetre

Local Water Management Strategy

Lots 4 & 12 Caves Road, Abbey



1 Introduction

1.1 Background

The Abbey Landowner Group (the proponent), coordinated by Rise Urban, is progressing development of Lot 4 & Lot 12 Caves Road & Lots 14, 15 & 402 Bussell Highway, Abbey (herein referred to as ‘the site’) for residential purposes. The site is approximately 30.5 ha in size and is located within the City of Busselton (CoB) and is shown in **Figure 1**. It is bounded by vegetation adjacent to Caves Road to the north, Bussell Highway to the east, an RAC holiday park to the west and existing agricultural areas/Broadwater Nature Reserve Swamp (BNRS) to the south.

The development will consist of residential lots, public open space (POS) areas and retained floodway associated with the BNRS. The proposed development is discussed further in **Section 2** and the local structure plan (LSP) is shown in **Appendix A**.

1.2 Planning context

Under the City’s Local Planning Scheme No.21 (LPS 21) (DPLH 2019), part of Lot 4 and Lot 12 Caves Rd and Lots 14, 15 & 402 Bussell Hwy, is zoned as ‘rural’. The lower portion of Lot 4 Caves Road adjacent to BNRS is zoned as ‘conservation’. Scheme amendment No. 55 has been attached to LPS 21 (DPLH 2022) where by Section 2.4 ‘Scheme special provision areas’ also applies to the site to ensure that the intent of the Leeuwin-Naturaliste Sub-regional Strategy (LNSS) is addressed by the structure plan to ensure the retention and enhancement of ecological values.

1.3 Purpose

It is important that the manner in which water will be managed is clearly documented early in the planning process, and this should be in a manner which avoids potential flooding, protects the environment and considers future climate change. This approach provides the framework for actions and measures to achieve the desired outcomes during development.

This local water management strategy (LWMS) details the water management approach to support the development of the site, and is intended to satisfy the requirements of Better Urban Water Management (WAPC 2008), and to address the expectations of the Department of Water and Environmental Regulation (DWER) and the CoB.

1.4 Policy framework

There are a number of Local and State Government policies of relevance to the development. These policies include:

- State Water Strategy (Government of WA 2003)
- State Planning Policy 2.9 Water Resources (WAPC 2006a)
- State Planning Policy 2.6 Coastal Planning (WAPC 2013)
- State Planning Policy 6.1 Leeuwin-Naturaliste Ridge (WAPC 1998)
- Statement of Planning Policy No. 3: Urban Growth and Settlement (WAPC 2006b)

Local Water Management Strategy

Lots 4 & 12 Caves Road, Abbey



- State Water Plan (Government of WA 2007)
- Liveable Neighbourhoods Edition 4 (WAPC 2009a)
- Planning Bulletin No. 64: Acid Sulfate Soils (WAPC 2009b)
- Water Wise Perth-Two Year Action Plan (Government of WA 2019).

In addition to the above policies, there are a number of published guidelines and standards available that provide direction regarding the water discharge characteristics that developments should aim to achieve. These are key inputs that relate either directly or indirectly to the development of the site and include:

- Australian Runoff Quality (Engineers Australia 2006)
- Stormwater Management Manual for Western Australia (DOW 2007a)
- Guidance Statement No. 33: Environmental Guidance for Planning and Development (EPA 2008)
- Better Urban Water Management (BUWM) (WAPC 2008)
- Decision Process for Stormwater Management in Western Australia (DWER 2017)
- A National Water Quality Management Strategy (Australian Government 2018)
- Australian Rainfall and Runoff (Ball J et al. 2019).

1.5 Previous studies

1.5.1 Hydraulic Review and Breach Modelling of Buayanyup Drain

The primary objectives of this study undertaken on behalf of Water Corporation was to assess the existing capacity of the Buayanyup Main Drain (BMD) and Sub A drain located between Florence Road and the coastal outlet, and to investigate the potential flooding impacts if the levee banks were to breach. To undertake the assessment, a detailed model was constructed to characterise the hydrodynamic flow conditions occurring in the BMD and its major tributary, the Sub-A Drain.

The parameters built into the model enabled the identification of where the likely locations of breaches may occur. In relation to the site, the identified a breach location which would provide the highest risk of flooding occurring within the site. The breaching of BXS5 on the eastern levee in a 1% annual exceedance probability (AEP) event would impact the lower portion of the site where the floodway and flood fringe (discussed in **Section 3.9**) is located. In the extreme case of a 60 m width breach, the floodway within the site could potentially experience flooding heights of 2.15 metres Australian height datum (m AHD) (further discussed in **Section 6.3.2**).

1.6 LWMMS objectives

This LWMMS has been developed in consideration of the objectives and principles detailed in the Better Urban Water Management (BUWM) (WAPC 2008). It is intended to support the development within the site and is based on the following major objectives:

- Provide a broad level stormwater management framework to support future development.
- Treat the first 15 mm and retain stormwater runoff within the development so that the pre-development discharge rate and volumes are not exceeded.
- Ensure that sufficient land area is set aside in the LSP to manage stormwater runoff.

Local Water Management Strategy

Lots 4 & 12 Caves Road, Abbey



- Protect future residences and adjacent areas against potential flooding as a result of developing the site and/or breaches to the BMD levee.
- Consider and respond to the implications of future sea level rise due to climate change.
- Develop a water conservation strategy for the site that will ensure the efficient use of all water resources.
- Incorporate appropriate best management practices (BMPs) and water sensitive urban design (WSUD) approaches into the development that address the environmental and water management issues identified.
- Reduce pollutant loads discharged from the development into the downstream environment.
- Minimise ongoing operation and maintenance costs for the land owners and the City.
- Gain support from DWER and COB for the proposed strategy to manage water within the site.

Detailed objectives for water management within the site are further discussed in **Section 4**.

Local Water Management Strategy

Lots 4 & 12 Caves Road, Abbey



2 Proposed Development

The LSP will allow for the creation of the following land uses:

- Low density residential lots (typically between 500-600 m²)
- POS areas
- Internal road network.

The stormwater management approach proposes to include the following WSUD measures (discussed further in **Section 6**) that will be incorporated into road reserves and POS.

- Vegetated roadside swales
- Bio-retention areas (BRAs)
- Flood storage areas (FSAs)
- Waterwise landscaping design and approaches at both lot and estate scale.

The LSP is provided in **Appendix A**.

Local Water Management Strategy

Lots 4 & 12 Caves Road, Abbey



3 Existing Environment

3.1 Sources of information

The following sources of information were used to provide a broad regional environmental context to the site:

- Weather and Climate Statistics (BoM 2022)
- Water Register (DWER 2022d)
- Water Information Reporting (DWER 2022c)
- Acid Sulfate Soils (ASS) Risk Mapping (DWER 2022a)
- Geomorphic Wetlands of the Swan Coastal Plain Database (DBCA 2022a)
- Landgate Map View Plus (Landgate 2022)

3.2 Historical and current land uses

Based on a review of publicly available aerial photography, the site has been cleared of a majority of native vegetation since at least 1970 (Landgate 2021). It has been used for general agricultural purposes (e.g. grazing), for a number of years, and more recently commercial operations have commenced within the minor north-eastern portion of the site, including an ice factory and fresh food market.

Currently, two residential houses are located on Lot 4 Caves Rd (one in the northern portion and one in the southern portion). Strips of remnant native vegetation exist in the eastern portion of the site (along lot boundaries) and individual paddock trees (predominantly *Agonis flexuosa*) are present throughout the site.

3.3 Climate

The site experiences a warm and temperate climate, and the winter months have much higher rainfall than the summer months. The closest weather station to the site which records rainfall and temperature data is located in Busselton (Bureau of Meteorology (BoM) station number 9515).

Based on weather data collected from 1877 to 2022 at this weather station, the local area experiences an average 807 mm of annual rainfall, mean annual maximum temperature of 22 °C and a mean minimum temperature of 10.4 °C (BoM 2022). The highest average rainfall months occur between May and August.

3.4 Topography

The entire site is relatively low lying with a slight south-westerly aspect. Elevation of most of the site generally ranges from approximately 2 m AHD within the southern portion of the site to 3 m AHD within the northern and south-eastern portion of the site. An exception to these elevations is a depression associated with the floodway connected to the BNRS which is located within the southern portion of the site and has elevations of around 1 m AHD. The topographic contours are shown within **Figure 2**.

Local Water Management Strategy

Lots 4 & 12 Caves Road, Abbey



3.5 Geotechnical conditions

3.5.1 Regional geology

Land resource mapping prepared by the Department of Primary Industries and Regional Development (DPIRD 2020) identifies the majority of the site as occurring within the Quindalup South System, whilst the south-western portion of the site is mapped as occurring within the Vasse System. The soil groups identified across the site are shown within **Figure 3**.

The Quindalup South System is described as coastal dunes of the Swan Coastal Plain, with calcareous deep sands and yellow sands. Whilst the Vasse System is described as poorly drained estuarine flats, of the Swan Coastal Plain, which contains tidal flat soil, saline wet soil and pale deep sand.

3.5.2 Local geology and soils

A total of five monitoring bores were installed across the site in June 2021, to depths ranging between 5 m below ground level (m BGL) to 7 m BGL. The bore logs indicate that topsoil is generally comprised of coarse calcareous sand with depths ranging between 3 m to 7 m. This layer was either the final depth of the monitoring bore or was underlain with one of the following:

- Clayey sand with a thickness of 1 m extending from 5 m BGL to 6 m BGL, or;
- Sandy clay extending to depths between 3 m BGL to 4 m BGL, further overlying clay and rock that extends to depths of approximately 5 m BGL.

The bore logs suggest that the soils in the northern portion of the site are sandy and moving towards to the southern portion of the site, sandy clay soils become more prominent at shallower depths. See bore locations and soil mapping in **Figure 3**.

3.5.3 Acid sulfate soils

ASS risk mapping (DWER 2022a) indicates that the northern two-thirds of the site is mapped as having a 'moderate to low' risk of ASS within 3 m of the natural soil surface, whilst the southern third of the site (which roughly aligns with areas identified as wetland features) is mapped as having a 'high to moderate' risk of ASS within 3 m of the natural surface. The ASS risk mapping applicable to the site is shown in **Figure 4**.

3.6 Environmentally sensitive areas

No environmentally sensitive areas are located within the site.

3.7 Sewage sensitive areas

The site is located within a sewerage sensitive area (SSA) based on the Government Sewerage Policy dataset (DPLH 2020). The entire site is classed as both type 'E' and 'F', due to being within 2 km of coastal embankments and within 1km of significant wetlands, respectively. The SSA mapping is shown in **Figure 5**.

Local Water Management Strategy

Lots 4 & 12 Caves Road, Abbey



3.8 Flora and fauna

As described in **Section 3.2**, a large portion of the site has historically been cleared of native vegetation. Strips of remnant native vegetation exist in the eastern portion of the site (along existing lot boundaries) and individual paddock trees are present throughout the site. Site inspection confirmed that these paddock trees are predominantly *Agonis flexuosa* (peppermint), *Eucalyptus rudis* in lower lying areas or planted eucalypts.

3.9 Surface water

A review of the publicly available flood mapping database (DWER 2022) and subsequent information provided by DWER indicates that a 1% AEP event floodway and flood fringe is located within the south-western corner of the site, as shown in **Figure 6**. This floodway connects to the BNRS floodway immediately south of the site. According to flood mapping (DWER 2022) the flood height of the adjacent floodway is approximately 1.65 m AHD in a 1% AEP event.

As discussed in **Section 1.5.1**, The BMD is located approximately 180 m west of the site. This drain is highly modified in the downstream reach and discharges north to Geographie Bay, which is 400 m north of the site. The Buayanyup drainage system is managed by Water Corporation and provides rural drainage from upstream catchments, safely catering and maintaining flood water conveyance up to the 5% AEP event.

The BNRS is located immediately south of the site and positioned between the BMD and the Vasse Diversion Drain (VDD). It acts as a large regional surface water retention area prior to discharging to the VDD via the outlet floodgates. A one-way culvert exists in the western extent of the BNRS providing a hydraulic connection into the BMD. The average annual groundwater level in the BNRS is approximately 0.8 m AHD (JDA 2017). In 1998, JDA prepared a water balance model estimating the 1% AEP event peak flood level in the BNRS to reach 1.66 m AHD. However, this model was undertaken over 10 years ago and is likely superseded by the Hydraulic Review and Breach Modelling of Buayanyup Drain (JDA 2017). It is noted that the more recent modelling undertaken indicates that 1% AEP flood levels within the BMD adjacent to the site as 2.32 m AHD.

3.9.1 Wetlands

A review of the Geomorphic Wetlands of the Swan Coastal Plain dataset (DBCA 2020) indicates that:

- A number of multiple use wetlands (MUWs) are identified within the site, including four MUWs in the southern and south-western portions of the site (unique feature identification (UFI) #39, #41, #63, #13195); and one MUW (UFI #64) within the north-eastern portion of the site. The location of the MUWs area shown in **Figure 7**.
- No conservation category wetlands (CCWs) are present within the site or within close proximity.
- A CCW is located west of Buayanyup Drain, however is more than 225 m from the site.

The presence of a wetland can indicate that groundwater may be close to the surface at different periods of the year. As part of the site visit, and based on discussions with the landowners, it appears that waterlogging may occur in areas identified as MUW (particularly in winter).

Local Water Management Strategy

Lots 4 & 12 Caves Road, Abbey



3.9.2 Pre-development modelling

Catchment analysis and hydrological and hydraulic (surface runoff) modelling of the site has been undertaken (using XPSWMMI software) to provide a representation of the pre-development environment. The catchment analysis indicates that the site is close to the top of catchment and most of the site is self retained and lesser part of the site discharging runoff at the southern boundary into the BNRS. The surface runoff modelling indicates that the 1% AEP peak flow rate leaving the site along the southern boundary is 1.1 m³/s with a total volume of 3,082 m³. The modelling assumptions report is contained in **Appendix B**.

3.10 Groundwater

3.10.1 Groundwater resources

The site is within the Busselton-Capel groundwater management area and the Dunsborough-Vasse subarea. The Water Register (DWER 2022) indicates that the site is underlain by a multi-layered system, including the following aquifers:

- Superficial Swan – unconfined
- Leederville – confined
- Sue Coal Measures – confined.

The Water Register indicates that the Superficial and Leederville aquifers are all fully allocated, however there is potentially allocation available in the Sue Coal Measures. This aquifer exists at a greater depth and may be problematic to access and or to successfully extract water from.

3.10.2 Groundwater levels

The DWER Busselton Shallow – BN16S monitoring bore (site reference 61030048) is located approximately 1km to the south east of the site and is screened between 2.6 to 5.6 m BGL. Historical groundwater levels recorded within this bore vary from approximately 0.1 m BGL (recorded in 2016) with more recent groundwater levels being 0.5 m BGL (recorded in 2021). While this bore is location close to the coast the variations noted above are unlikely to be influenced by the proximity to the coastline, see **Plate 1** for the hydrograph of BH16S.

Emerge Associates undertook groundwater monitoring of the five monitoring bores across the site monthly between July to November in 2021 and 2022, with results shown in

Table 1. The monitoring results indicate that the maximum groundwater level (MGL) occurred across different months (between August to October in 2021) and ranged from 1.19 m BGL in the north eastern portion of site to 1.54 m BGL in the lower central section of the site.

Local Water Management Strategy

Lots 4 & 12 Caves Road, Abbey

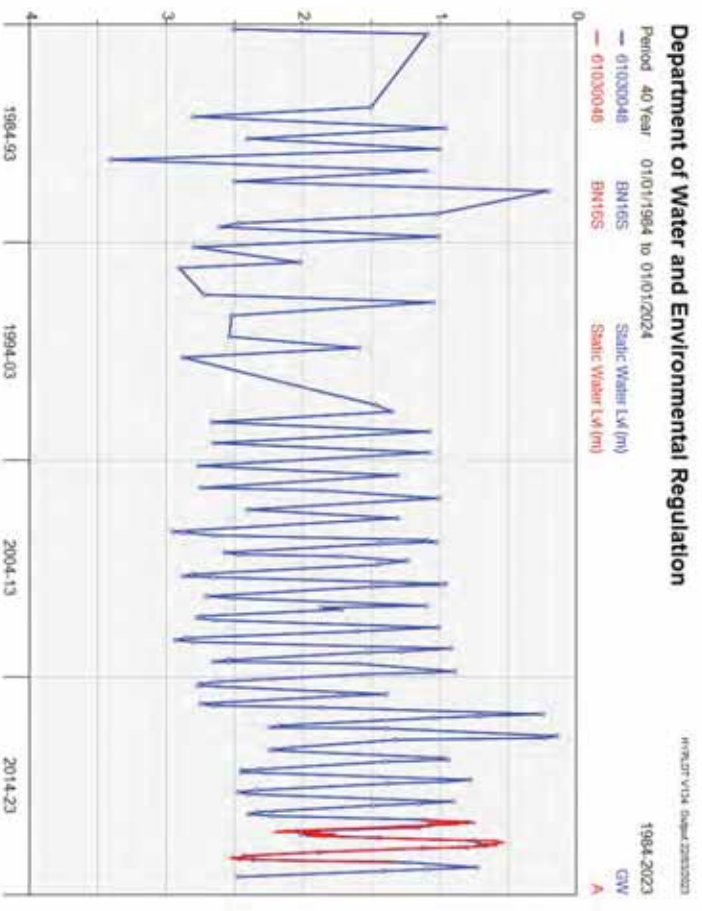


Plate 1: Hydrograph of static water level (m BGL) for DWER monitoring bore BN165.

Table 1: Measured groundwater levels.

Bore ID	Depth to groundwater (m BGL)									
	Jul-21	Aug-21	Sep-21	Oct-21	Nov-21	Jul-22	Aug-22	Sep-22	Oct-22	Nov-22
MW1	2.26	1.49	1.77	1.32	1.55	1.95	1.78	1.9	2.05	2.15
MW2	1.74	1.52	1.19	1.29	2.04	1.83	1.46	1.458	1.67	1.74
MW3	1.82	1.54	1.69	1.77	2.44	2.16	1.84	1.907	2.08	2.19
Table 1: Measured groundwater levels: MW4										
MW5	1.60	1.26	1.39	1.79	1.74	1.99	1.58	1.627	1.81	1.90

Bold values – Indicates the groundwater level monitoring round where the 2021 annual winter peak was recorded.

The locations of bores and MGL contours derived from the data provided in

Table 1 are shown on **Figure 2**.

3.10.3 Groundwater quality

Groundwater quality sampling was undertaken by Emerge Associates in August 2021 and September 2022, with the results provided in **Table 2**. Whilst intended to be applied to surface water, comparison of groundwater quality to the National Water Quality Management Strategy (NWQMS)

Local Water Management Strategy

Lots 4 & 12 Caves Road, Abbey



(Australian Government 2018) guideline values for lowland rivers (i.e. surface water), the sample results from both monitoring rounds indicate that all locations were within the guideline range for pH, except for MW01 that experienced a minor exceedance of the upper trigger value. All sites, except for one (MW02) exceeded the total nitrogen (TN) guideline value of 1.2 mg/L and all sites, except one (MW2 in Sept-22) exceeded the total phosphorous (TP) guideline value of 0.065 mg/L. While described as an ‘exceedance’, as indicated the trigger values described are intended to be applied to surface water, and not necessarily to groundwater. Further, the nutrient concentrations recorded are not inconsistent with what would be expected for historical agricultural land in the region. The comparison of results should therefore be viewed as providing context to the site conditions, but does not necessarily indicate cause for concern or action.

Table 2: Groundwater quality results

Monitoring location	Monitoring round	pH	EC µS/cm	DO mg/L	TN mg/L	Ammonia mg/L	TKN mg/L	TP mg/L
NWMOMS (Australian Government 2018)		6.5 – 8.0	-	-	1.2			0.065
MW1	Aug-21	7.55	985	2.72	3.2	<0.01	1.4	0.64
	Sept-22	8.05	636	0.46	1.8	0.15	1.2	0.14
MW2	Aug-21	7.35	861	0.18	0.8	0.31	0.7	0.16
	Sept-22	7.45	709	0.55	0.7	0.02	0.3	0.04
MW3	Aug-21	7.59	745	3.61	1.4	<0.01	0.8	0.21
	Sept-22	7.64	663	3.79	3.2	0.02	1.3	0.23
MW4	Aug-21	7.47	1798	1.64	1.5	0.02	1.2	0.19
	Sept-22	7.71	1377	0.85	3.2	0.07	3.2	0.41
MW5	Aug-21	7.25	1690	2.07	3.1	<0.01	1.0	0.09
	Sept-22	7.39	1485	1.45	1.8	0.05	1.1	0.30

3.11 Climate change

A review of Coastal Risk Australia (NGIS 2022) indicated that the lower southern portion of the site that contains a floodway is predicted to become inundated by a further 0.84 m under the highest tide event by 2100 (See **Plate 2**). This predicted inundation scenario is classed as high risk with a medium confidence. Given the potential for further sea level rise of 0.84 m, the flood height of the adjacent floodway has the potential to be 2.49 m AHD.

In response to the sea level rising projections, the City have developed a draft adaptation plan to accommodate for the potential coastal inundation impact of a 0.2% AEP storm event (which is equivalent to a 1:500 year average recurrence interval (ARI)). The adaptation plan is detailed within the document Coastal hazard Risk Management and Adaptation Plan (CHRMAP) (COB 2021) and provides coastal development planning requirements that need to be implemented in future development.

Local Water Management Strategy

Lots 4 & 12 Caves Road, Abbey



Plate 2: Prediction inundation scenario – High (medium confidence) (NGIS 2022)

The planning response to mitigate inundation risk of future development within the Abbey region is to establish a minimum finished floor level (FFL) of 3.0 m AHD. The northern portion of the site is located within the City's 2120 coastal erosion hazard line within the Abbey Coastal Management Area, therefore triggering the minimum FFL of dwellings to be 3.0 m AHD. Based on the breach modelling undertaken by JDA (see location BXS5) there would be a significant increase in flood heights within the BNRS if there was to be a levy breach (via overtopping in a 1% AEP event). However, the resulting flood depths would remain within the mapping flood fringe and floodway of the BNRS found within the site and so would not present a risk to proposed lot levels.

3.12 Summary of existing environment

In summary, environmental investigations undertaken during the LWMMS indicate that:

- Historically the site has been used for general agricultural purposes (i.e. cattle grazing) and in minor part for commercial operations (i.e. ice factory and fresh food market).
- The majority of the site has now been cleared leaving small pockets of native vegetation remaining.
- The mean annual rainfall is 807 mm, with the heaviest rainfall months occurring between May and August.
- Topography of the site ranges from 2 m AHD within the southern portion of the site to 3 m AHD in the northern and south-eastern portion of the site, with the exception of a depression within the southern portion of the site, which has elevations of approximately 1 m AHD.
- The site is split between two soil type systems; the northern/upper part of the site is within the Quindalup South System, whilst the southern/lower portion of the site is mapped as occurring within the Vasse System.
- The installation of monitoring bores across the site described the subsurface conditions beneath the site as mostly sand to depths up to 5 m BGL to 7 m BGL. The presence of clay starts to become more prominent in the deeper soil profile closer to BNRS. Sandy clay was found

Local Water Management Strategy

Lots 4 & 12 Caves Road, Abbey



- extending to depths between 3 m BGL to 4 m BGL, further overlying clay and rock extending to depths of approximately 5 m BGL.
- The northern two-thirds of the site is mapped as having a 'moderate to low' risk of ASS occurring within 3 m of the natural soil surface, whilst the southern third of the site (which approximately aligns with areas identified as a wetland feature) is mapped as a 'high to moderate' risk of ASS occurring within 3 m of the natural soil surface.
 - The site is located within an SSA (feature type 'E' and 'F') due to being within 2 km of coastal embankments and within 1 km of significant wetlands, respectively.
 - The remaining native vegetation onsite includes individual paddock trees, predominantly Agonis flexuosa (peppermint), Eucalyptus rudis in lower lying areas or planted eucalypts.
 - Four MUWs have been identified within the site.
 - A floodway and flood fringe area is located within the lower south-western portion of the site, which is connected to the BNRS, located approximately 100 m south of the site.
 - Flood mapping of the BNRS indicates that the 1% AEP flood elevation at the southern end of the site is 1.65 m AHD.
 - According to coastal risk inundation mapping, the floodway and flood fringe within the site are predicted to undergo further inundation of 0.84 m under the highest tide in 2100, resulting in a future flood elevation of up to 2.49 m AHD.
 - Results from the pre-development surface runoff modelling of the site indicate that the 1% AEP peak flow rate leaving the site along the southern boundary is 1.1 m³/s, and that the total volume discharging from the site in this same event being 3,082 m³.
 - The annual winter peak groundwater level was recorded between August 2021 to October 2021 and ranged between 1.19 m BGL to 1.54 m BGL. The MGL beneath the site therefore ranges from 2.1 m AHD along the eastern boundary to 1.5 m AHD in the south eastern corner of the site.
 - Analysis of groundwater quality samples collected in August 2021 and September 2022 found that TP ranged between 0.04 mg/L to 0.64 mg/L and TN ranged between 0.7 mg/L to 3.2 mg/L. It is noted that the nutrient concentrations recorded are not inconsistent with what would be expected for historical agricultural land in the region.

Local Water Management Strategy

Lots 4 & 12 Caves Road, Abbey



4 Design Criteria and Objectives

This section outlines the objectives and design criteria that this LWMS and future water management plans must achieve. The water management strategy includes water conservation, surface water management and groundwater management.

4.1 Integrated water cycle management

The State Water Strategy (Government of WA 2003) and BUWM (WAPC 2008) endorses integrated water cycle management and application of WSUD principles to provide improvements in the management of surface water, and to increase the efficient use of other existing water supplies. The key principles of integrated water cycle management include:

- Considering all water sources, including wastewater, surface water and groundwater.
- Integrating water and land use planning.
- Allocating and using water sustainably and equitably.
- Integrating water use with natural water processes.
- Adopting a whole catchment integration of natural resource use and management.

Integrated water cycle management addresses not only physical and environmental aspects of water resource use and planning, but also integrates other social and economic concerns. Water management design objectives should therefore seek to deliver best practice outcomes in terms of:

- Water conservation/consumption
- Surface water management
- Groundwater management.

The first step in applying integrated water cycle management is to establish agreed environmental values for receiving environments. The existing environmental context of the site has been discussed in **Section 3**. Guidance regarding environmental values and criteria is provided by a number of National and State policies and guidelines, as well as previous studies relevant to the site. These were detailed in **Section 1.4** and **Section 1.5**, respectively.

4.2 Water conservation

This LWMS proposes the following water conservation criteria:

Criteria WC1 Utilise fit-for-purpose water sources throughout the development.

Criteria WC2 POS to be irrigated at no more than 7,500 KL/ha/year

The manner in which the above objectives will be achieved is further detailed in **Section 5**.

Local Water Management Strategy

Lots 4 & 12 Caves Road, Abbey



4.3 Stormwater management

This LWMMS proposes the following stormwater design criteria:

Criteria SW1 Manage runoff from the small rainfall event (i.e. first 15 mm) within the site at source or as close as practically possible.

Criteria SW2 Ensure the major rainfall event (1% AEP) peak flow rates and volumes do not exceed the pre-development environment.

Criteria SW3 Finished floor levels must be a minimum of 3.0 m AHD (to meet coastal process requirements) and at least 500 mm above the adjacent 1% AEP flood level.

Criteria SW4 Finished floor levels must have at least 500 mm clearance above the major event top water levels (TWLs) in onsite retention and detention structures.

Criteria SW5 Reduce nutrient loads by applying appropriate non-structural measures.

The manner in which these objectives will be achieved is further detailed in **Section 6**.

4.4 Groundwater management

This LWMMS proposes the following groundwater management criteria:

Criteria GW1 The invert level of drainage basins must have a minimum of 300 mm clearance above the maximum groundwater level.

Criteria GW2 Provide adequate consideration for future sea level rise and the influence it will have on groundwater levels beneath the site

Criteria GW3 Minimise the risk of nutrient enrichment to downstream surface water bodies from groundwater sources.

The manner in which these objectives will be achieved is further detailed in **Section 7**.

Local Water Management Strategy

Lots 4 & 12 Caves Road, Abbey



5 Water Conservation Strategy

5.1 Fit-for-purpose water use

To minimise the use of water, a fit-for-purpose supply and the conservation of water via adoption of best management approaches is strongly encouraged.

The measures outlined below will assist in achieving **Criteria WC1** and **WC2**.

5.1.1 Scheme water

Scheme water within the CoB is currently supplied by Busselton water. The site is proposed to be connected to the local reticulated potable water supply (i.e. scheme water).

5.1.2 Groundwater

The site may require some measure of irrigation of POS area during establishment of vegetation and/or water may be required to facilitate earthworks at the site. The site is however capable of being developed to a high standard even without a permanent water supply due to the extensive retained trees and floodway areas that remain green through all seasons. The CoB has confirmed that a requirement of 5,000 m² of turfed area is to be delivered within the development which will require the use of groundwater for irrigation. Currently there is no groundwater allocation held by the proponent for irrigation, however if an allocation becomes available and attained, a trade partner provided an irrigation supply, or the deeper Sue Coal Measures were accessible these would provide an appropriate source of non-potable water for irrigation. It is expected that the proponent will secure a suitable source of water for irrigation prior to conditional subdivision approval.

5.1.3 Rainwater tanks

Harvested rainwater can be used in lots for some irrigation requirements however this will need to be supplemented with scheme water during the lower rainfall months. During the higher rainfall months, the majority of the harvested rainwater could be used to supplement internal building non-potable uses. This water efficiency strategy recommends that rainwater tanks are implemented and that the harvested water is used in washing machines, toilets and hot water systems. It is not mandatory to install rainwater tanks and uptake rates are expected to be consistent with typical uptake rates in the region.

5.2 Water Conservation measures

The development will utilise water wise garden (WWG) principles for lot scale gardens and estate landscaping. Water efficient fixtures and appliances (WEFA) are important approaches to ensure that lot water use is minimised. These measures are further discussed in the following Sections.

5.2.1 Water efficient fixtures and appliances

Significant reductions in in-house water uses can be achieved with the use of WEFA and the water conservation strategy recommends that all dwellings use WEFA. Water efficient fittings will be

Local Water Management Strategy

Lots 4 & 12 Caves Road, Abbey



implemented by the lot owner during building construction, while uptake of water efficient appliances can be encouraged by the proponent through provision of educational materials at point of sale. Examples of educational material are provided in **Appendix C**.

The above measures will assist in achieving **Criteria WC1**.

5.2.2 Water wise gardens

Reductions in water use for irrigation by employing water efficiency measures can significantly reduce the total water usage. The following water efficiency measures will be used/promoted:

- Retain as many remnant native trees and vegetation as practical.
- Landscape planting to occur during the winter months (i.e. May to August), where the rainfall can supplement establishment.
- The planting species palette will adopt local native waterwise species, adapted to the seasonal changes and tolerant against dry months with little to no rainfall.
- If utilised, irrigation should not occur during winter months.
- Where required, soil to be improved with soil conditioner certified to Australian Standard AS4454 to a minimum depth of 150 mm if turf is to be planted and a minimum depth of 300 mm for garden beds.
- Implementation of hydrozoning design practices, which will group plant species with similar/equivalent water requirements.
- The adoption of xeriscaped gardens (garden beds are landscaped using 'waterwise plants') where possible.
- Street trees to be mulched to 75 mm with a product certified to Australian Standard AS4454.
- Community awareness of water conservation will be promoted at the point of sale and during the development sales lifestan.

WWG principles will be utilised within POS, road reserves and where relevant within lots. Permanent irrigation of POS areas is not currently proposed, however it is recognised that some selective irrigation of POS may be required if rainfall proves to be insufficient and/or during establishment. If this were the case, water would be imported via water cart and hand watering would be undertaken. Uptake of WWG practices for lot landscaping will be encouraged by the proponent at the point of sale of lots through the provision of educational material (see examples provided in **Appendix C**).

Whilst a permanent source of water has not at this stage been sourced, investigations are underway to obtain a suitable allocation. It is anticipated that the Landscape Strategy (contained in **Appendix D**) will be updated to present the required 5,000 m² of turfed area within the site.

The above measures will assist in achieving **Criteria WC1**.

Local Water Management Strategy

Lots 4 & 12 Caves Road, Abbey



5.3 Wastewater management

The site is proposed to be connected to the reticulated wastewater network servicing the surrounding area.

5.4 Water conservation criteria compliance summary

A summary of the proposed water conservation design criteria and how these will be addressed within the site is provided in **Table 3**.

Table 3: Water conservation compliance summary

Criteria number	Criteria description	Manner in which compliance will be achieved
WC1	Utilise fit-for-purpose water sources throughout the development.	<p>There is currently no ongoing permanent irrigation proposed for the site, unless a groundwater allocation can be secured. The development will utilise WWG principles for lot scale gardens and estate landscaping. Water efficient fittings will be implemented by the lot owner during building construction, while uptake of water efficient appliances can be encouraged by the proponent through provision of educational materials at point of sale.</p> <p>Residential lots will be connected to the local reticulated potable water supply that is supplied by Busselton Water.</p> <p>Rainwater tanks may be adopted by residents to meet some lot scale non-potable needs</p> <p>Installation of water efficient fittings and appliances within residential lots.</p> <p>Adoption of WWG practices by lot owners.</p> <p>Adoption of native waterwise species adapted to seasonal changes</p> <p>Education regarding water conservation provided to lot purchasers</p>
WC2	POS to be irrigated at no more than 7,500KL/ha/year	<p>During the temporary period of vegetation establishment, WWG measures will be implemented to ensure that no more than 7,500 KL/ha/year is used for irrigation.</p>

Local Water Management Strategy

Lots 4 & 12 Caves Road, Abbey



6 Stormwater Management Strategy

The principle behind the stormwater management strategy is to ensure that the pre-development 1% AEP peak flow rate and volume discharging offsite is not exceeded post-development. This will be achieved by ensuring runoff up to the 1% AEP rainfall event is detained within the site and/or treated as close to source as possible. Runoff which exceeds the capacity of BRAs will be directed to FSAs to infiltrate onsite or to be discharged offsite at the southern boundary and at a flow rate which mimics the existing hydrology.

The stormwater management approach that is proposed for the site is discussed in the following sections. Water management infrastructure proposed includes:

- Pit and pipe network within road reserves
- Flush kerbing
- Vegetated swales
- BRA
- FSA.

Detailed hydrological and hydraulic modelling using XPSWM has been completed to determine the required size of stormwater management infrastructure. The assumptions/methodology for this is detailed in the Modelling Assumptions Report (MAR) provided in **Appendix B** and discussed further in the following sections.

6.1 Lot drainage

Given the large size of lots (500 - 600 m²) and sandy soils, all residential lots will adopt soakwells to cater for the small rainfall events (first 15 mm). Lots will also have sufficient permeable area (through garden areas) to facilitate infiltration within lots. This is possible due to the high permeability of the sandy soils underlying the majority of the site and/or sand fill that will be imported to achieve the required finished floor levels, which will have a high capacity to infiltrate runoff.

In order to address the potential that lots are able to adequately manage the minor (20% AEP) and major (1% AEP) rainfall event, lot retention assumptions were modified so that the front 20% of lots (which includes driveway, paths, and garden areas) direct runoff towards estate drainage (i.e. swales, BRA, and FSA). The balance of the lot (remaining 80%) was considered to be fully retained based on the previously discussed large lot assumptions. The results of the above assumptions are presented in this LWMs.

6.2 Development drainage

6.2.1 Road drainage network

A traditional pit and pipe network will collect runoff from road reserves/pavement. The piped drainage network will be designed to convey runoff from up to the 20% AEP event to downstream BRAs and FSAs, where eventually stormwater will infiltrate or discharge offsite. The road drainage

Local Water Management Strategy

Lots 4 & 12 Caves Road, Abbey



network may also incorporate flush kerbing where BRAs and/or roadside swales are adjacent to road pavement.

6.2.2 Vegetated swales

Roadside swales will be provided for those catchments that do not contain a POS area that could contain a BRA or FSA. These swales will be located within road reserve and will provide water quality treatment for small rainfall events (i.e. the first 15mm - see **Table 4**) and retention for runoff up to the 1% AEP event (see **Table 8**). Road reserves will be graded for runoff to be directed to either a pipe network and/or into swales via flush kerbing, where water quality treatment and infiltration up to the 1% AEP event will occur. The drainage network may also include local portions of road pavement directed to the roadside swales via flush kerbing or kerb breaks, reducing the need for a concrete piped network. Swales will typically be up to 6 m wide, have 1:6 side slopes, and have a maximum depth up to 500 mm. All road reserves where swales are proposed will be wide enough to accommodate the proposed swales.

Discharge from swales for runoff up to 1% AEP event may occur in some (southern) areas of the site, where these catchments have been identified as having a pre-development outflow. In the event runoff is discharged off site, it will be directed towards the southern boundary that will discharge at a rate not exceeding the pre-development peak flow rate and volume. This would occur via weir structure or similar and via overland flow.

A vegetated conveyance swale will be located within the central POS area running through the middle of the site to collect runoff from the BRAs and FSA from contributing catchments that naturally discharge southwards and offsite to the BNRS.

Swales will be vegetated using plant species with high nutrient uptake capacities and low water requirements, consistent with the Vegetation guidelines for stormwater biofilters in the South West of Western Australia (Monash University 2014). They will be underlain with a soil suitable for water quality treatment (which may include an engineered or amended soil mixture) for nutrient removal purposes. It is also acceptable to utilise existing soils where these can be demonstrated to provide an appropriate permeability and nutrient removal function.

Swales will assist in achieving **Criteria SW1, SW2 and SW5**.

6.2.3 Bio-retention areas

Runoff from the small rainfall event not retained higher in catchments will be conveyed and treated within vegetated BRAs, located within a downstream POS area. BRAs have been sized to treat the small rainfall event (i.e. first 15 mm) from the road reserve. They will provide water quality treatment by removing fine sediments, trace metals, nutrients, bacteria and organics. Design characteristics of BRAs include:

- Vegetated with native nutrient removing plant species
- 1:3 side slopes
- 500 mm depth
- Underlain by 500 mm of soil suitable for water quality treatment.

Local Water Management Strategy

Lots 4 & 12 Caves Road, Abbey



It is noted that, if side slopes of BRAs/FSAs were to be greater than 1:3, that fencing of these areas must be considered. BRAs will be planted with native vegetation to encourage biological nutrient uptake, consistent with the Vegetation guidelines for stormwater biofilters in the south-west of Western Australia (Monash University 2014). As per vegetated swales, they will also be underlain with soil media that has a high phosphorous retention index (PRI) (PRI > 10) or equivalent to increase nutrient removal from runoff during infiltration. It is also acceptable to utilise existing soils where these can be demonstrated to provide an appropriate permeability and nutrient removal function.

BRAs are not designed to be permanently wet. Instead, stormwater will infiltrate into the underlying soil medium, or will overland flow to the adjacent FSA. If required, subsoil drains may also be utilised beneath the BRAs to ensure they can dry out in an acceptable time between storm events, however the conceptual approach developed for lot levels and the recorded MGL indicate that there will be sufficient clearance between MGL and BRA inverts (see **Section 6.3.1**).

The size and spatial requirements for BRAs are shown in **Table 4** and location of BRAs are shown in **Figure 8**. The BRAs have also been strategically located to allow for the retention of as many remnant native trees as possible. BRAs will assist in achieving **Criteria SW1, SW3 and SW5**.

6.2.4 Flood storage areas

Surface runoff from impervious road pavement up to the major (1% AEP) event are to be retained within FSAs, thereby maintaining the pre-development hydrological regime (for the northern part of the site there is no site discharge and runoff is therefore infiltrated onsite).

FSAs will be designed according to the following parameters:

- 1:6 side slopes
- Maximum depth of 1.2 m
- Minimum 500 mm clearance from MGL
- Finished floor levels of adjacent lots will be 500 mm above the 1% AEP event top water level.

Further geotechnical investigations are required to be undertaken within the site, and this will include the proposed locations of BRAs/FSAs/swales. The retention of remnant native trees will also be taken into consideration when selecting the ultimate location of FSAs. The measured infiltration rate will need inform the final BRA/FSA designs.

The use of FSAs will assist in achieving **Criteria SW2 and SW4**.

6.2.5 Existing retained floodway

As discussed in **Section 3.9**, a floodway and flood fringe is located in the southern portion of the site and is proposed to be retained and integrated within the southern POS area.

The floodway will become inundated as a result of intermittent stormwater entering the system, both from the site and possibly from the BNRS in major flood events. The retention of this floodway will also provide conveyance and maintain hydraulic connectivity to southern BNRS.

A clearance of at least 500 mm will be maintained between inverts of the FSAs and maximum flood levels to ensure they are able to infiltrate and provide appropriate drainage. The design lot levels

Local Water Management Strategy

Lots 4 & 12 Caves Road, Abbey



adjacent to the floodway will be such that FFLs of adjacent lots will be at least 500 mm above the maximum flood level of the BNRS (i.e. 1.65 m AHD) to ensure protection from flooding during major rainfall events.

Providing appropriate vertical clearance of finished floor levels above top water levels in infiltration basins and the 1% AEP flood levels of the BNRS will assist in achieving **Criteria SW3** and **SW4**.

6.3 Stormwater management design

The stormwater management plan, which shows the location of water management features is shown on **Figure 8**, and this has been designed to achieve the objectives and criteria stated in

Section 6. Two landscape concept plans are provided in **Appendix D**, demonstrating the manner in which water management features has been incorporated and the amenity that will be achieved depending on whether POS will be irrigated or non-irrigated. Surface runoff modelling undertaken using XPSWMM has been used to inform the design of stormwater infrastructure with modelling assumptions and methodology provided in **Appendix B**.

6.3.1 Small rainfall event

Runoff from the road reserve will be conveyed to either a vegetated swale or BRA for water quality treatment of the small (first 15 mm) rainfall event. The size and spatial requirements of water quality treatment assets are presented in **Table 4**, and inundation resulting from the small event is shown in **Figure 9**.

Table 4: Small event (first 15 mm) treatment requirements

Catchment	POS no.	Treatment structure	Depth (m)	TWL surface area (m ²)	Volume (m ³)
Ct-01	-	Swale-01	0.05	333	15
Ct-02	-	Swale-02	0.05	393	17
Ct-03	POS-1	BRA-03	0.50	136	52
Ct-04	-	Swale-04	0.05	293	14
Ct-05	-	Swale-05	0.06	186	11
Ct-06	POS-2	BRA-06	0.50	147	57
Ct-07	-	Swale-07	0.08	104	8
Ct-08	POS-5	BRA-08	0.50	325	135
Ct-09	POS-4	BRA-09	0.50	365	155
Ct-10	POS-3	BRA-10	0.50	318	135
Ct-11	-	Swale-11	0.21	378	70
Ct-12	-	Swale-12	0.08	166	13
Ct-13 A	POS-3	BRA-13A	0.50	90	35
Ct-13 B	POS-3	BRA-13B	0.50	115	45

Local Water Management Strategy

Lots 4 & 12 Caves Road, Abbey



6.3.2 Flood storage

Runoff from all events greater than the small event will be managed within FSAs or swales located across the site. The proposed locations of these features are shown in **Figure 8** and the storage requirements which will assist in achieving **Criteria SW2, SW3, SW4, and SW5**. The volumes, top water levels and areas in response to a 20% AEP and 1% AEP events are provided in **Table 5**. Inundation resulting from the minor and major events is shown in **Figure 10** and **Figure 11**, respectively.

Table 5: Stormwater flood storage requirements from the minor (20% AEP) and major (1% AEP) event.

Catchment and storage type	POS no.	Minor storm event			Major storm event		
		Depth (m)	TWL surface area (m ²)	Volume (m ³)	Depth (m)	TWL surface area (m ²)	Volume (m ³)
Ct-01 Swale	-	0.22	411	78	0.50	560	215
Ct-02 Swale	-	0.19	462	76	0.50	638	248
Ct-03 FSA	POS-1	0.41	294	107	1.20	623	399
Ct-04 Swale	-	0.21	361	65	0.50	507	192
Ct-05 Swale	-	0.21	236	41	0.50	330	115
Ct-06 FSA	POS-2	0.51	296	104	1.20	644	417
Ct-07 Swale	-	0.26	151	30	0.50	231	76
Ct-08 FSA	POS-5	0.51	317	112	1.20	685	450
Ct-09 FSA	POS-4	0.50	452	170	0.9	880	625
Ct-10 FSA	POS-3	0.59	513	217	0.90	696	405
Ct-11 Swale	-	0.50	495	190	-	-	-
Ct-12 Swale	-	0.25	222	45	0.50	320	112

To ensure infrastructure and assets are adequately protected against potential flooding events and/or breaches of the BMD levee (as discussed in **Section 1.5.1**) all FFLs will be provided a 500 mm clearance from the TWL of adjacent WSUD structures. In some cases, in order to achieve the required minimum FFL, permeable sand fill will need to be imported. As shown in **Table 6**, the minimum clearance is 500 mm, achieving **Criteria SW3** and **SW4**.

Table 6: Summary of clearances between storage structure 1% AEP TWLs and the FFL of adjacent lots.

Storage structure	POS no.	Invert (m AHD)	1% AEP TWL (m AHD)	Minimum FFL (m AHD)	Clearance (m) between TWL and FFL
Ct-01 Swale	-	2.00	2.50	3.00	500
Ct-02 Swale	-	2.15	2.65	3.15	500
Ct-03 FSA	POS-1	1.90	3.10	3.60	500
Ct-04 Swale	-	2.00	2.50	3.00	500

Local Water Management Strategy

Lots 4 & 12 Caves Road, Abbey



Table 7: Summary of clearances between storage structure 1% AEP TWLs and the FFL of adjacent lots (continued).

Storage structure	POS no.	Invert (m AHD)	1% AEP TWL (m AHD)	Minimum FFL (m AHD)	Clearance (m) between TWL and FFL
Ct-05 Swale	-	2.20	2.70	3.20	500
Ct-06 FSA	POS-2	2.20	3.40	3.90	500
Ct-07 Swale	-	2.35	2.85	3.35	500
Ct-08 FSA	POS-5	1.98	3.18	3.68	500
Ct-09 FSA	POS-4	2.02	2.92	3.42	500
Ct-10 BRA	POS-3	2.00	2.50	3.00	500
Ct-10 FSA	POS-3	1.80	2.70	3.20	500
Ct-11 Swale	-	2.00	2.50	3.00	500
Ct-12 Swale		2.15	2.65	3.15	500
Ct-13A BRA	POS-3	2.00	2.50	3.00	500
Ct-13B BRA	POS-3	2.00	2.50	3.00	500

6.3.2.1 Imported fill

Imported fill will likely be utilised to achieve the minimum FFL required to facilitate appropriate vertical separation from major event flood levels in BRAs and FSAs. The specification for fill and proposed depths will likely also be influenced by the desired geotechnical classification, which is yet to be determined. Imported fill should aim to achieve a permeability of 5 m/day. Where a lower permeability specification of fill is adopted consideration of this should be made within surface runoff modelling, fill depth assumptions and any other aspects relying on infiltration.

Considerations for the use of imported fill beneath infiltration structures has not been made as these soils will not be underlying these structures. Soils used beneath these structures is detailed in **Section 6.2.3.**

6.3.3 Maintaining pre-development peak flow rates

As mentioned in **Section 3.9.2**, the pre-development peak flow rate and volume discharging offsite in a 1% AEP event is 1.1 m³/s and 3,082 m³, respectively. In order to avoid exceeding this flow rate and volume, whilst also considering any potential breaches of the BMD that could result in increased flood levels, the conceptual drainage design involves the retention of upstream catchments within FSAs. The retention of the 1% AEP event in upstream catchments ensures that those catchments contributing to discharge offsite will not exceed the pre-development hydrology and lessen the potential impact to the southern floodway in the event of a potential BMD breach.

The catchments that discharge the minor and major event offsite are Ct-10, Ct-11, Ct-13A, and Ct-13B (shown in **Figure 8**, along with catchments that are proposed to retain up to the 1% AEP event). The surface runoff modelling indicates that the post-development 1% AEP peak flow rate and volume leaving the site via the southern conveyance swale is 0.97 m³/s and 2,525 m³, respectively (see **Table**

Local Water Management Strategy

Lots 4 & 12 Caves Road, Abbey



8). which is slightly less than the pre-development hydrology. The detailed methodology and catchment analysis for the surface runoff modelling is outlined in the modelling assumptions report provided in **Appendix B**.

Table 8: Summary of surface runoff modelling for minor and major peak flow rates and volumes.

Outflow location	20% AEP peak discharge (m ³ /s)		1% AEP peak discharge (m ³ /s)		1% AEP peak volume (m ³)	
	Pre-development	Post-development	Pre-development	Post-development	Pre-development	Post-development
Outflow-01	0.33	0.12	1.1	0.72	3,082	2,545
Outflow-02		0.07		0.25		
Total	0.33	0.19	1.1	0.97	3,082	2,545

It is possible that the future design approach and storage volumes could be refined and outflow rates and volumes increase up to the pre-development peak flow rates and volumes, however at this stage the lower peak outflow rate and volume allows for future design evolution in a manner which can mitigate the risk of increases to the land area required for flood retention and detention.

On this basis, **Criteria SW2** is achieved.

6.4 Non-structural stormwater management measures

A number of non-structural measures will be implemented across the site to help reduce nutrient loads within stormwater runoff. These measures include:

- Minimising fertiliser use to establish and maintain vegetation within BRAs, POS, swales, and road verges.
- Use of drought tolerant species that require minimal water and nutrients.
- Street sweeping.
- Maintenance of BRAs, FSAs, swales and the pipe network to remove sediments and other pollutants.
- Education of residents regarding fertiliser use and nutrient absorbing vegetation species within lots. Examples of educational materials are provided in **Appendix C**.

The above measures will assist in achieving **Criteria SW4**.

6.5 Stormwater design criteria compliance

A summary of the proposed stormwater management design criteria and how these will be addressed within the development is provided in **Table 9**.

Local Water Management Strategy

Lots 4 & 12 Caves Road, Abbey



Table 9: Stormwater management compliance summary

Criteria number	Criteria description	Manner in which compliance will be achieved
SW1	Manage runoff from the small rainfall event (i.e. first 15 mm) within the site at source or as close as practicably possible.	<p>Lots will retain the first 15 mm of rainfall within pervious garden areas.</p> <p>Runoff from the road reserve and POS will be retained and treated within vegetated BRAs and swales. Treatment will occur via vegetation and the underlying soil profile which will adsorb nutrients and pollutants prior to reaching groundwater.</p>
SW2	Ensure the major rainfall event (1% AEP) peak flow rates and volumes do not exceed the pre-development environment.	<p>The major storm (1% AEP) event will be detained and infiltrate onsite and runoff from road reserves and POS will be retained in FSAs and swales. Part of the runoff generated across the site will be conveyed and discharged offsite along the southern boundary to ensure pre-development hydrology is not exceeded.</p> <p>The pre-development peak flow rate and volume exiting the site is 1.1 m³/s and 3,082 m³ has not been exceeded, and post-development modelling shows the peak flow rate and volume is 0.97 m³/s and 2,545 m³, respectively.</p>
SW3	Finished floor levels must be a minimum of 2.7 m AHD (to meet coastal process requirements) or at least 500 mm above adjacent the 1% AEP flood level.	<p>In accordance with the 'Coastal Hazard Risk Management and Adaption Plan' (CoB 2021), all dwellings will achieve a FFL of 3.0 m AHD or at least 500 mm above the 1% AEP flood level, as shown in Table 6.</p>
SW4	Finished lot levels must have at least 500 mm clearance above the major event top water levels (TWLs) in onsite retention and detention structures.	<p>All residential lots adjacent to retention and detention structures will provide a minimum of 500 mm clearance from the TWL. As shown in Table 6, the minimum clearance achieves this criteria.</p> <p>Future civil designs to support UWNMPs will confirm that lots will have sufficient clearance (> 500 mm) to major event TWLs within BRAs, FSAs and swales.</p>
SW5	Reduce nutrient loads by applying appropriate non-structural measures.	<p>The following measures will reduce nutrients and treat stormwater runoff prior to discharge offsite:</p> <ul style="list-style-type: none"> • Construction stage measures (e.g. silt fences, other temporary measures). • Landscaping will adopt waterwise planting practices that will reduce the amount of fertiliser required. • Education of lot owners regarding fertiliser use and waterwise gardening practices. • Street sweeping will occur to prevent sediments entering swales and BRAs. • The swales and BRAs will be vegetated and underlain by a 300 mm to 500 mm layer of soil suitable for nutrient removal. • Maintenance of nutrient stripping vegetation and removal of sediments within swales and BRAs.

Local Water Management Strategy

Lots 4 & 12 Caves Road, Abbey



7 Groundwater Management

Groundwater management at the site will incorporate measures relating to both levels and quality, as discussed in the following sections.

7.1 Groundwater level management

As discussed in Section **3.10.2**, the MGL is a minimum of 1.19 m below the natural surface for the majority of the site, therefore clearance to groundwater is not a significant site constraint. However, in the event of a potential BMD levee breach or future sea level rising occurring, to ensure the protection of the drainage infrastructure, the inverts of storage basins are assumed to achieve a minimum of 300 mm clearance to existing MGLs across the site. **Table 10** demonstrates that this will be achieved within all storage structures.

Table 10: Summary of clearances between the MGL and invert of storage structures

Catchment	MGL (mAHD)	Minimum invert (mAHD)	Clearance (mm)
Ct-01 Swale	1.55	2.00	450
Ct-02 Swale	1.85	2.15	300
Ct-03 FSA	1.60	1.90	300
Ct-04 Swale	1.65	2.00	350
Ct-05 Swale	1.90	2.20	300
Ct-06 FSA	1.90	2.20	300
Ct-07 Swale	2.05	2.35	300
Ct-08 FSA	1.68	1.98	300
Ct-09 FSA	1.72	2.02	300
Ct-10 BRA	1.59	2.00	410
Ct-10 FSA	1.50	1.80	300
Ct-11 Swale	1.50	2.00	500
Ct-12 Swale	1.85	2.15	300
Ct-13A BRA	1.62	2.00	380
Ct13B BRA	1.59	2.00	410

The potential for groundwater to rise post-development in response to future sea level rise has been considered, and a conservative approach has been taken to design stormwater Infrastructure (e.g. FSAs are assumed to be 1.2 m deep). A conservative approach has been proposed for the placement and depths of stormwater infrastructure and clearance to groundwater for the site. If additional clearance to groundwater is required, this will likely be achieved by raising the FFL of lots which can be considered for the structure plan during the later detailed design phase. Whilst not required to meet current design assumptions, subsoil drains can also potentially be used at the base of BRAs to ensure these dry out in an acceptable timeframe and between storm events. These could be

Local Water Management Strategy

Lots 4 & 12 Caves Road, Abbey



retrofitted if required in the future to respond to changing conditions. If subsoils are required, subsoil drains will require free draining outlets to ensure they remain free draining.

7.2 Groundwater quality management

As discussed in **Section 3.10.3**, baseline groundwater quality data has been collected from beneath the site. The overall objective is to maintain or improve the quality of groundwater beneath the site. This will firstly be achieved by the change in landuse (from agricultural use to residential), thereby reducing the total nutrient loads infiltrating into the soil profile.

The adoption of a WSUD approach within stormwater infrastructure and WWG approach to landscaping, will result in an improvement to water quality being discharged from the site.

As discussed in **Section 6.2**, the proposed stormwater quality treatment infrastructure may include a combination of structural (e.g. BRAs, swales) and non-structural measures (e.g. vegetation, soil media) to manage surface water quality on site. Retention of small event runoff will provide treatment of stormwater runoff through interaction with vegetation and soils prior to infiltration. Non-structural measures (detailed in **Section 6.4**) will similarly reduce the nutrient loading into the underlying groundwater.

Groundwater quality will be maintained or improved via the following:

- Lot scale landscape design and management to minimise/avoid the application of nutrients.
- Minimal to no fertiliser use to establish and maintain vegetation within open space areas.
- Appropriate treatment of small rainfall event runoff.

7.3 Groundwater design criteria compliance

A summary of the proposed groundwater design criteria and how these are addressed within the development area is provided in **Table 11**.

Table 11: Groundwater management compliance summary

Criteria number	Criteria description	Manner in which compliance will be achieved
GW1	The invert level of drainage basins must have a minimum of 300 mm clearance above the or maximum groundwater level.	Drainage basins will be designed to ensure the invert level provides a minimum of 300 mm clearance from the underlying MGL.
GW2	Provide adequate consideration for the future sea level rise and the influence it may have on the groundwater levels beneath the site.	The inverts of basins and swales have been designed to provide a 300 mm clearance from the MGL. This will provide adequate protection from potential sea level rises influencing the rise of groundwater levels. Where appropriate subsoils can be provided to facilitate the free drainage.
GW3	Minimise the risk of nutrient enrichment to downstream surface water bodies from groundwater sources.	Change in landuse from agricultural to residential will reduce the total nutrient loads infiltrating into the underlying groundwater. Infiltration via BRAs and vegetated swales will also provide treatment via filtration and adsorption of pollutants/nutrients.

Local Water Management Strategy

Lots 4 & 12 Caves Road, Abbey



8 Subdivision and Urban Water Management Plans

The requirement to undertake preparation of more detailed water management plans to support subdivision is generally imposed as a condition of subdivision. The development of any future UWMMP should follow the guidance provided in Urban Water Management Plans: Guidelines for Preparing Plans and for Complying with Subdivision Conditions (Dow 2008).

While strategies have been provided within this LWMS that address planning for water management, it is a logical progression that future subdivision designs and the supportive UWMMP will clarify details not provided within the LWMS. The main areas that will require further clarification within the future UWMMP include:

- Implementation of water conservation strategies
- Modelling and configuration of the drainage structures
- Non-structural water quality improvement measures
- Construction period management strategy
- Management and maintenance requirements
- Floodway management.

These are further detailed in the following sections.

8.1 Implementation of water conservation strategies

A number of potential measures to conserve water have been presented within this LWMS (see **Section 5**). These water conservation strategies will be incorporated into the design and the ongoing maintenance of POS. Landscape design measures that will be incorporated into the water conservation strategy will be further detailed within the future UWMMP.

It is expected that where any temporary irrigation for establishment is proposed, the future UWMMP will demonstrate that an adequate water source has been obtained to meet irrigation requirements.

The manner in which the developer intends to promote water conservation measures discussed in this LWMS to future lot owners will also be discussed within the future UWMMP.

8.2 Modelling and configuration of drainage structures

The design of the drainage system to date has been undertaken at an appropriate level for local structure planning and surface runoff modelling of the stormwater drainage system will be reviewed once detailed drainage design has commenced.

It is acknowledged that the drainage strategies documented in this LWMS are based upon broad-scale assumptions. These assumptions are considered adequate for development of treatment and drainage structures and are of an appropriate level of detail. However, if the site layout is refined then verification of proposed subdivision drainage designs will be undertaken by modelling the catchments serviced by the drainage network. Such modelling will allow verification that the development undertaken within the structure planning area is consistent with this LWMS. This would also likely include allowing the peak flow rate to be increased up to the 1.1 m³/s identified by pre-

Local Water Management Strategy

Lots 4 & 12 Caves Road, Abbey



development modelling. It is anticipated that this will occur during the subdivision design process and detailed within the future UWMMP.

The exact location and shape of stormwater management assets will therefore need to be specified and presented within the future UWMMP.

8.3 Non-structural water quality improvement measures

Guidance for the development and implementation of non-structural water quality improvement measures is provided within the Stormwater Management Manual for Western Australia (DOW 2007b). Some measures will be more appropriately implemented at a local government level, such as street sweeping, however many can be implemented relatively easily within the design and maintenance of the subdivision.

It is expected that the future UWMMP will provide reference to measures such as public education (through measures such as signage that may be implemented to raise awareness).

8.4 Construction period management strategy

It is anticipated that the construction stage will require some management of various aspects (e.g. dust, surface runoff, noise, traffic etc.). The management measures undertaken for construction management will be addressed either in the future UWMMP or a separate Construction Management Plan (CMP).

8.5 Management and maintenance requirements

The management measures to be implemented to address surface water quality (BRAs and swales) will require ongoing maintenance. It is therefore expected that future UWMMPs will provide detailed management and maintenance plans that will set out maintenance actions (e.g. gross pollutant removal), timing (e.g. how often it will occur), locations (e.g. exactly where it will occur) and responsibilities (e.g. who will be responsible for carrying out the actions). Given that approval from COB will be sought for the proposed measures, it is anticipated that consultation with these agencies will be undertaken and referral to guiding policies and documents will be made.

8.6 Floodway management

Given the presence of the floodway area and likely expectations on function and amenity, it is expected that the management requirements and design considerations for the floodway will need to be appropriately documented. Any relevant aspects from the proposed approach to managing the floodway will need to be considered during detailed design process. This may include consideration of placement WSUD assets, vegetative planting and access for maintenance.

These management and design considerations (i.e. those relevant to water management) will be included in the future UWMMP.

Local Water Management Strategy

Lots 4 & 12 Caves Road, Abbey



9 Monitoring

9.1 Pre-development monitoring

The pre-development monitoring of groundwater levels and quality data collected by Emerge Associates in 2021 (see **Section 3.10**) is being supplemented by additional monitoring during winter 2022. The completed groundwater monitoring will be used to inform concept civil and landscape designs and further refine guideline values discussed in **Section 3.10.2**. Any additional monitoring data undertaken prior to the future UWMPs and detailed civil design process will be used to further refine/inform (if necessary) the civil and landscape designs and will be reported on in the UWMP.

9.2 Post-development monitoring

9.2.1 Condition monitoring

The overall condition of the development will be monitored on a bi-annual basis from completion of the civil and landscaping works, if required by CoB. A visual assessment will be undertaken to monitor the overall condition of the development, with the aim to ascertain that the maintenance activities (which will be detailed in the future UWMP as described in **Section 8**) are achieving the overall management objectives for the development. Additional considerations should be given to the monitoring of flood levels within the BNRS for potential impacts to local infrastructure (i.e. bike paths and walkways) to ensure that the amenity of these assets is maintained. The parameters that will be monitored include:

- Gross pollutants
- Terrestrial weeds
- Vegetation density
- Paths, benches, walkways and other infrastructure.

The management and maintenance objectives will be detailed within the future UWMP along with details of the corresponding monitoring program. Condition monitoring will continue for a period of two years to ensure that the development is in a satisfactory condition at a point of management handover of POS to the CoB.

9.2.2 Groundwater monitoring

The pre-development monitoring bore locations (shown in **Figure 6**) will be retained where possible or be reinstalled on site and used within post-development monitoring to provide direct comparison, if required by CoB. It may be appropriate for some bore locations to be moved to facilitate the intended monitoring (e.g. where bores will be located within private lots these would not be retained or reinstated).

Post-development groundwater quality monitoring will be carried out to ensure that the proposed WSD measures, mentioned in **Section 6.2**, are working effectively. Groundwater bores should be located at the upstream and downstream ends of at least one representative POS area containing a BRA. The bores should be monitored quarterly for a period of two years from practical completion of

Local Water Management Strategy

Lots 4 & 12 Caves Road, Abbey



the BRAs and swales to provide an upstream/downstream comparison. The monitoring program is summarised in **Table 12**.

Table 12: Groundwater monitoring program summary

Monitoring Type	Locations	Frequency	Parameters	Length of monitoring
Groundwater	Existing bores (where possible to retain), bores upstream and downstream of on representative POS area	Quarterly (typically Jan, April, July, Oct).	In situ pH, EC, temperature. Sample TSS, TN, TKN, NH ₄ , NOX, TP, FRP	From landscape completion to handover (minimum 2 years) Duration of works and 2 years post-completion of final stage

9.3 Post-development guideline values

Groundwater quality trigger values for the site have been derived in consideration of the pre-development monitoring (see **Section 3.10.3**) and the National Water Quality Management Strategy (Australian Government 2018) guideline values. While trigger values have been defined in **Table 13**, the water quality data over the site is varied and guideline values are considered to be dynamic and should be reviewed regularly and in consideration of any additional data obtained.

Table 13: Water quality monitoring trigger values

Analyte	Short-term groundwater quality guideline values	Long-term groundwater quality guideline values
TN as N (mg/L)	3.2	1.2
TP as P (mg/L)	0.21	0.065

9.4 Reporting

A post-development monitoring report will be prepared on conclusion of the two-year monitoring period, and will be made available to the City on request.

Local Water Management Strategy

Lots 4 & 12 Caves Road, Abbey



10 Implementation

The LWMS is a key supportive document for the LSP. The development of the LWMS has been undertaken with the intention of providing a structure within which subsequent development can occur consistent with an integrated water cycle management approach. It is also intended to provide overall guidance to the general stormwater management principles for the area and to guide the development of the future UWMP.

10.1 Roles and responsibility

The LWMS provides a framework that the proponent can utilise to assist in establishing stormwater management methods that have been based upon the existing environment, are consistent with relevant State and Local Government policies and have been endorsed by the CoB. The responsibility for working within the framework established within the LWMS rests with the developer, although it is anticipated that the future UWMP will be developed in consultation with the CoB and DWER and in consideration of other relevant policies and documents.

10.2 Funding

The cost of implementing the management strategies outlined in this LWMS will be borne solely by the proponent, with the exception of lot scale measures, which will be borne by the lot purchaser.

10.3 Review

It is not anticipated that this LWMS will be reviewed, unless the development undergoes significant change post-lodgement of the LWMS. If the development is substantially modified, surface runoff modelling undertaken for this LWMS will need to be reviewed and the criteria proposed revised to ensure that all are still appropriate.

The following stage of development is subdivision, and it is likely that a condition of subdivision approval will be to prepare a UWMP. **Section 8** discusses water management aspects that should be reviewed/revised at UWMP stage.

The next stage of development following the UWMP is single lot or multiple dwelling developments. It is recognised that certain elements of the LWMS and the UWMP will not be implemented until this late stage, and that there is little or no statutory control that can be applied to ensure the implementation of any remaining measures. While the remaining measures are unlikely to be enforced at this stage their implementation could be encouraged by the CoB through policy (or modification of these where necessary), building licence or awareness programs (such as the Busselton Water Waterwise Irrigation Garden Program).

Local Water Management Strategy

Lots 4 & 12 Caves Road, Abbey



11 References

11.1 General references

The references listed below have been considered as part of preparing this document.

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Local Water Management Strategy

Lots 4 & 12 Caves Road, Abbey



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- Western Australian Planning Commission (WAPC) 2013, State Planning Policy No. 2.6 State Coastal Planning Policy Perth.

11.2 Online references

The online resources that have been utilised in the preparation of this report are referenced in **Section 11.1**, with access date information provided in **Table R1**.

Local Water Management Strategy

Lots 4 & 12 Caves Road, Abbey



Table R 1 Access dates for online references

Reference	Date accessed	Website or dataset name
(BoM 2022)	14 April 2022	Bureau of Meteorology
(NGIS 2022)	19 April 2022	Coastal Risk Australia
(Landgate 2022)	14 April 2022	Landgate Map Viewer
(DBCA 2022b)	14 April 2022	NatureMap
(DPIRD 2019)	14 April 2022	Soil Landscape Mapping
(DWER 2022b)	19 April 2022	Western Australia Floodplain Mapping

Local Water Management Strategy

Lots 4 & 12 Caves Road, Abbey



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Figures



Figure 1: Site Locality

Figure 2: Topography

Figure 3: Soil Landscape Mapping

Figure 4: Acid Sulfate Soil Mapping

Figure 5: Sewage Sensitive Area

Figure 6: Existing Hydrological Features

Figure 7: Geomorphic Wetlands

Figure 8: Stormwater Management Plan

Figure 9: Inundation Plan: First 15 mm

Figure 10: Inundation Plan: 20% AEP event

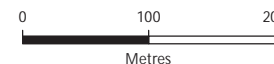
Figure 11: Inundation Plan: 1% AEP event



Figure 1: Site Locality

Project: Local Water Management Strategy
 Lot 4 and 12 Caves Road, Abbey
Client: Landowner Group

Plan Number:
 EP20-141(03)-F17
Drawn: WJC
Date: 15/06/2022
Checked: AJJ
Approved: DPC
Date: 21/07/2022



Scale: 1:6,000@A4
 GDA 1994 MGA Zone 50

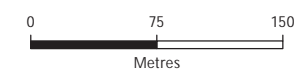




Figure 2: Topography

Project: Local Water Management Strategy
 Lot 4 and 12 Caves Road, Abbey
 Client: Landowner Group

Plan Number:
 EP20-141(03)-F18a
 Drawn: WJC
 Date: 16/06/2022
 Checked: AJJ
 Approved: DPC
 Date: 20/12/2022



Scale: 1:4,500@A4
 GDA 1994 MGA Zone 50



While Emerge Associates makes every attempt to ensure the accuracy and completeness of data, Emerge accepts no responsibility for externally sourced data used
 ©Landgate (2021). Nearmap Imagery date: 06/04/2022

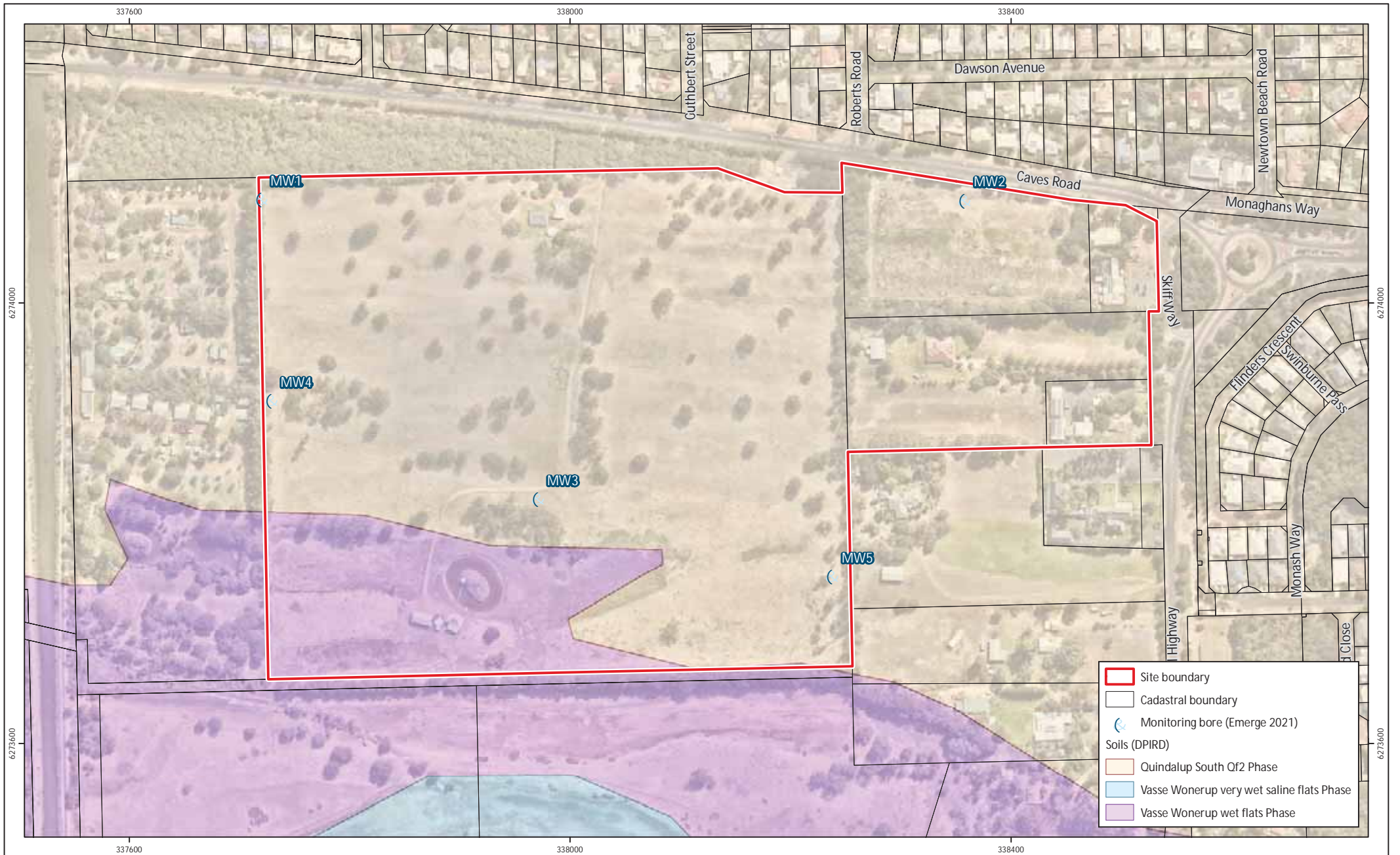
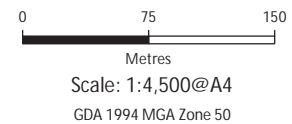


Figure 3: Soil Landscape Mapping

Project: Local Water Management Strategy
 Lot 4 and 12 Caves Road, Abbey
Client: Landowner Group

Plan Number:
 EP20-141(03)-F19
Drawn: WJC
Date: 15/06/2022
Checked: AJJ
Approved: DPC
Date: 21/07/2022



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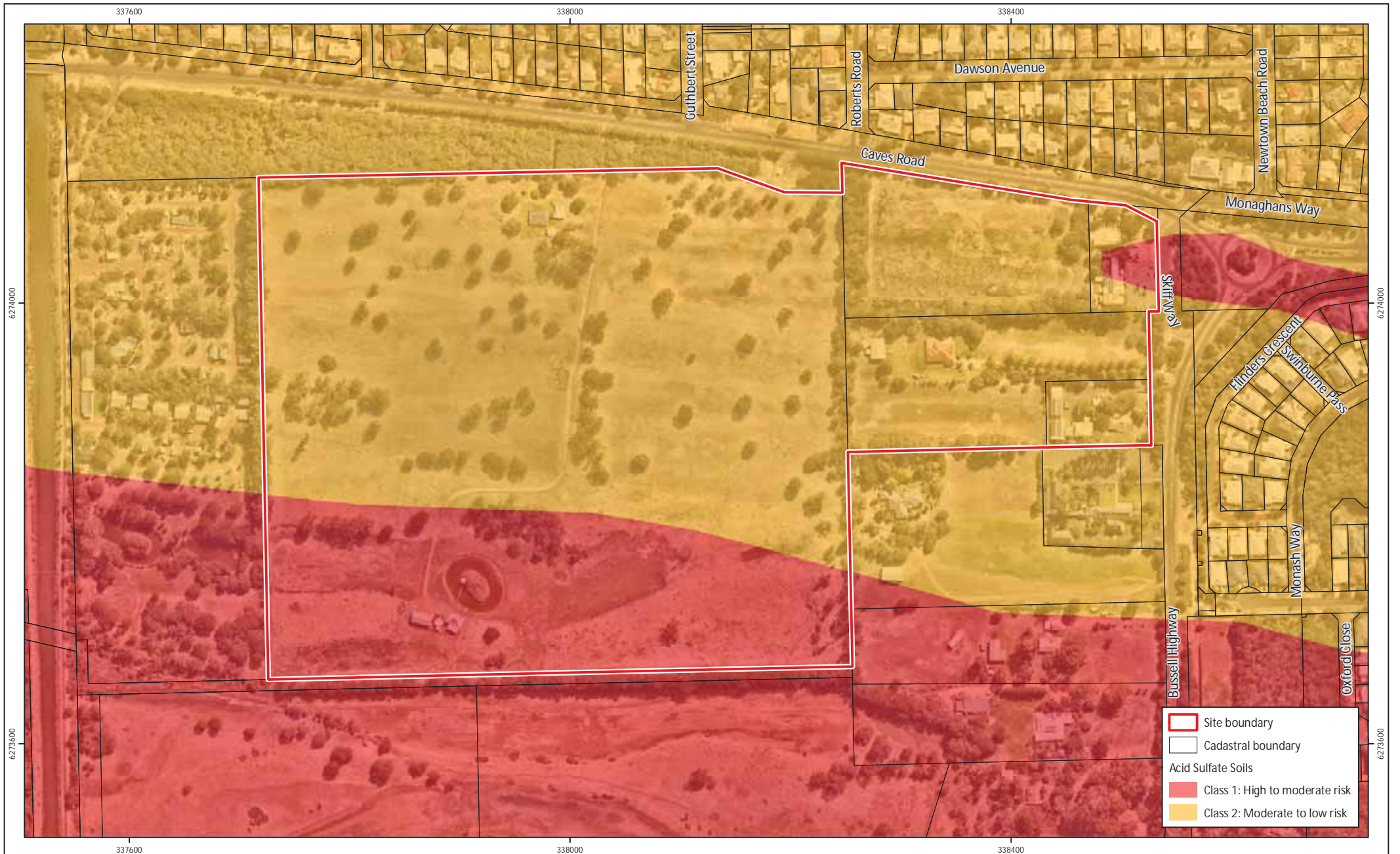
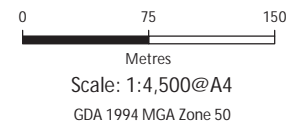
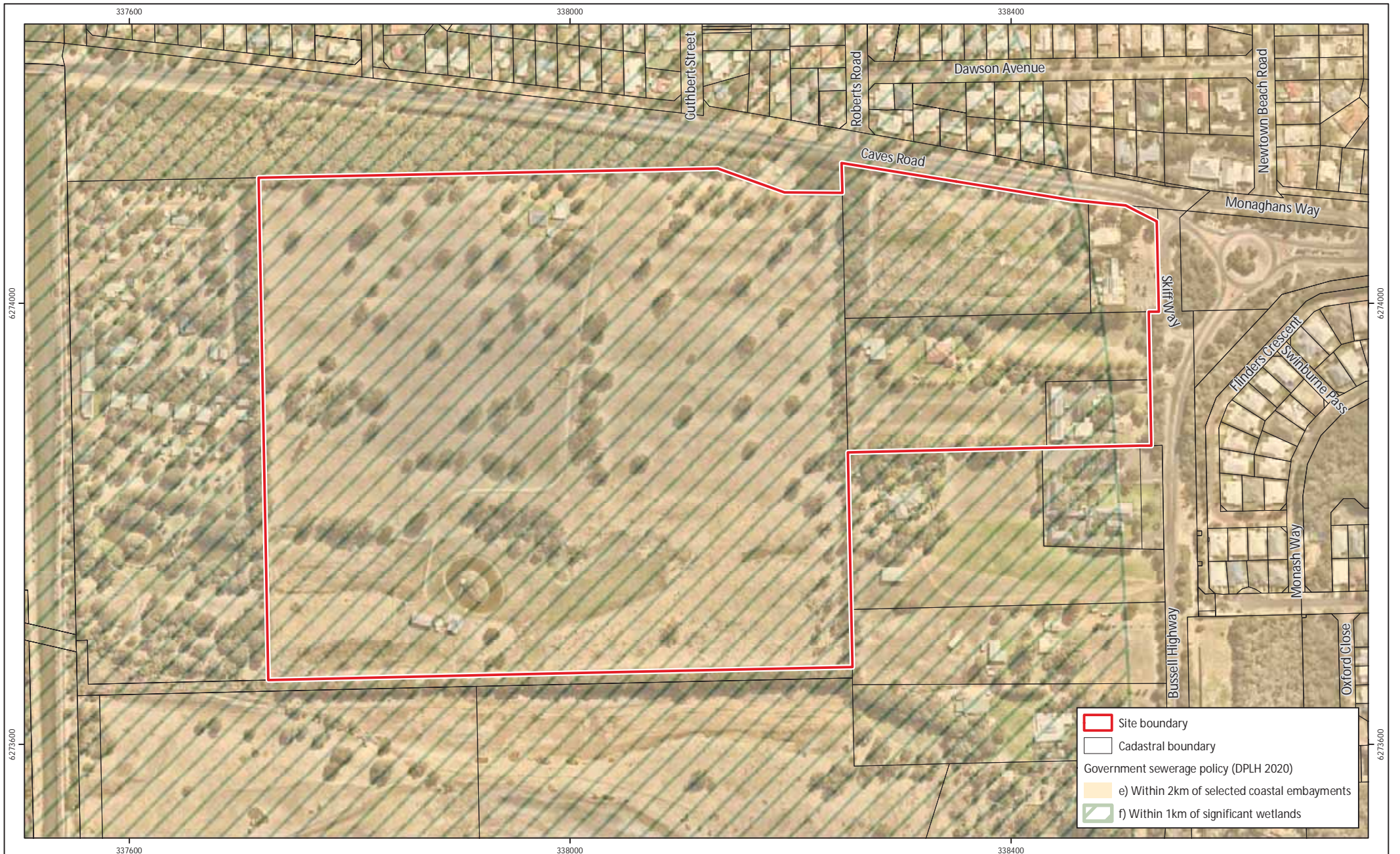


Figure 4: Acid Sulfate Soil Mapping

Project: Local Water Management Strategy
 Lot 4 and 12 Caves Road, Abbey
Client: Landowner Group

Plan Number:
 EP20-141(03)--F20
Drawn: WJC
Date: 15/06/2022
Checked: AJJ
Approved: DPC
Date: 21/07/2022



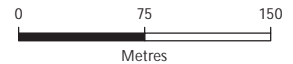


Site boundary
 Cadastral boundary
 Government sewerage policy (DPLH 2020)
 e) Within 2km of selected coastal embayments
 f) Within 1km of significant wetlands

Figure 5: Sewage Sensitive Areas

Project: Local Water Management Strategy
 Lot 4 and 12 Caves Road, Abbey
Client: Landowner Group

Plan Number:
 EP20-141(03)--F21
Drawn: WJC
Date: 15/06/2022
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Scale: 1:4,500@A4
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Figure 6: Existing Hydrological Features

Project: Local Water Management Strategy
 Lot 4 and 12 Caves Road, Abbey
Client: Landowner Group

Plan Number:
 EP20-141(03)-F22
Drawn: WJC
Date: 16/06/2022
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Approved: DPC
Date: 21/07/2022



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 GDA 1994 MGA Zone 50

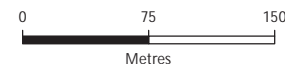




Figure 7: Geomorphic Wetlands

Project: Local Water Management Strategy
 Lot 4 and 12 Caves Road, Abbey
Client: Landowner Group

Plan Number:
 EP20-141(03)--F23
Drawn: WJC
Date: 15/06/2022
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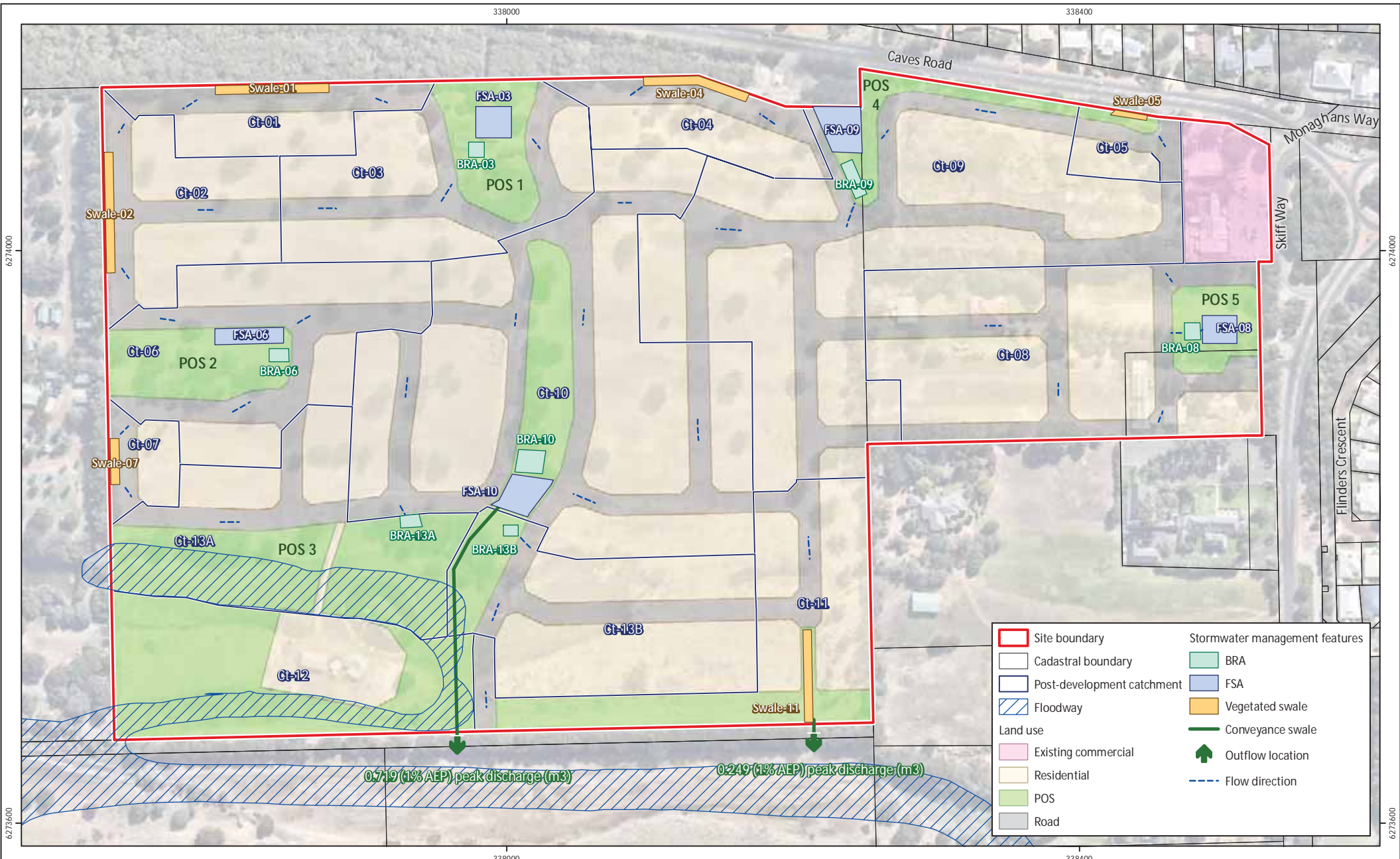
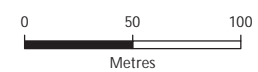


Figure 8: Stormwater Management Plan

Project: Local Water Management Strategy
 Lot 4 and 12 Caves Road, Abbey
Client: Landowner Group

Plan Number:
 EP20-141(03)--F24c
Drawn: WJC
Date: 12/06/2024
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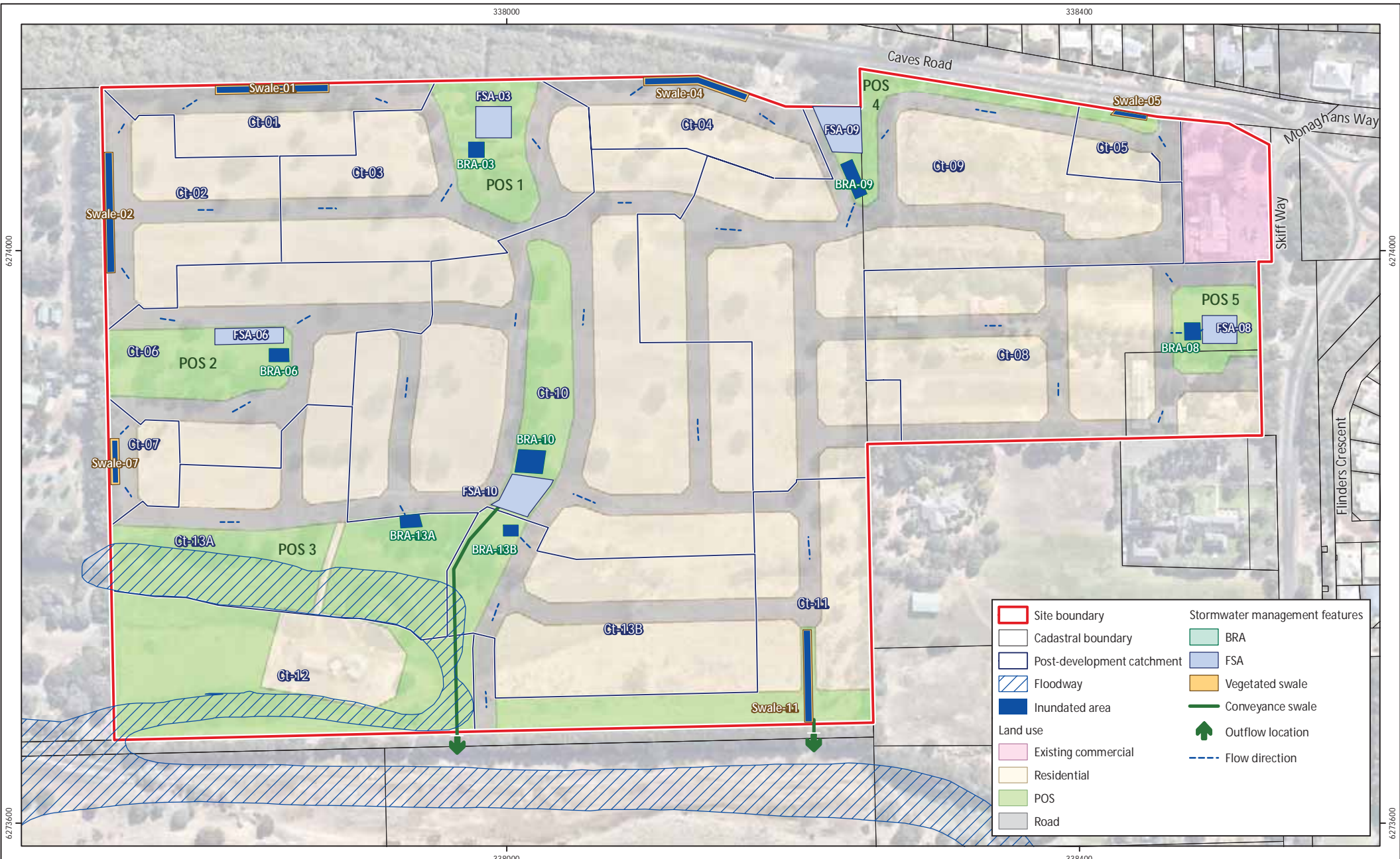
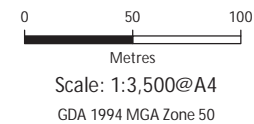


Figure 9: Inundation Plan - First 15mm

Project: Local Water Management Strategy
 Lot 4 and 12 Caves Road, Abbey
Client: Landowner Group

Plan Number:
 EP20-141(03)--F25c
Drawn: WJC
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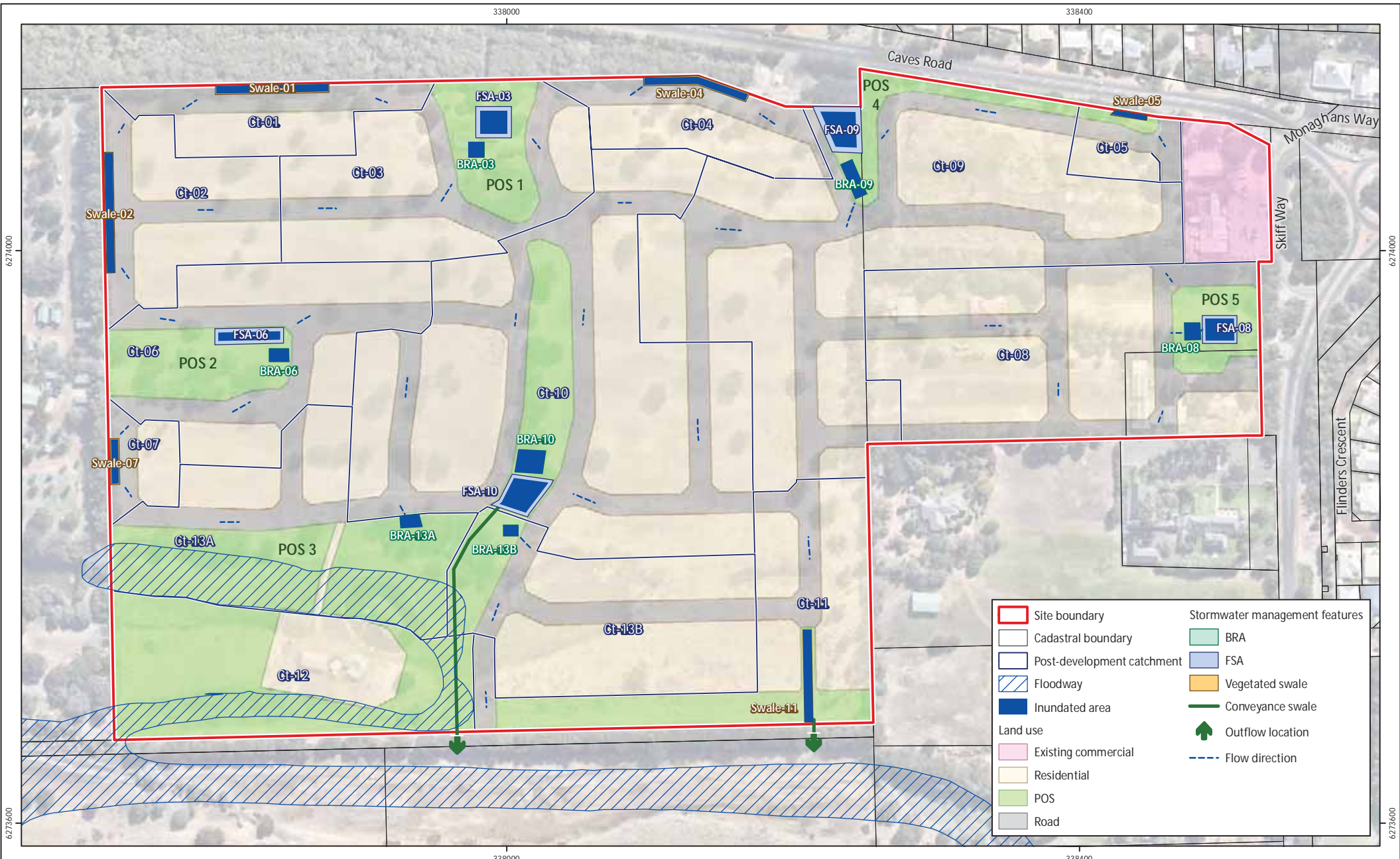
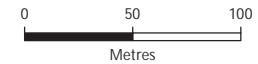


Figure 10: Inundation Plan - 20% AEP Event

Project: Local Water Management Strategy
 Lot 4 and 12 Caves Road, Abbey
 Client: Landowner Group

Plan Number:
 EP20-141(03)--F26c
 Drawn: WJC
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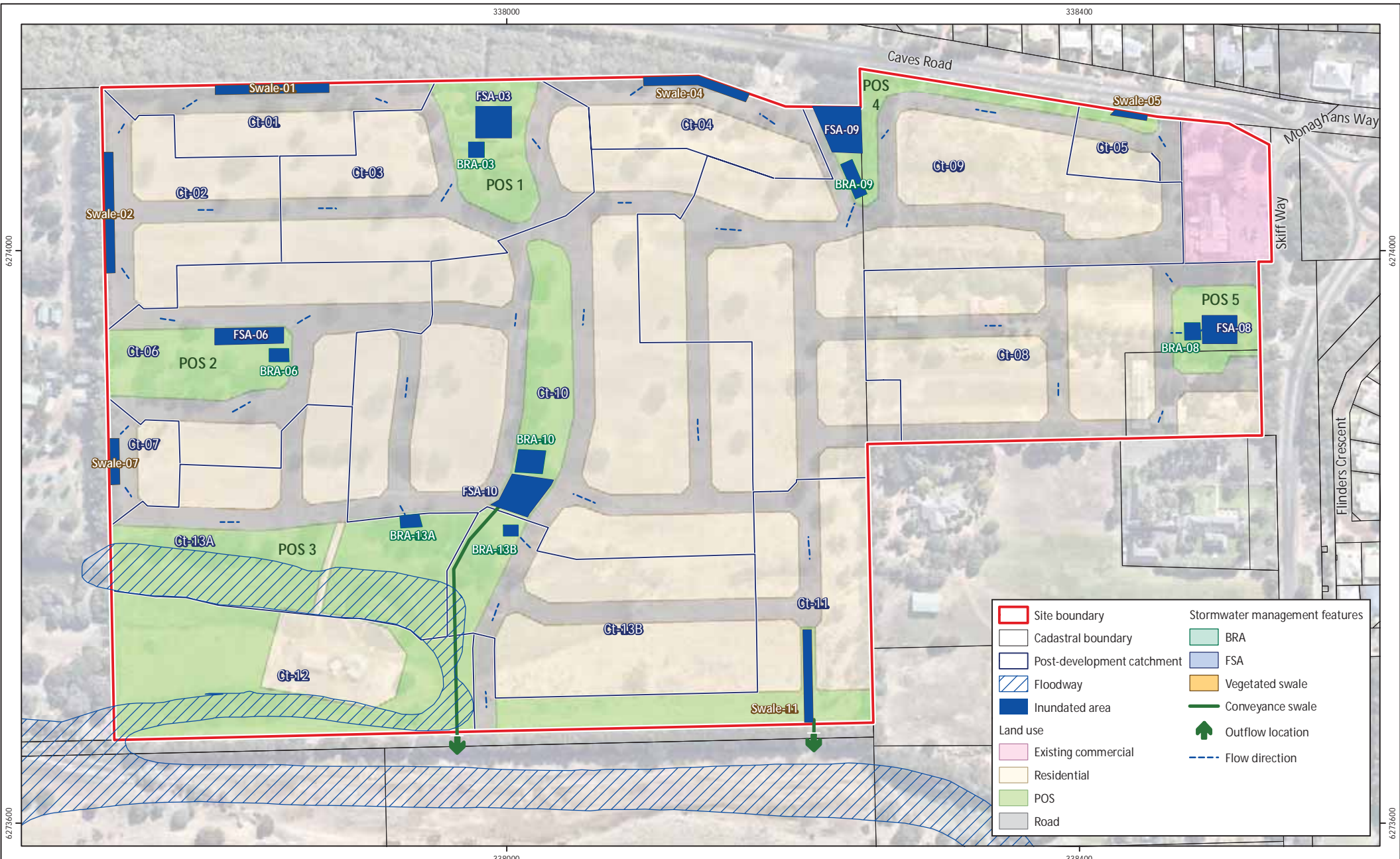
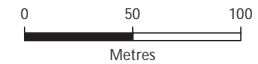


Figure 11: Inundation Plan - 1% AEP Event

Project: Local Water Management Strategy
 Lot 4 and 12 Caves Road, Abbey
 Client: Landowner Group

Plan Number:
 EP20-141(03)--F27c
 Drawn: WJC
 Date: 12/06/2024
 Checked: UH
 Approved: DPC
 Date: 12/06/2024



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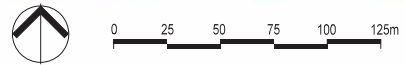
Appendix A

Local Structure Plan – Rise Urban





ABBEY PLANNING INVESTIGATION AREA - CONCEPT PLAN
 LOTS 4 & 12 CAVES ROAD & LOTS 14, 15 & 402 BUSSELL HIGHWAY, ABBEY.



NOTE:
 Base Data supplied by Landgate / Denada Surveys
 Aerial Photo - Jan 2023
 Areas and dimensions shown are subject to final survey calculations.

Revision	Date	Item
A	7/05/21	Initial Issue

LEGEND
 SUBJECT LOT BOUNDARY
 ROAD RESERVE WIDTH

- : CLIENT
 A3@1:2,500 / A1@1:1,250 : SCALE
 7 May 2024 : DATE
 IA Abbey-1-020 : PLAN No
 A : REVISION
 C.L. : PLANNER
 B.L. : DRAWN



Appendix B

Modelling Assumptions Report – Emerge Associates



Abbey South Structure Plan Area

Modelling Assumptions Report

Project No: EP20-141(03)

Prepared for the Abbey Landowners Group
June 2024

Abbey South Structure Plan Area

Modelling Assumptions Report



Document Control

Doc name:		Abbey South Structure Plan Area Modelling Assumptions Report			
Doc no.:		EP20-141(03)—013B All			
Version	Date	Author	Reviewer		
1	July 2022	April Irwin	All	Dave Coremans	DPC
	Prepared to support the LWMS				
A	December 2022	April Irwin	All	Dave Coremans	DPC
	Prepared to support the LWMS				
B	June 2024	Ben Brash	BPB	Dave Coremans	DPC
	Prepared to support the LWMS				

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Abbey South Structure Plan Area

Modelling Assumptions Report



Table of Contents

1	Background.....	1
2	Methodology.....	2
2.1	Rainfall	2
3	Pre development model	3
3.1	Pre-development model	3
3.2	Discharge.....	3
4	Post-development model.....	4
5	References	6
5.1	General references.....	6
5.2	Online references.....	6

List of Tables

Table 1:	Pre-development parameters.....	3
Table 2:	Pre-development catchment areas (ha)	3
Table 3:	Pre-development discharges	3
Table 4:	Post-development parameters.....	4
Table 5:	Post-development catchment areas (ha)	4

Abbey South Structure Plan Area

Modelling Assumptions Report



1 Background

This report provides a summary of the detailed hydrological and hydraulic modelling that was undertaken to inform the Abbey South Structure Plan Area local water management strategy (LWMS). The LWMS details the drainage design for the residential development located on Lot 4 & Lot 12 Caves Road & Lots 14, 15 & 402 Bussell Highway, Abbey.

The site covers approximately 30.5 ha and is bound by Caves Road to the north, Bussell Highway to the east, an RAC holiday park to the west and existing agricultural areas to the south.

Abbey South Structure Plan Area Modelling Assumptions Report



2 Methodology

XPSWMM hydrological and hydraulic modelling software was used to calculate the surface water runoff volumes. The hydrological component of the software uses the Laurenson non-linear runoff-routing method to simulate runoff from design storm events. Key assumptions regarding the hydrological model include:

- Runoff is proportional to slope, area, infiltration and percentage of imperviousness of a catchment.
- Sub-catchment areas and slopes are determined from surveyed topographical data and earthworks plans.
- Infiltration rates and percentage imperviousness have been selected based on experience with model preparation for similar soil conditions.

Runoff from each sub-catchment is routed through the catchment using the hydraulic component of XPSWMM. Generally, assumptions associated with the hydraulic component of the model include:

- Virtual links (i.e. purely for model construction, not equivalent to flow path onsite) between nodes within a sub-catchment are given the length of 10 m and slope of 0.05 to minimise the lag time of conveying the water from a sub-catchment node to a 'storage' node, a 'dummy intermediate' node or a conduit/link.
- Links between sub-catchment storages act as conveyance channels (e.g. sheet flow within roads in a 1% annual exceedance probability (AEP)). These links are given lengths and slopes that are representative of the site conditions and actual pathway lengths between catchments.
- All channels are designed with a width of 5 m, roughness of 0.02 (Manning's n) and are trapezoidal in shape. This allows for easy conveyance and represents concrete pipes and road surfaces within the model.
- Where relevant roadside swales, bio-retention areas (BRAs), and flood storage areas (FSAs) are modelled as nodal-reservoirs with infiltration depth-rating curves to account for differential infiltration rates with changing depth.

2.1 Rainfall

The ensemble temporal patterns obtained from the Australian Rainfall and Runoff (AR&R) Data Hub (AR&R 2019) were used for the rainfall analysis.

Up to eight durations ranging between 1 hour and 72 hours were tested, with the peak flood elevation being assessed as the determining result.

Following the process suggested by AR&R (Ball J et al. 2019), the highest mean duration was selected as the critical duration. AR&R also recommends that when it is not practical to run the entire ensemble array, the ensemble that produces the result closest to the mean (for the critical duration) should be adopted. The 1 hour duration ensemble 6 and the 3 hour duration ensemble 5 was adopted for the 1% AEP and 20% AEP events respectively. The post-development durations were either 3 or 6 hours and the ensembles were assigned depending on the storage location and type.

Abbey South Structure Plan Area

Modelling Assumptions Report



3 Pre development model

3.1 Pre-development model

Pre-development modelling was undertaken to determine the discharge from the site. An initial loss proportional loss model was adopted to account for catchment losses. Loss values, roughness and runoff coefficients were based on site conditions, as shown in **Table 1**. The northern portion of the site is assumed to be fully retained and does not contribute to discharge offsite. The pre-development catchments are shown in **Figure 1**.

Table 1: Pre-development parameters

Land type	Initial loss (mm)	Continuing loss	Manning's n
Sandy	25	2.5	0.035
Clayey	15	1.5	0.035

The pre-development catchment areas and land use types were digitised using aerial photography and these are shown in **Error!** Reference source not found..

Table 2: Pre-development catchment areas (ha)

Sub-catchment	Slope	Area (ha)
Ct-01	0.025	8.9
Ct-02	0.025	1.2

3.2 Discharge

The pre-development peak flow rate and volume leaving the site as determined by the XPSWMM model is summarised in **Table 3**.

Table 3: Pre-development discharges

AEP event	Discharge (m ³ /s)	Volume (m ³)
20% AEP	0.3	1,591
1% AEP	1.1	3,082

Abbey South Structure Plan Area Modelling Assumptions Report



4 Post-development model

An initial loss continuing loss model was adopted to account for post-development catchment losses. The post-development catchment area, land types and loss values were based on the structure plan design, typical infiltration rates for the soils which occur onsite and based on project team experience. Post-development catchment areas and land types within the site were informed by the structure plan provided by Rise Urban (catchments were slightly modified based on localised topography). **Table 4** summarises the loss parameters used within the post-development model.

Table 4: Post-development parameters

Land type	Initial loss (mm)	Continual loss (mm)	Roughness
Road Surface	1	0.1	0.02
Road Verge	9	1.5	0.05
Front of lot impervious	1	0.1	0.02
Front of lot pervious	25	2.5	0.02
POS	25	2.5	0.05

A summary of post-development catchment information is provided in **Table 5**. The assumption for lots is that back of lots and front of lot pervious areas will fully retain all runoff up to a 1% AEP event and not contribute to storage basins and swales or discharge offsite. The post-development catchment layout is shown in **Figure 2** and runoff storage locations are shown in **Figure 8** of the LWMMS (Emerge Associates 2024).

Table 5: Post-development catchment areas (ha)

Catchment	Slope	Road pavement	Road verge	POS
Ct-01	0.025	0.261	0.174	-
Ct-02	0.004	0.278	0.185	-
Ct-03	0.005	0.333	0.222	0.538
Ct-04	0.010	0.223	0.149	-
Ct-05	0.002	0.088	0.059	0.06
Ct-06	0.003	0.400	0.267	0.603
Ct-07	0.025	0.089	0.059	-
Ct-08	0.001	0.582	0.388	0.347
Ct-09	0.002	0.989	0.659	0.330
Ct-10	0.002	0.898	0.598	0.604
Ct-11	0.006	0.539	0.359	0.651
Ct-12	0.001	0.000	0.000	1.636
Ct-13a	0.006	0.215	0.143	1.422
Ct-13b	0.005	0.235	0.156	0.280

Abbey South Structure Plan Area

Modelling Assumptions Report



The following assumptions were incorporated into the model:

- Lots
 - Back of lots will retain the 1% AEP event on lot using soakwells and infiltration in pervious garden areas.
 - Front of lot impervious areas (driveways, footpath) will contribute to downstream stormwater assets.
 - Garden areas in lots (front and back) will have high infiltration rates as it is likely that sand-based landscape mix or mulch will be used.
- Road reserve
 - There will be no infiltration on roads and pavements. There will however be some minor absorption storage loss which is accounted for in the initial and continuing loss values.
 - Road reserve contains 60% pervious verge and 40% impervious bitumen areas.
- Basin catchments and POS
 - Basin catchment areas (basin footprint and contributing open space) are assumed to be 100% pervious.
 - Basin catchment areas will likely contain landscaped or remnant vegetation.
- Storage
 - BRAs retain runoff from events up to and including the frequent event (i.e. first 15 mm).
 - BRAs have 1:3 side slopes and maximum depth of 500 mm.
 - Swales have 1:6 side slopes and maximum depth of 500 mm.
 - FSAs have 1:6 side slopes and maximum depth of 1.2 m.
 - FSA-10 has 1:6 side slopes and maximum depth of 0.9 m.
 - FSAs and swales retain runoff from events up to and including the 1% AEP event.
- Infiltration
 - A hydraulic conductivity of 5 m/day is assumed.
 - BRAs will be vegetated and used for treatment; therefore a 50% clogging factor is applied.
 - Infiltration through the base area and side slopes of the FSAs are considered in the overall infiltration rating curve for these areas.
- Evapotranspiration
 - Volumes leaving the system through evapotranspiration were assumed to be negligible when compared to the total runoff volume and since the duration of the model run was comparatively short. XPSWMM default evapotranspiration assumptions are therefore used.

Abbey South Structure Plan Area Modelling Assumptions Report



5 References

5.1 General references

The references listed below have been considered as part of preparing this document.

Emerge Associates 2024, Abbey South Structure Plan Area: Local Water Management Strategy, EP20-141, Rev E.

5.2 Online references

Australian Rainfall and Runoff (AR&R) 2021, ARR Data Hub, viewed 1 December 2021, Available from: <<https://data.arr-software.org/>>.

Bureau of Meteorology (BoM) 2021a, Climate Data Online, viewed 1 December 2021, Available from, <<http://www.bom.gov.au/water/designRainfalls/revised-iftd/>>.

Bureau of Meteorology (BoM) 2021b, Design Rainfall Data System (2016), viewed 1 December 2021, Available from, <<http://www.bom.gov.au/water/designRainfalls/revised-iftd/>>.

Figures



Figure 1: Pre-development Catchments.

Figure 2: Post-development Catchments.

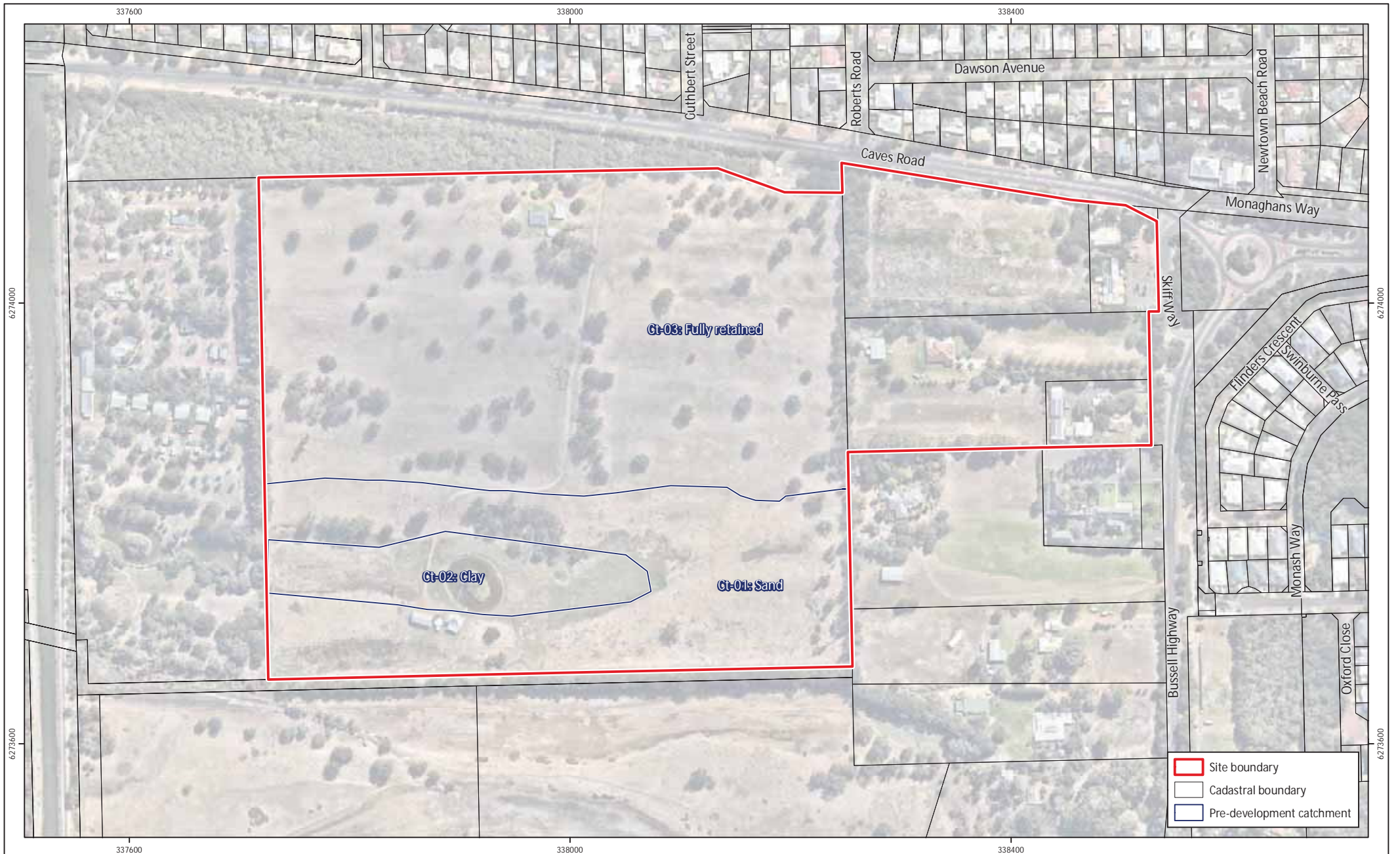


Figure 1: Pre-development Catchments

Project: Modelling Assumption Report
Abbey South Structure Plan Area
Client: Landowner Group

Plan Number:
EP20-141(03)--F28
Drawn: WJC
Date: 13/07/2022
Checked: AJJ
Approved: DPC
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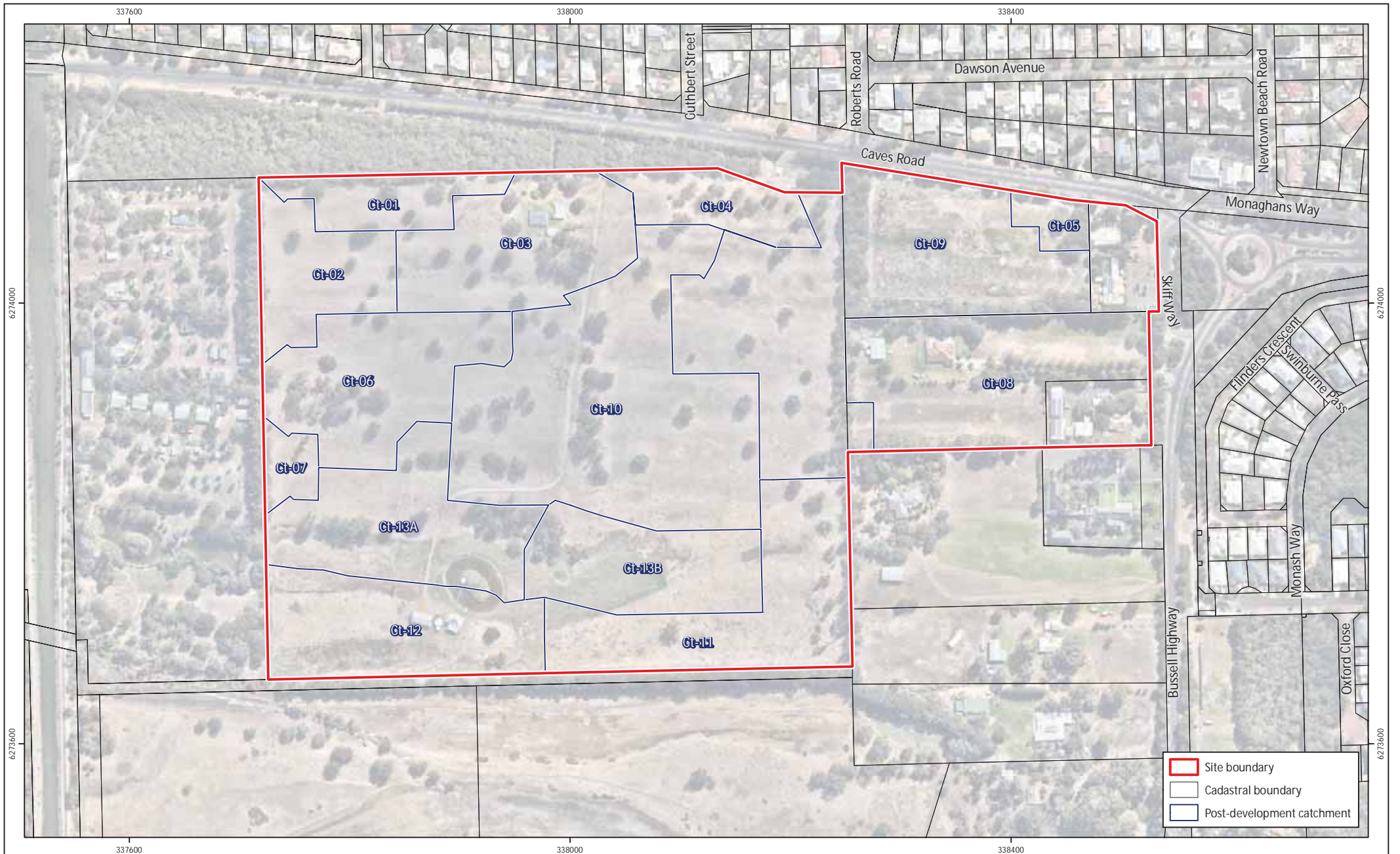
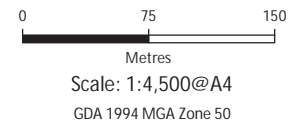


Figure 2: Post-development Catchments

Project: Modelling Assumption Report
Abbey South Structure Plan Area
Client: Landowner Group

Plan Number:
EP20-141(03)--F29
Drawn: WJC
Date: 13/07/2022
Checked: AJJ
Approved: DPC
Date: 21/07/2022



Appendix C

Educational material





Planning your planting

Create 'watering zones' in your garden by grouping plants with similar watering needs. This will allow you to make more efficient use of your garden water by ensuring that no plants are over or under watered.

The Waterwise 'Drop Zone' system makes it easy to identify a plant's water requirements. This system divides plants into one of three groups depending on their watering needs. 'Three Drop' plants require the most watering (usually every second day in summer), whereas 'Two Drop' and 'One Drop' plants require less watering respectively.

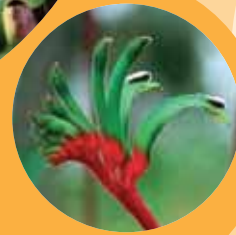
It's also important to reticulate only once on your allocated days, either before 9am or after 6pm. Look for the Waterwise 'Drop Zone' system at your local Waterwise garden centre. To find the centre closest to you, visit www.watercorporation.com.au or call the Waterwise Helpline on 13 10 39.

Remember, a small amount of planning now can save plenty of water in the future.



Planting
a local
native
garden

Looking after all our water needs



In an era of rising temperatures and decreasing rainfall it is important to look at how we use water in our gardens.

Did you know?

About half of the water typically used in our homes is actually used to water the garden (and of that almost all is used to water lawns).

Many of us water lawns that we simply don't use, or water more than we need to. Similarly, often the plant species in our gardens are exotic and not entirely suitable to our climate – needing more water to survive.

Why go native?

- Local native plants are best suited to the local climate, conditions and soil. Therefore they require minimal inputs such as water, fertiliser and maintenance.
- They attract local wildlife, insects and birds and provide corridors of biodiversity in developed areas.
- They have minimal impact on the environment – unlike many introduced species, which have become bushland weeds and prove difficult and expensive to eradicate.
- They represent local heritage, teaching us about nature and our local identity.

Mulch. Mulch. Mulch.

If everyone fully utilised mulch in the garden, a much lower percentage of household water usage would end up on the garden.

The even better news is that mulching is very easy! Raw materials like woodchips and tree clippings are best, but any organic mulch will suffice. Simply spread at least 50mm of mulch over the whole planting area, leaving a small amount of breathing space at the base of the stem. This mulch won't need to be topped up again until autumn. Be sure not to turn or disturb the mulch as this will break the fine feeder roots that develop between the mulch and the soil.

In addition to mulch, a wetting agent can help overcome water repellence in soils, allowing water to penetrate the soil more quickly and in larger amounts. You can find wetting agents at your local nursery or garden centre.

Want to know more?

The Department of Water is committed to making sure that the water needs of Western Australia are met now, and in the future. Small steps we each take can make a big difference to the sustainability of our precious water supply. If you would like to know more, visit the Department of Water website – www.water.wa.gov.au.

Key tips for reducing groundwater use

- Design gardens and landscaping to enhance absorption of rain into the ground and to minimise evaporation – by using local native garden beds, mulch and subsurface irrigation etc.
- Keep planted areas dense and group plants with similar water needs together and make use of windbreaks.
- Prepare the soil before planting to ensure that plants can make the most of the water they need.
- Re-use water from the home in the garden – this includes bucketing greywater from the laundry and bathroom as well as water from downpipes connected to your house gutters. You can also install a subsurface greywater reuse system. For further information, contact your local council or visit www.water.wa.gov.au



Key tips for protecting our groundwater

- **Reduce your reliance on bore water.** Our rainfall has reduced, which means less water to recharge our aquifers. Continued housing development in some areas can increase the number of new garden bores and the use of groundwater.
The Department of Water has drawn up a map of Perth's groundwater area with boundaries showing which areas are better suited for bores.
- **Design gardens and landscaping to enhance maximum absorption of rainfall into the groundwater and minimise evaporation.**
Use local native plants, mulch and subsurface irrigation.
- **Reduce your use of fertilisers and chemicals.**
These can contaminate groundwater, particularly products high in phosphate.
- **Reduce water use through a variety of water saving mechanisms in the home and garden.**
- **Re-use water from the home in the garden – this includes bucketing greywater from the laundry and bathroom as well as water from downpipes connected to your house gutters. You can also install a subsurface greywater reuse system. For further information, contact your local council or visit www.water.wa.gov.au**

For your watering days and other information on water saving in homes and gardens visit www.watercorporation.com.au or call 1800 508 55

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Perth WA 6000
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Fax (08) 6364 7601
www.water.wa.gov.au

Looking after all
our water needs

Extracting
groundwater



Water quality

The quality of groundwater can be affected in many ways.

- The use of lawn and garden fertilisers heavy in phosphate is a major issue in Perth. Phosphates easily soak through the sand plain into the aquifer, rivers, ocean, creeks and swamps. This results in aquatic life dying and the growth of dangerous algae in freshwater lakes and rivers.
- Oils, paint thinners, various workshop chemicals – if poured into the sandy soil – will soak through to the aquifer and create long-term pollution issues.
- Heavy metal particles are dangerous to our health, as are hydrocarbons. These come from vehicle fuel systems, brake linings and exhaust systems. When vehicles are parked on private driveways and carports, such material will wash into your private soak wells and eventually into the aquifer. Remember to clean out your soak wells annually, to remove any leaf and pollutant build-up. This will also aid in the efficiency of your soak wells and reduce internal flooding problems.

Groundwater – the situation

Over two-thirds of Perth's water supply comes from groundwater. The Perth region has an underground geology which includes large areas of deep sand and limestone. Rain falling over this area and running off the hills builds up underground as a shallow semi-freshwater aquifer, which is available for household bores in some areas.

The freshwater aquifer is renewed each year with rainfall. With rainfall continuing to decline in Perth, and more homes being equipped with bores, the draw on the aquifer is increasing, thus creating a threat to ongoing bore water supply.

Groundwater recharge

Traditionally, stormwater run-off from roofs and roads and other surfaces has been collected in drainage pipes and exported into the ocean or waterways.

This 'lost' water can be a valuable resource to recharge a shallow groundwater aquifer. Sandy soils are extremely permeable and well suited to infiltration of stormwater to increase groundwater levels.

Recharging the groundwater aquifer with stormwater helps manage the local water cycle balance and prevents problems associated with increased bore water extraction, acid sulphate soils, salinity and waterlogging.

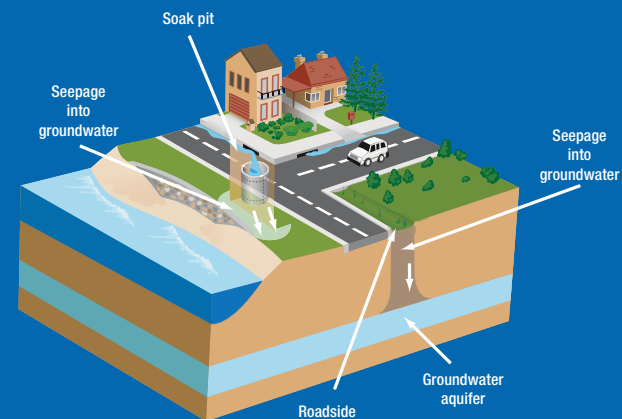


Managing local stormwater

'Stormwater' is a term used to describe the water which runs off surfaces such as houses and driveways and flows down into drains and stormwater pipes.

Poor stormwater management can damage not only individual properties but the environment in general. Local councils invest significant amounts of money into operating and maintaining the stormwater network.

Maximising infiltration of stormwater into groundwater can be achieved by replacing traditional drainage pipes with infiltration devices such as soakage pits and bioretention swales, as illustrated below.





Water sensitive urban design

Rainwater storage and reuse systems

Summary

Rainwater storage systems are a simple method of capturing rainwater, traditionally from roofs, for use as an alternative water supply source and to reduce consumption of scheme water. When installed and maintained in accordance with recommended guidelines, they can provide a high quality source of water.

This brochure is part of a series that explain various aspects of water sensitive urban design. Please see *Water sensitive urban design in Western Australia* for background information on water sensitive urban design.

Main benefits

- Rainwater storage systems reduce the demand on potable water supplies.
- More rainwater is harvested when the tank is plumbed inside the house for uses such as toilet flushing. This creates a consistent drawdown on the tank supply, so there is always space to collect rainwater.
- They reduce the amount of directly connected impervious areas.
- They reduce stormwater peak flow rates and volumes.
- They reduce water supply peak flow rates and volumes.
- They can be retrofitted in houses and other buildings, including in high density urban areas.
- They can provide a water supply for (water sensitive) urban gardens and reduce the heat island effect in high density urban landscapes.

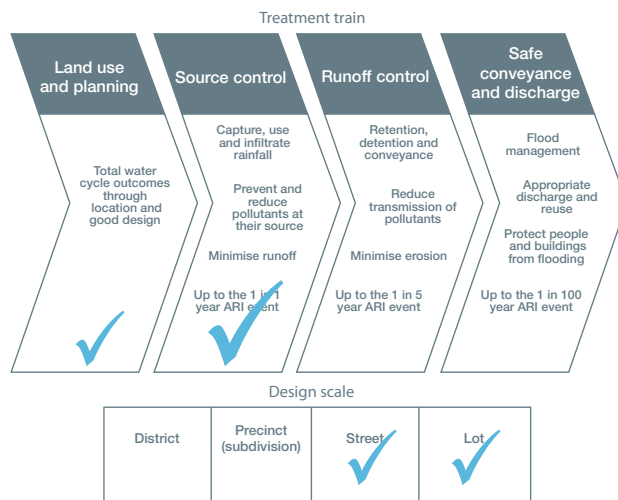
Design factors

- Put 'first flush' devices and mesh screens over all inlets and outlets to minimise maintenance requirements and preserve water quality.
- Designs for stormwater management include an air gap with trickle feed discharge level control and may include an infiltration trench or soakwell, depending on site characteristics.
- Storage can be above or below ground.
- Match storage size to collection area, end use, rainfall quantity and seasonal variability.
- Larger storage sizes are required where rainfall is unreliable and alternative supplies are not available.

Target pollutants

Rainwater storage systems are not designed to achieve direct improvements in stormwater quality.

Where they can be used in the water sensitive urban design process



Concrete underground tank



Slimline domestic rainwater tank

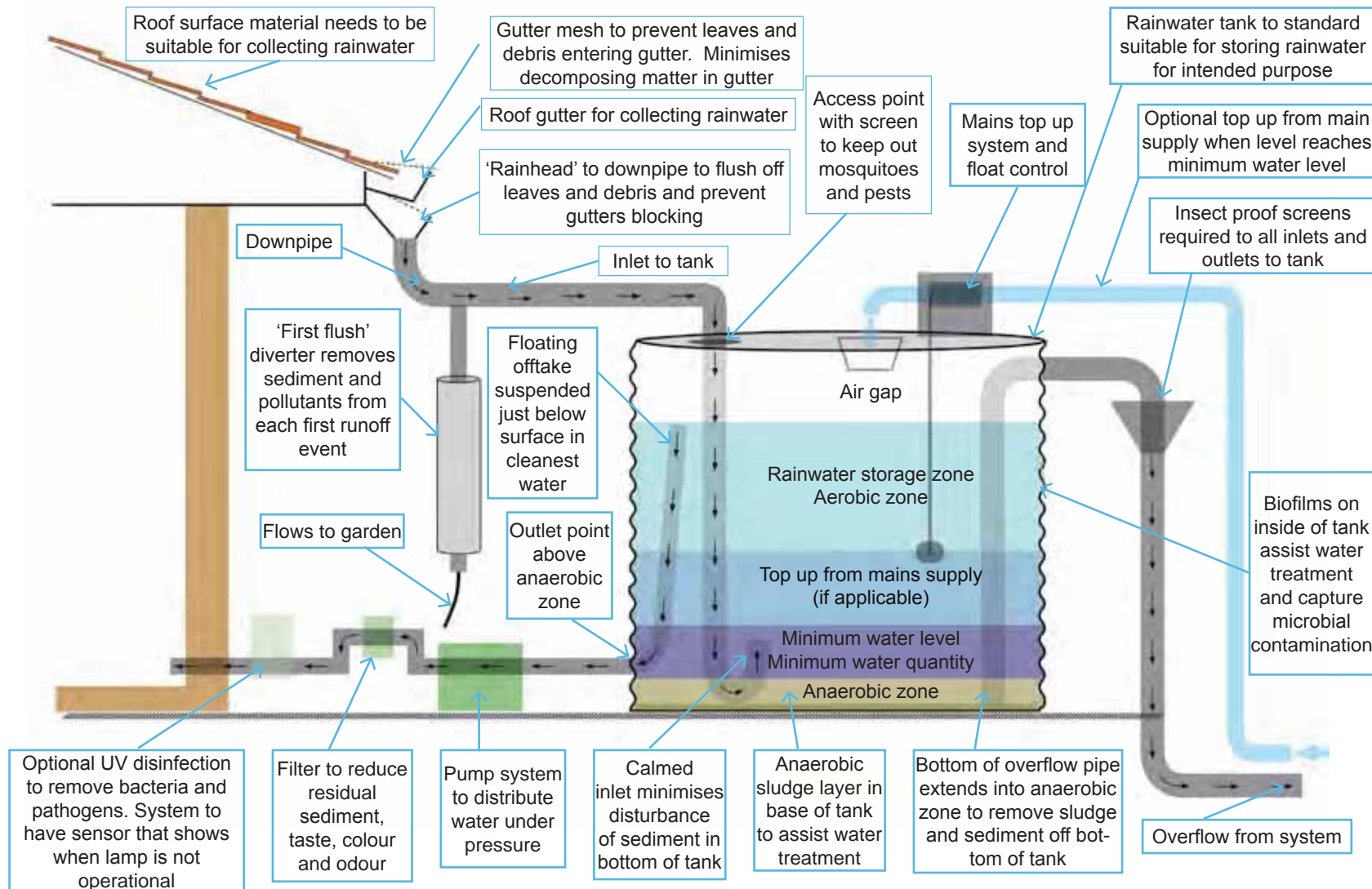


Poly domestic rainwater tanks

Water sensitive urban design

Rainwater storage and reuse systems

Example of above ground rainwater tank



Required reading

Australian runoff quality: a guide to water sensitive urban design, 2006, Engineers Australia, available at <www.arq.org.au>.

Rainwater tank design and installation handbook, 2008, HB230-2008, Standards Australia.

Stormwater management manual for Western Australia, 2004-07, Department of Water, available at <www.water.wa.gov.au>. See Section 2.1 of Chapter 9 – Structural controls.

Testing of products for use in contact with drinking water, 2005, AS/NZS 4020:2005, Standards Australia.

Urban rainwater collection guidelines, Department of Health, Western Australia.

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(Source: Thompson McRobert Edgeloe Group 2008)



Saving water in the garden.



Did you know?

Pot plants use a lot more water than plants in the ground. They're more exposed to the sun and wind, only store a small amount of water and dry out faster, so you water them more.



- Reduce your lawn cover. Most of the water used in our homes goes on the lawn.
- Plant local natives. They require less water and fertiliser.
- Mulch. Organic mulches reduce evaporation and restrict weed growth.
- Collect rainwater. This will save scheme water.
- Water deeply. Watering slower, for longer, less often encourages deep root growth.
- Use greywater. Re-use your laundry and bathroom water on your garden.
- Install a drip irrigation system. This will deliver water straight to the root system.
- Landscape. Group plants to suit watering needs. Keep high water use plants together.
- Use a pool cover. It will reduce evaporation by up to 97%, saving water and money.
- Maintain. Check taps and reticulation regularly for leaks and blockages.



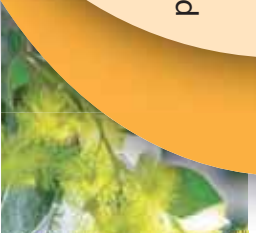
Grow local native plants and save water.



Did you know?

About half the water typically used in our homes is used to water the garden, generally lawns. Many of us water a large lawn and only use part of that lawn. Some of us overwater even those parts of the lawn we do use regularly. Think about the areas of lawn you use regularly and whether you can reduce the amount of watering. Similarly, often the plant species in our gardens are exotic and not suitable to our climate, needing more water to survive. These can be regrouped together and more waterwise plants put in their place.

- Local native plants are best suited to the local climate, conditions and soil.
- They require less water, fertiliser and maintenance.
- They attract local wildlife, insects and birds.
- They have minimal impact on the environment, unlike some introduced species which have become bushland weeds.
- Local plants represent local heritage, teaching us about nature and our local identity.





Protect and maintain our local water supplies. Fertilisewise.

Did you know?

Fertilisers are a major contributor to surface and groundwater contamination. They run off into the stormwater system through roadside drains, collect in sumps and leach into the groundwater system. They also wash into the rivers and sea, creeks and swamps where they can do major damage to reefs and aquatic life.

WHAT YOU CAN DO TO HELP

- Minimise lawn areas and use plants that don't use fertiliser
- Grow local native plants – they require less water and fertiliser
- Where possible, use organic fertilisers
- If you must use a chemical fertiliser, look for one that is phosphorus free. Use a nitrogen to phosphorus to potassium (N:P:K) ratio of 10:0:6.
- Use a slow release fertiliser
- Only apply in spring or early autumn, not in winter or summer
- Fertilise only when symptoms of deficiency occur (e.g. yellowing)
- Use liquid fertiliser if you have a subsurface irrigation system
- Compost your garden waste
- Don't fertilise near waterways or road verges
- Don't let grass clippings or leaves go down the drain
- Wash your car on the lawn (if you have any) not on the driveway
- Pick up after your dog
- Use phosphorus-free detergents (always read the labels)





Top 5 tips for saving water in the kitchen

Did you know the kitchen is a major consumer of water in the home using around 10 per cent of total household water for consumption for cooking, cleaning, washing or drinking?

If you follow these simple tips you can reduce your use dramatically.

- If you have a leaking tap, replace the washer or other components as required. Dripping taps can waste 30 – 200 litres of water per day.
- Look for dishwashers that have a National Water Conservation or WELS Label. The best water rating achieved by dishwashers is 5 stars.
- To avoid wasting warm water from a running tap when you first turn it on, collect it in a bottle or a jug and store it in the fridge until it is cool enough to drink.
- Only use dishwashers when you have full load.
- When boiling vegetables, use enough water to cover them and keep the lid on the saucepan. Your vegetables will boil quicker and it will save you water and power.

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Copies of this document are also available in alternative formats on request for those with special needs. The Department of Water is committed to quality service to its customers and makes every attempt to ensure accuracy, currency and reliability of the data contained in this document. However, changes in circumstances after time of publication may impact the quality of this information.

LINC-DOW/318617

WATER SAVING TIPS

Saving water
in the home

Looking after all our water needs



In southern Western Australia, water resources are under pressure due to reduced rainfall, increased population and other factors.

With the current pressure on Western Australia's water resources, it's time for us all to do our bit to protect and maintain them.

Water use in the home and garden

Consider the following to reduce water use:

- Don't use drinking quality water to water your garden. Use bore water and/or water recycled from showers and clothes washing machines (grey water).
- Use covers on swimming pools and spas, to reduce evaporation. Evaporation can remove more water from a pool per year than toilet use in a home.
- A home can be cooled in summer using good orientation, window shading, natural ventilation and fans. This could remove the need for an air conditioner, particularly evaporative, where large amounts of water are used.
- All new houses must adhere to the criteria of 5 Star Plus for water efficiency, but the guidelines can also be used when renovating to help create a more waterwise home.
- Install flow control aerators on taps. They are inexpensive and can reduce water flow by 50 per cent.

Find out more

For information on greywater use and systems visit the Department of Health website at www.health.wa.gov.au
 For waterwise tips see the Water Corporation website at www.watercorporation.com.au and follow the "Being Waterwise" links.
 To find out more visit www.water.wa.gov.au

What you can do to help?

- **Buy and install water smart fittings and appliances in the kitchen, bathroom and laundry.** Low flow showers and taps, systems that store colder water while the hot tap is reaching the desired temperature, toilets with lower flush volumes, waterless toilets, front loading washing machines etc are all modern ways of saving on water use and cost.
- **Consider installing rainwater tanks.** The stored water can be used in a number of ways, even in Perth where there are less summer rain events. Such water can be plumbed into toilets and reduce the use of high-quality treated scheme water for flushing.
- **Install a waterwise garden and/or irrigation system.** The garden and irrigation system can be designed to minimize water use.

Use products and services with the Smart Approved WaterMark label. This is a water saving program for outdoor water use and ensures any product bearing the label will save water.

Visit www.smartwatermark.org for more information

Did you know?

In the typical house, the use of showers, clothes washing machines and toilets can consume more than three quarters of all indoor water use. In the majority of homes, all of this quality drinking water is used once then goes to the sewer. There are now simple, low cost ways of reducing this water use whilst saving on your water costs.



Bushfire Management Plan

Abbey South Structure Plan Area

Project No: EP20-141(05)

Prepared for Various Landowners
June 2024

Bushfire Management Plan

Abbey South Structure Plan Area



Document Control

Doc name: Bushfire Management Plan
Abbey South Structure Plan Area

Doc no.: EP20-141(05)—011c SJB

Version	Date	Author	Reviewer	
1	July 2022	Sarah Beukes	SJB	Kristen Knox
				Dana Elphinstone
Report issued for client review.				
A	September 2022	Kristen Knox	KK	Dana Elphinstone
			Update following City of Busselton comments.	
B	December 2022	Kristen Knox	KK	Dana Elphinstone
			Updated to address revised structure plan – minor changes to layout.	
C	June 2024	Kristen Knox	KK	Anthony Rowe
			Updated to address revised structure plan and Western Australian Planning Commission comments	

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This document has been prepared primarily to consider the layout of development and/or the appropriate building construction standards applicable to development, where relevant. The measures outlined are considered to be prudent minimum standards only based on the standards prescribed by the relevant authorities. The level of bushfire risk mitigation achieved will depend upon the actions of the landowner or occupiers of the land and is not the responsibility of the author. The relevant local government and fire authority (i.e. Department of Fire and Emergency Services or local bushfire brigade) should be approached for guidance on preparing for and responding to a bushfire.

Notwithstanding the precautions recommended in this document, it should always be remembered that bushfires burn under a wide range of conditions which can be unpredictable. An element of risk, no matter how small, will always remain. The objective of the Australian Standard AS 3959-2018 is to “prescribe particular construction details for buildings to reduce the risk of ignition from a bushfire while the front passes” (Standards Australia 2018). Building to the standards outlined in AS 3959 does not guarantee a building will survive a bushfire or that lives will not be lost.

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Bushfire Management Plan

Abbey South Structure Plan Area



Executive Summary

Emerge Associates have been engaged by a number of landowners (the proponent), to support a scheme amendment and structure plan over Lots 4, 12 and 402 Caves Road, and 14 and 15 Bussell Highway, Abbey (also described as the 'Abbey South Structure Plan Area' and herein referred to as the 'site') for future residential development. The site encompasses 30.52 hectares (ha) and is bound by Bussell Highway to the east, Caves Road to the north, the RAC Busselton Holiday Park to the west and an existing nature reserve/agricultural area to the south.

The site is currently zoned 'rural' and 'conservation' under the City of Busselton Local Planning Scheme 21. It is also situated within the Leeuwin-Naturaliste Sub-regional Strategy (DPLH 2019a) and is identified as the 'Abbey Planning Investigation Area', to be considered for development as future tourism, aged care, mixed use and/or medium density residential.

The site is located within a 'bushfire prone area' under the state-wide Map of Bush Fire Prone Areas prepared by the Office of Bushfire Risk Management (OBRM) (2021). The identification of a site within an area declared as bushfire prone necessitates further assessment of the determined bushfire risk affecting the site in accordance with Australian Standard 3959:2018 Construction of buildings in bushfire prone areas (AS 3959), and the satisfactory compliance of the proposal with the policy measures described in State Planning Policy 3.7 Planning in Bushfire Prone Areas (SPP 3.7) (WAPC 2015) and the Guidelines for Planning in Bushfire Prone Areas Version 1.4 (the Guidelines) (DPLH & WAPC 2021).

The purpose of this bushfire management plan (BMP) is to assess the bushfire hazards, both within and nearby the site, and identify the 'management' strategies required to ensure the development of the land is consistent with the intent of SPP 3.7 - to preserve life and reduce the impact of bushfire on property and infrastructure. The policy intent can be met by demonstrating compliance with the policy objectives, and policy measures informed by the bushfire protection criteria in the Guidelines and satisfaction of its four elements. Each element in the bushfire protection criteria can be met by utilising an acceptable solution or a performance principle.

This BMP has followed the requirements of SPP 3.7 to identify bushfire risk and the bushfire protection measures that will make the land suitable for its intended purpose. As part of this, a Bushfire Attack Level (BAL) assessment involving the classification and condition of vegetation within 150 m of the site has been undertaken.

The existing vegetation within the site and 150 m of the site has been classified in accordance with AS 3959, which has then informed a bushfire hazard level (BHL) assessment for the existing vegetation conditions. This BHL assessment indicates that the majority of the site is subject to a 'moderate' bushfire hazard as it is largely cleared paddock areas.

As part of assessing the long-term bushfire risk to the site, vegetation classifications have been detailed for the post-development scenario. While it is anticipated that future public open space (POS) areas within the site will be maintained and could achieve low threat in accordance with Section 2.2.3.2 of AS 3959, in accordance with consultation with the City of Busselton, all areas of POS have been assumed to be a bushfire hazard with a vegetation classification applied (and outlined

Bushfire Management Plan

Abbey South Structure Plan Area



below). The following bushfire hazards were identified as applicable to the site following residential development:

- Forest (Class A) vegetation, associated with existing remnant vegetation to the north of the site, which is assumed to remain in the long-term.
- Woodland (Class B) vegetation, associated with a small area of vegetation adjacent to Skiff Way. This area does appear to have been subject to fuel load management but has been conservatively identified as woodland.
- Scrub (Class D) vegetation, associated with areas of POS within the site (which will include planting/garden areas), as well as a small area of unmanaged vegetation within the southern portion of the RAC Busselton Holiday Park to the west of the site and along Bussel Highway to the east. The POS areas include areas of existing trees, which will form part of the scrub classification. The vegetation along Bussell Highway does appear to be subject to some fuel load management but has been conservatively assessed as scrub.
- Grassland (Class G) vegetation, associated with existing paddock areas to the south and south-east of the site. This area, while associated with the Broadwater Nature Reserve Swamp, has been cleared since at least 1970, and is subject to grazing by kangaroos and is subject to regular inundation. Given the long-term presence of grass in this area, grassland is considered an appropriate classification. Grassland has also been applied to a number of POS areas within the site, based on the City's request and current classification (and anticipated planting approach).

In order to resolve the potential for bushfire to affect the site, a post development scenario has been assumed in which all classified vegetation within future residential lots and road reserves within the site will be removed and converted to non-vegetated (exclusion 2.2.3.2(e)) and low threat vegetation (exclusion 2.2.3.2(f)). If some or all POS areas are able to be managed to achieve low threat vegetation, this will reduce the BAL rating impacts on lot areas within the site.

Compliance Assessment

The outcomes of this BMP demonstrate that as development progresses, it will be possible for an acceptable solution to be adopted for each of the applicable bushfire protection criteria outlined in the Guidelines. This includes:

- **Location:** The site is largely subject to a moderate bushfire hazard level based on existing conditions. The proposed development is at a higher order strategic planning stage, and the site will, overall, include sufficient area to enable all habitable buildings to achieve BAL-29 or lower in the post-development scenario (i.e. following implementation of clearing/vegetation modification) to accommodate future residential development. The majority of the site will be subject to BAL-LOW upon completion of development.
- **Siting and Design:** The site accommodates a suitable asset protection zone (APZ) for all proposed lots generally through the provision of a perimeter public road network or the existing road network, enabling the majority of lots to achieve BAL-29 or less. A small portion of the development cells within the site in the south will not have a perimeter road and will be subject to BAL-FZ and BAL-40 either as a result temporary hazards identified within adjacent rural lots, or assumed bushfire risk from vegetation within the POS areas (associated with the POS strip

Bushfire Management Plan

Abbeey South Structure Plan Area



along the southern boundary which is likely to support a walking/bridle trail function). Due to the size of the development cells, it would be possible to accommodate the minimum 13 m and or 8 m setback required from these hazards to achieve BAL-29. This can be considered when lot layout is addressed at future subdivision stages.

- **Vehicular Access:** Vehicle access to multiple destinations can be provided, with the site providing direct access to Caves Road to the north and Bussell Highway to the east, which provide access to Dunsborough, Busselton and Vasse town sites. One permanent no-through road is proposed in the structure plan, as part of managing access to/from Bussel Highway in accordance with Main Roads requirements. The proposed permanent no-through road is less than 200 m in length and can meet the acceptable solution. One temporary no-through road will be present as a result of staged development in the broader area, however, they are less than 200 m in length and therefore meet the acceptable solution. The western-most development cell currently only has one public road in and out, and this is to support retaining as many existing trees as possible within a POS corridor through the central portion of the site and balancing the floodway and drainage requirements. Additional access to this cell can be accommodated in the form of an emergency access way across the POS. The specific form and location of the second access can be determined at future development stages, as part of accommodating drainage design and tree retention.
- **Water:** the proposed future residential development will be serviced by a reticulated water network and provision of hydrants.

The management/mitigation measures to be implemented through the future development of the site, as discussed in this BMP, demonstrate that the acceptable solutions and the intent of each element can be met. Accordingly, having regard to clause 6.11 of SPP 3.7, the precautionary principle has been satisfied.

Bushfire Management Plan

Abbey South Structure Plan Area



Table of Contents

1	Introduction	1
1.1	Background	1
1.2	Aim of this report	2
1.3	Statutory policy and framework	3
1.4	Description of the proposed development	3
1.5	Description of land characteristics	3
2	Environmental Considerations	5
2.1	Native vegetation – modification and clearing	7
2.2	Revegetation and landscape plans	7
3	Bushfire Assessment Results	8
3.1	Vegetation classification	8
3.2	Assessment outputs	20
3.2.1	BHL assessment	20
3.2.2	BAL assessment	21
3.2.2.1	Assumptions	21
3.2.2.2	BAL outputs	22
4	Identification of Bushfire Hazard Issues	24
4.1	Temporary hazards	24
4.2	Permanent hazards	24
5	Assessment Against the Bushfire Protection Criteria	26
5.1	Additional management strategies	30
5.1.1	Future approval considerations	30
5.1.2	Landscape management	31
5.1.3	Within the site	31
5.1.3.1	Surrounding the site	31
5.1.4	City of Busselton annual firebreak notice	32
5.1.5	Vulnerable or high-risk land uses	32
5.1.6	Public education and preparedness	33
6	Responsibilities for Implementation and Management of Bushfire Measures	34
7	Applicant Declaration	36
7.1	Accreditation	36
7.2	Declaration	36
8	References	37
8.1	General references	37
8.2	Online references	37

Bushfire Management Plan

Abbey South Structure Plan Area



List of Tables

Table 1 : Summary of potential environmental considerations that may be associated with the site (based on a search of the SLIP databases)	5
Table 2: Pre-development vegetation classification and/or exclusions, effective slope and future management 10	
Table 3: Summary of the assumed post-development vegetation classification and associated effective slope within the site and 150 m in accordance with Table 2.5 (AS3959)	22
Table 4: Setback distances based on vegetation classification and effective slope and Table 2.5 of AS 3959, as determined by the method 1 BAL assessment	23
Table 5: Assessment against the bushfire protection criteria from the Guidelines	26
Table 6: Responsibilities for the implementation of this BMP	34

List of Plates

Plate 1 : Areas within and surrounding the site identified as 'bushfire prone areas' (as indicated in purple) under the state-wide Map of Bush Fire Prone Areas (OBRM 2021)	1
Plate 2: Hydrological features present within the site and broader area (DBCA 2020)	4
Plate 3: The five fuel layers in a forest environment that could be associated with fire behaviour (Gould et al. 2007) 9	
Plate 4: Excerpt of Table 6 from The Guidelines (DPLH & WAPC 2021)	30

Figures

Figure 1: Site Location and Topographic Contours	
Figure 2: Pre-development AS 3959 Vegetation Classifications	
Figure 3: Pre-Development Bushfire Hazard Level	
Figure 4: Post-development As 3959 Vegetation Classifications and Effective Slope	
Figure 5: Bushfire Attack Level Contour Plan	
Figure 6: Spatial Representation of Bushfire Management Strategies	

Appendices

Appendix A

Structure Plan and Concept Plan

Bushfire Management Plan

Abbey South Structure Plan Area



List of Abbreviations

Table A1: Abbreviations – General terms

General terms	
AHD	Australian Height Datum
AS	Australian Standard
APZ	Asset Protection Zone
BAL	Bushfire Attack Level
BMP	Bushfire Management Plan
BPAD	Bushfire Planning and Design
Developable land	Position Statement: Planning in bushfire prone areas - Demonstrating Elements 1: Location and Element 2: Siting and design (DPLH 2019b) has outlined that 'developable land' is "land that can accommodate a habitable dwelling and would not generally include areas of BAL-40 and/or BAL-FZ, areas within the local government setback and areas subject to environmental constraints".
ESA	Environmentally Sensitive Area
EAW	Emergency access way
FDI	Fire Danger Index
FSAR	Fire Service Access Route
FZ	Flame Zone
Habitable building	As defined in Planning and Development (Local Planning Schemes) Regulations 2015, a 'habitable building' is "a permanent or temporary structure on land that – (a) is fully or partially enclosed; and (b) has at least one wall of solid material and a roof of solid material; and (c) is used for a purpose that involves the use of the interior of the structure by people for living, working, studying or being entertained"
SLIP	Shared Location Information Platform
TEC	Threatened ecological community

Bushfire Management Plan

Abbey South Structure Plan Area



Table A2: Abbreviations – Organisations

Organisations	
DBCA	Department of Biodiversity Conservation and Attractions
DFES	Department of Fire and Emergency Services
DPLH	Department of Planning, Lands and Heritage
DWER	Department of Water and Environment Regulation
EPA	Environmental Protection Authority
OBRM	Office of Bushfire Risk Management
WAPC	Western Australian Planning Commission
WASAT	Western Australian State Administrative Tribunal

Table A3: Abbreviations – Legislation and policies

Legislation	
AS 3959	Australian Standard 3959-2018 Construction of buildings in bushfire prone areas
Guidelines	Guidelines for Planning In Bushfire Prone Areas version 1.4 (DPLH & WAPC 2021)
NCC	National Construction Code
SPP 3.7	State Planning Policy 3.7 Planning in Bushfire Prone Areas (WAPC 2015)

Table A4: Abbreviations – Planning and building terms

Planning and building terms	
LPS	Local Planning Scheme

Table A5: Abbreviations – units of measurement

Units of measurement	
cm	Centimetre
ha	Hectare
m	Metre
m ²	square metre
m AHD	m in relation to the Australian height datum
mm	Millimetre

Bushfire Management Plan

Abbey South Structure Plan Area



1 Introduction

1.1 Background

Various landowners (the proponent) are progressing a scheme amendment and structure plan over Lots 4, 12 and 402 Caves Road, and 14 and 15 Bussell Highway, Abbey (herein referred to as the ‘site’) to facilitate future residential development. The proposed structure plan and concept plan are provided in **Appendix A**. The site is 35.76 ha in size and is bound by Bussell Highway to the east, Caves Road to the north, the RAC Busselton Holiday Park to the west and the Broadwater Nature Reserve Swamp to the south, as shown in **Figure 1**.

The site is located within a ‘bushfire prone area’ under the state-wide Map of Bush Fire Prone Areas prepared by the Office of Bushfire Risk Management (OBRM) (2021) as shown in **Plate 1**. The identification of a site within an area declared as bushfire prone necessitates a further assessment of the determined bushfire risk affecting the site in accordance with Australian Standard 3959:2018 Construction of buildings in bushfire prone areas (AS 3959), and the satisfactory compliance of the proposal with the policy measures described in State Planning Policy 3.7 Planning in Bushfire Prone Areas (SPP 3.7) (WAPC 2015) and the Guidelines for Planning in Bushfire Prone Areas Version 1.4 (the Guidelines) (DPLH & WAPC 2021).

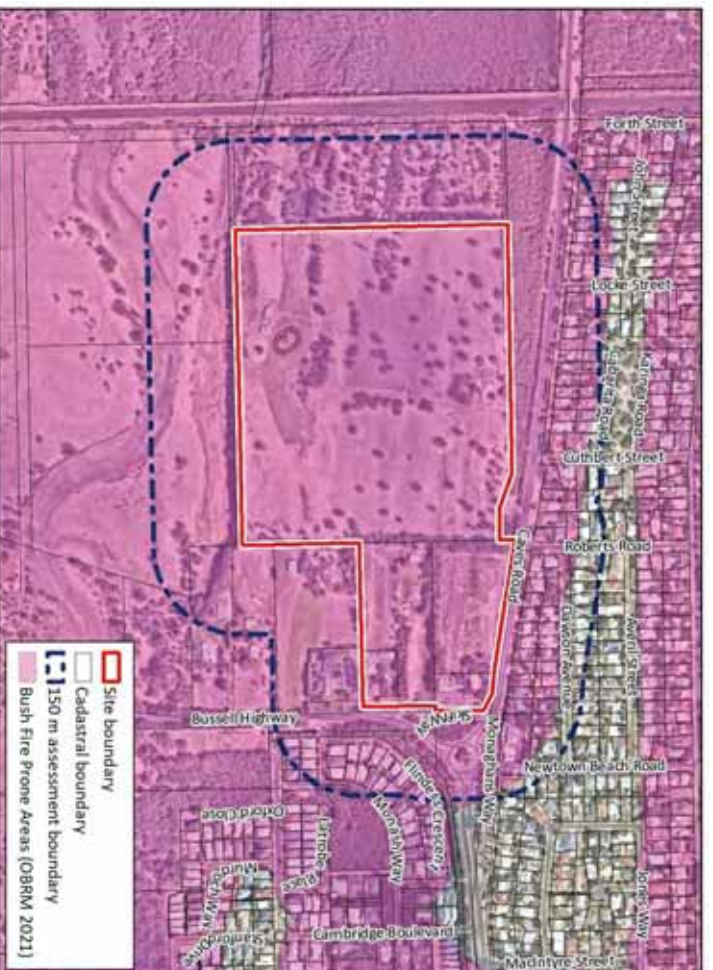


Plate 1: Areas within and surrounding the site identified as ‘bushfire prone areas’ (as indicated in purple) under the state-wide Map of Bush Fire Prone Areas (OBRM 2021).

The purpose of SPP 3.7 and its policy intent is to preserve life and reduce the impact of bushfire on property and infrastructure through effective risk-based land use planning. Importantly, it is risk-based, requiring a methodical approach to identify and evaluate the hazards and provide the treatments to ameliorate these hazards to an acceptable level. SPP 3.7 requires that the determining authority give consideration to the precautionary principle (clause 6.11 in SPP 3.7) and they must be

Bushfire Management Plan

Abbey South Structure Plan Area



satisfied that the potential for significant adverse impacts can be adequately reduced or managed. In particular:

SPP 3.7 does not require that there be no increase at all in the threat of bushfire to people property or infrastructure. Rather, as is seen in clause 2 of SPP 3.7, the intention of the policy is to 'implement effective, risk-based land use planning and development to preserve life and **reduce the impact of bushfire on property and infrastructure**'. (emphasis added)¹

1.2 Aim of this report

The aim of this BMP is to assess bushfire hazards within the site and nearby areas and ensure that the threat posed by any identified hazards can be appropriately mitigated and managed and demonstrate satisfaction of clause 6.11 of SPP 3.7 (the precautionary principle). This BMP has been prepared to support the rezoning and structure planning of the site and addresses the requirements of SPP 3.7 (WAPC 2015), the Guidelines (DPLH & WAPC 2021) and AS 3959 (Standards Australia 2018). The document provides an assessment of the general bushfire management strategies to be considered as part of the future residential development within the site and includes:

- Overview of the proposed development (see **Section 1.4**).
- An assessment of the existing classified vegetation in the vicinity of the site (within 150 m) and consideration of bushfire hazards that will exist in the post-development scenario (**Section 3**).
- Commentary on how future development can achieve the bushfire protection criteria outlined within the Guidelines (**Section 5**).
- An outline of the roles and responsibilities associated with implementing this BMP (see **Section 6**).

¹ Harmanis Holdings No. 2 Pty Ltd and Western Australian Planning Commission [2019] WASAT 43 (Harmanis).

Bushfire Management Plan

Abbey South Structure Plan Area



1.3 Statutory policy and framework

The following key legislation, policies and guidelines are relevant to the preparation of a bushfire management plan:

- Bush Fires Act 1954
- Fire and Emergency Services Act 1998
- Planning and Development Act 2005 and associated regulations
- Building Act 2011 and associated regulations
- State Planning Policy 3.7 Planning in Bushfire Prone Areas (WAPC 2015)
- Guidelines for Planning in Bushfire Prone Areas Version 1.4 (DPLH & WAPC 2021)
- Australian Standard AS 3959 – 2018 Construction of buildings in bushfire prone areas (Standards Australia 2018)

1.4 Description of the proposed development

The northern portion of the site is currently zoned 'rural' under the City of Busselton Local Planning Scheme No. 21 (LPS No.21), whilst the southern portion of the site is currently zoned 'conservation', and an area within the eastern portion of the site is zoned 'tourism'. The site is also identified as part of a number of 'special control areas', with wetland, floodway and landscape values. Through the scheme amendment, the site is proposed to be rezoned to 'development' or similar, and is supported by a structure plan which will guide future subdivision and development. The structure plan and concept plan (Rise Urban 2022) has been provided in **Appendix A**. The proposed development within the site will include:

- Residential lots of various sizes, typically between 500-600 m²
- A commercial precinct, on the corner of Caves Road and Bussell Highway.
- Interconnected road network, including perimeter roads and external connections to Caves Road and Bussell Highway.
- Public open space (POS) areas, supporting retention of existing trees and available for future residents to use for passive and active recreation.

1.5 Description of land characteristics

The entire site is relatively low lying with a slight south-westerly aspect. Elevation ranges from approximately 2 m Australian Height Datum (m AHD) within the southern portion of the site to 3 m AHD within the northern and south-eastern portion of the site. A depression is located within the southern portion of the site, associated with a floodway, with elevations of around 1 m AHD.

The site is characterised by largely cleared areas composed of paddock grasses that have been used for livestock grazing. More recently, commercial operations have commenced within the north-eastern portion of the site, including an ice factory and fresh food market. Strips of remnant native vegetation exist in the eastern portion of the site (along lot boundaries) and individual paddock trees (predominantly *Agonis flexuosa*) are present throughout the site.

A review of the Geomorphic Wetlands of the Swan Coastal Plain dataset (DBCA 2020) indicates that a number of multiple use wetland (MUWs) are identified within the site, and include four MUWs in the

Bushfire Management Plan

Abbey South Structure Plan Area



southern and south-western portions of the site (unique feature identification (UFI) 39, 41 63, 13195); and one MUW within the north-eastern portion of the site (UFI 64). These are shown in Plate 2.



Plate 2: Hydrological features present within the site and broader area (DBCA 2020)

From a broader context perspective, an RAC holiday/caravan park is located immediately to the west of the site, with Buayangup Drain located immediately adjacent to the western boundary of the park. To the north and east of the site, land use is more urbanised and associated with existing urban/residential development, whilst land use to the south of the site is part of the Broadwater Nature Reserve Swamp. This reserve has been cleared since at least 1970, and has been subject to historic livestock grazing, with heavy ongoing grazing by kangaroos and is also subject to regular inundation.

Bushfire Management Plan

Abbey South Structure Plan Area



2 Environmental Considerations

In accordance with the Bushfire Management Plan – BAL Contour template prepared by the Department of Planning, Lands and Heritage (DPLH) (2018), this BMP has considered whether there are any environmental values that may require specific consideration through either protection, retention or revegetation. To support this, a review of publicly available databases has been undertaken, with particular reference to the Shared Location Information Platform (SLIP) databases and investigations undertaken to support the scheme amendment and structure plan, including a Local Water Management Strategy (LWMS) and an Environmental Assessment and Management Strategy. A summary of the search results has been provided in **Table 1**.

Key environmental considerations for future development of the site and management of bushfire risk include the remnant native vegetation to the immediate north of the site, and a floodway and flood fringe within the south-western portion of the site.

Table 1: Summary of potential environmental considerations that may be associated with the site (based on a search of the SLIP databases)

Key environmental feature (information in brackets refers to mapping data source)	Yes / no / potentially occurring within the site	If yes / potentially, describe the value that may be impacted
Conservation category wetlands and buffers (DBCA-019)	No	No conservation category wetlands (CCW) are present within the site. A conservation category wetland is mapped 225 m west of the site. No buffer extends into the site.
RAMSAR wetlands (DBCA-010)	No	Not applicable. No RAMSAR wetlands are located within or adjacent to the site.
Waterways (Hydrography / Linear (Hierarchy)) (DWER-031))	Yes	An offshoot of the floodway and flood fringe, associated with the Broadwater River and its main floodplain, is mapped within the south-western portion of the site. This area is currently composed largely of paddock grasses, with the flood fringe able to be developed and the floodway to be protected within POS areas. The Buanyup Drain occurs 180 m west of the site.
Threatened and priority flora (DBCA-036)	No	Following a review of the publicly available datasets, a number of threatened flora or priority flora may occur in the general area. Whilst a detailed flora and vegetation survey has not been completed for the site, the site is cleared of remnant native vegetation, apart from occasional <i>Agonis flexuosa</i> and eucalypts (<i>Eucalyptus rudis</i>) present as paddock trees, and is composed of paddock grasses. It is highly unlikely that threatened or priority flora species occur within the site.
Threatened and priority fauna (DBCA-037)	No	A review of publicly available databases indicates that a number of conservation significant species may occur within the site or nearby, including the three black cockatoo species (Garraby's, Baudin's and forest red-tailed) and the western ringtail possum.
		No detailed fauna or fauna habitat surveys have been completed for the site, however as outlined above, the site is cleared of remnant native vegetation, apart from occasional <i>Agonis flexuosa</i> and eucalypts (<i>Eucalyptus rudis</i>) present as paddock trees, and is composed of paddock grasses. It is highly unlikely the site would provide important habitat for threatened or priority fauna species.

Bushfire Management Plan

Abbey South Structure Plan Area



Table 1: Summary of potential environmental considerations that may be associated with the site (based on a search of the SLIP databases) (continued)

Key environmental feature (information in brackets refers to mapping data source)	Yes / no / potentially occurring within the site	If yes / potentially, describe the value that may be impacted
Threatened ecological communities (TEC) (DBCA-038)	No.	A review of the publicly available datasets and our knowledge of the area, indicates a number of threatened ecological communities (TECs), priority ecological communities (PECs) may occur in the general area. As outlined above, while no detailed flora and vegetation surveys have been completed, none of these values are likely to be present given the highly disturbed nature of the site, with the site dominated by paddock grasses with occasional <i>Agonis flexuosa</i> and eucalypts (<i>Eucalyptus rudis</i>) present as paddock trees.
Department of Biodiversity Conservation and Attractions (DBCA) controlled lands or waters (DBCA-011)	No	Not applicable. No DBCA controlled lands or waters exist within or adjacent to the site.
Clearing regulations – Environmentally Sensitive Areas (DWER-046)	No	The site is not mapped as an environmentally sensitive area (ESA). An ESA is mapped approximately 170 m to the west.
Conservation Covenants Western Australia (DPIRD-023)	No	Not applicable.
Aboriginal heritage (DPLH-001)	Yes	A portion of an 'Other Heritage Place' (ID 5337) is mapped as extending into the western portion of the site. This feature is described as 'skeletal material/burial' and is likely to be associated with the drain further to the west (supported by information provided in the Buayanyup River Action Plan (Geographic Catchment Council 2010) where the Aboriginal site is described as being associated with the drain). As it is an 'other heritage site', no specific approval is required under the existing enacted Aboriginal heritage legislation.
Non-indigenous heritage (DPLH-090)	No	No non-indigenous heritage sites were identified within the site. A non-indigenous heritage site (Place No. 5354, 'Newtown House') occurs immediately south of the site, adjacent to Bussell Highway. It is understood the current land uses will continue and will not be impacted by future urban development within the remainder of the site. Therefore, no specific consideration from an approval or management perspective is likely to be required.

Bushfire Management Plan

Abbey South Structure Plan Area



2.1 Native vegetation – modification and clearing

As outlined above, the site has historically been cleared and mainly supports paddock grasses. Native vegetation comprises scattered native trees, or trees along fence lines only.

No areas of native vegetation outside the site are proposed to be modified or cleared by the proponent as part of the proposed development.

With regard to bushfire management, native vegetation clearing within the site may be required to enable the relevant siting and access requirements of typical subdivision development as well as the Guidelines to be achieved and would be associated with clearing to establish:

- Future lots
- Asset protection zones (APZs)
- Public roads
- POS areas.

Where clearing of native vegetation is undertaken in accordance with a future subdivision approval under the Planning and Development Act 2005, it is exempt from requiring a clearing permit under Schedule 6 of the Environmental Protection Act 1986 (EP Act). Additionally, a clearing permit will not be required where other exemptions pursuant to the Environmental Protection Act 1986 such as those associated with or Section 33 of the Bush Fires Act 1954 or Environmental Protection (Clearing of Native Vegetation) Regulations 2004 (where outside and ESA) exist, such as those associated with a approved buildings and other structures (through building licence).

2.2 Revegetation and landscape plans

No revegetation is proposed. However, following consultation with the City of Busselton, while it is anticipated that future POS areas within the site will be maintained and could achieve low threat in accordance with Section 2.2.3.2 of AS 3959, all areas of POS have been assumed to be a bushfire hazard with a vegetation classification applied (and outlined further below). Therefore, no management is assumed.

Bushfire Management Plan

Abbey South Structure Plan Area



3 Bushfire Assessment Results

Bushfire risk for the site has been appropriately considered both in context to the site and potential impact upon the site using AS 3959 and the Guidelines.

The objective of AS 3959 is to reduce the risk of ignition and loss of a building to bushfire. It provides a consistent method for determining a radiant heat level (radiant heat flux) as a primary consideration of bushfire attack. AS 3959 measures the Bushfire Attack Level (BAL) as the radiant heat level (kW/m²) over a distance of 100 m. AS 3959 also prescribes deemed-to-satisfy construction responses that can resist the determined radiant heat level at a given distance from the fire. It is based on six Bushfire Attack Level (BAL) ratings: BAL-LOW, BAL-12.5, BAL-19, BAL-29, BAL-40 and BAL-FZ.

A BAL contour plan has been prepared in accordance with Appendix Three of the Guidelines and Method 1 of AS 3959 to determine the BAL ratings likely to be applicable to future buildings. This has been based on the vegetation classifications and the effective slope under the vegetation, with the result presented on the BAL contour plan.

To support the proposed scheme amendment and structure planning process, the following has been undertaken and are discussed further below:

- Bushfire hazard levels (BHL) within and nearby to the site have been determined in accordance with Appendix Two of the Guidelines and based on the pre-development vegetation classification detailed in **Table 2**.
- In accordance with Appendix Five of the Guidelines, a method 1 BAL assessment has been undertaken to demonstrate that the proposed development areas can achieve BAL-29 or less, based on the post-development vegetation classifications and effective slope detailed in **Table 3**.

3.1 Vegetation classification

Assessing bushfire hazards takes into account the vegetation classifications and exclusions within the site and surrounding area for a minimum of 100 m, in accordance with AS 3959 and the Guidelines. The assignment of vegetation classifications is based on an assessment of vegetation structure, which includes consideration of the various fuel layers of different vegetation types, as outlined in **Plate 3**. These defined fuel layers are considered when determining the classification of vegetation and associated BAL contours. The BMP considers vegetation within the site and nearby areas based on current conditions, observed through the site visit (termed 'pre-development'), and changes to that vegetation that will occur as a result of implementing the proposed development (termed 'post-development').

An assessment of existing vegetation and effective slope within the site and surrounding 150 m was undertaken over multiple site visits in November 2020, November 2021, December 2021 and June 2022, in accordance with AS 3959 and the Guidelines. Each distinguishable pre-development vegetation plot (based on existing conditions) is described in **Table 2** and shown in **Figure 2**. Existing

Bushfire Management Plan

Abbey South Structure Plan Area



bushfire hazard levels (based on vegetation identified in **Figure 2**) are shown in **Figure 3** and discussed in **Section 3.2.1**.

Not all vegetation is a classified bushfire risk. Vegetation and ground covers that are exempt from classification as a potential hazard is identified as a low threat under Section 2.2.3.2 of AS 3959. Low threat vegetation includes the following:

- a. Any vegetation that is more than 100 m from the site.
- b. Single areas of vegetation less than 1 ha in area and not within 100 m of other areas of vegetation being classified.
- c. Multiple areas of vegetation less than 0.25 ha in area and not within 20 m of the site, or each other, or of other areas of vegetation being classified.
- d. Strips of vegetation less than 20 m in width (measured perpendicular to the elevation exposed to the strip of vegetation) regardless of length and not within 20 m of the site or each other, or other areas of vegetation being classified.
- e. Non-vegetated areas, that is, areas permanently cleared of vegetation, including waterways, exposed beaches, roads, footpaths, buildings and rocky outcrops.
- f. Vegetation regarded as a low threat due to factors such as flammability, moisture content or fuel load. This includes grassland managed in a minimal fuel condition, mangroves and other saline wetlands, maintained lawns, golf courses (such as playing areas and fairways), maintained public reserves and parklands, sporting fields, vineyards, orchards, banana plantations, market gardens (and other non-curing crops), cultivated gardens, commercial nurseries, nature strips and windbreaks.

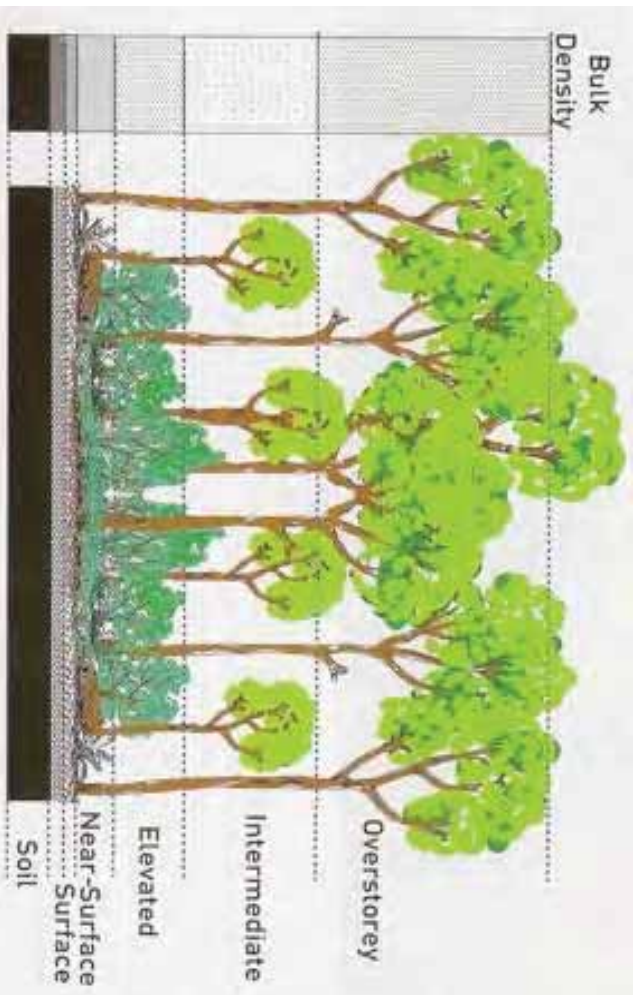


Plate 3: The five fuel layers in a forest environment that could be associated with fire behaviour (Gould et al. 2007)




The post-development vegetation classifications are shown in **Figure 4** and are based on the assumptions detailed in **Section 3.2.2**.

Bushfire Management Plan

Abbey South Structure Plan Area



Table 2: Pre-development vegetation classification and/or exclusions, effective slope and future management

Photo ID:	1	Plot:	1
Vegetation Classification or Exclusion Clause			
Forest (flat / upslope)			
Description / Justification for Classification			
Plot 1 contains Class A (forest) vegetation and is situated immediately north of the site. The vegetation has a multi-tiered fuel structure, with an overstorey of Peppermint trees (<i>Agonis flexuosa</i>) reaching between 10 – 15 metres in height and providing more than 30% foliage cover. The understorey is primarily comprised of juvenile trees and the Coastal Sword-Sedge (<i>Lepidosperma gladiatum</i>).			
Photo ID:	2	Plot:	1
Vegetation Classification or Exclusion Clause			
Forest (flat / upslope)			
Description / Justification for Classification			
Plot 1 contains Class A (forest) vegetation and is situated immediately north of the site. The vegetation has a multi-tiered fuel structure, with an overstorey of Peppermint trees (<i>Agonis flexuosa</i>) reaching between 10 – 15 metres in height and providing more than 30% foliage cover. The understorey is primarily comprised of juvenile trees and the Coastal Sword-Sedge (<i>Lepidosperma gladiatum</i>).			
Photo ID:	3	Plot:	2
Vegetation Classification or Exclusion Clause			
Woodland (Flat / Upslope)			
Description / Justification for Classification			
Vegetation within Plot 2 consists of a Class B (woodland) structure with an overstorey of Peppermint trees (<i>Agonis flexuosa</i>) with an understorey of sporadic unmanaged grassland. The overstorey reaches an approximate height of 15 m and as per Appendix B of AS 3959, mid-storey/understorey fuels are the defining factor, rather than canopy cover. Plot 2 is situated within the north-eastern corner of the site (Lot 12).			
			
			
			

Bushfire Management Plan

Abbey South Structure Plan Area



Table 2: Pre-development vegetation classification and/or exclusions, effective slope and future management (continued)

Photo ID:	4	Plot:	2
Vegetation Classification or Exclusion Clause			
Woodland (flat / upslope)			
Description / Justification for Classification			
Vegetation within Plot 2 consists of a Class B (woodland) structure with an overstorey of Peppermint trees (Agonis flexuosa) with an understorey of sporadic unmanaged grassland. The overstorey reaches an approximate height of 15 m and as per Appendix B of AS 3959, mid-storey/understorey fuels are the defining factor, rather than canopy cover. Plot 2 is situated within the north-eastern corner of the site (Lot 12).			
Photo ID:	5	Plot:	3
Vegetation Classification or Exclusion Clause			
Scrub (flat / upslope)			
Description / Justification for Classification			
Plot 3 contains Class D (scrub) vegetation, which reaches an approximate height of 4 m to 6 m. The understorey contains grasses greater than 100 mm in length. Photo 5 illustrates the presence of Caves Road to the north and a mineral earth firebreak to the south.			
Photo ID:	6	Plot:	5
Vegetation Classification or Exclusion Clause			
Scrub (flat / upslope)			
Description / Justification for Classification			
Plot 5 contains Class D (scrub) vegetation, which reaches an approximate height of 4 m to 6 m. There is evidence of some understorey management, but also a consistent fuel load structure from ground to canopy and accordingly has been conservatively assessed as scrub vegetation. Bussell Highway separates Plot 5 from the site, as illustrated within Photo 6.			
			
			
			

Bushfire Management Plan

Abbey South Structure Plan Area



Table 2: Pre-development vegetation classification and/or exclusions, effective slope and future management (continued)

Photo ID:	7	Plot:	5
Vegetation Classification or Exclusion Clause			
Scrub (flat / upslope)			
Description / Justification for Classification			
Plot 5 contains Class D (scrub) vegetation, which reaches an approximate height of 4 m to 6 m. There is evidence of some understorey management with an inconsistent fuel load from ground to canopy and accordingly has been conservatively assessed as scrub vegetation.			
			
Photo ID:	8	Plot:	6
Vegetation Classification or Exclusion Clause			
Scrub (flat / upslope)			
Description / Justification for Classification			
Plot 6 contains Class D (scrub) vegetation, which reaches an approximate height of 4 m to 6m. Plot 6 is situated to the south-west of the site, within the RAC Busselton Holiday Park and is unmanaged. It contains vegetation with a consistent fuel load structure from ground to canopy.			
			
Photo ID:	9	Plot:	7
Vegetation Classification or Exclusion Clause			
Grassland (flat / upslope)			
Description / Justification for Classification			
Plot 7 contains Class G (grassland) vegetation, which occupies the majority of the site. Within this plot, the grass is unmanaged and greater than 100 mm in length, with shrubs and trees being less than 10% foliage cover overstorey.			
			

Bushfire Management Plan

Abbey South Structure Plan Area



Table 2: Pre-development vegetation classification and/or exclusions, effective slope and future management (continued)

Photo ID:	10	Plot:	7
Vegetation Classification or Exclusion Clause			
Grassland (flat / upslope)			
Description / Justification for Classification			
Plot 7 contains Class G (grassland) vegetation, which occupies the majority of the site. Within this Plot, the grass is unmanaged and greater than 100 mm in length, with trees forming less than 10% overall foliage cover.			
			
Photo ID:	11	Plot:	7
Vegetation Classification or Exclusion Clause			
Grassland (flat / upslope)			
Description / Justification for Classification			
Plot 7 contains Class G (grassland) vegetation, which occupies the majority of the site. Within this plot, the grass is unmanaged and greater than 100 mm in length, with trees less than 10% overall foliage cover. Photo 15 was taken at the southern extent of the site (Lot 4) and illustrates the row of trees separating the site from the lot to the south.			
			
Photo ID:	12	Plot:	7
Vegetation Classification or Exclusion Clause			
Grassland (flat / upslope)			
Description / Justification for Classification			
Plot 7 contains Class G (grassland) vegetation, which occupies the majority of the site. Photo 16 shows grassland vegetation in foreground and background, with trees forming less than 10% overall foliage cover.			
			

Bushfire Management Plan

Abbeys South Structure Plan Area



Table 2: Pre-development vegetation classification and/or exclusions, effective slope and future management (continued)


Photo ID:	13	Plot:	7
Vegetation Classification or Exclusion Clause			
Grassland (flat / upslope)			
Description / Justification for Classification			
Plot 7 contains Class G (grassland) vegetation, which occupies the majority of the site and is shown in the foreground and mid-ground of Photo 13. Within this plot, the grass is unmanaged and greater than 100 mm in length, with trees forming less than 10% foliage cover overall.			
Photo ID:	14	Plot:	7
Vegetation Classification or Exclusion Clause			
Grassland (flat / upslope)			
Description / Justification for Classification			
Plot 7 contains Class G (grassland) vegetation, which occupies the majority of the site and shown in the mid-ground of Photo 14. Within this plot, the grass is unmanaged and greater than 100 mm in length, with trees less than 10% foliage cover overall.			
Photo ID:	15	Plot:	7
Vegetation Classification or Exclusion Clause			
Grassland (flat / upslope)			
Description / Justification for Classification			
Plot 7 contains Class G (grassland) vegetation, which occupies the majority of the site. Within this plot, the grass is unmanaged and greater than 100 mm in length, with trees less than 10% foliage cover overall.			
			
			
			

Bushfire Management Plan

Abbey South Structure Plan Area



Table 2: Pre-development vegetation classification and/or exclusions, effective slope and future management (continued)

Photo ID:	16	Plot:	8
Vegetation Classification or Exclusion Clause			
Grassland (flat / upslope)			
Description / Justification for Classification			
Plot 8 also comprises Class G (grassland) vegetation, where the grass is unmanaged and greater than 100 mm in length. Photo 16 (mid-ground to background) and aerial imagery illustrates that the Broadwater Nature Reserve Swamp to the south comprise pasture grasses with scattered trees and shrubs less than 10% foliage cover.			
Photo ID:	17	Plot:	8
Vegetation Classification or Exclusion Clause			
Grassland (flat / upslope)			
Description / Justification for Classification			
Plot 8 also comprises Class G (grassland) vegetation, where the grass is unmanaged and greater than 100 mm in length. Photo 17 and aerial imagery illustrates that the land situated to the south (comprise pasture grasses. Photo 17 shows the row of trees adjacent to the southern boundary of the site, which when considered as part of the broader area form less than 10% foliage cover.			
Photo ID:	18	Plot:	8
Vegetation Classification or Exclusion Clause			
Grassland (flat / upslope)			
Description / Justification for Classification			
Plot 8 also comprises Class G (grassland) vegetation, where the grass is unmanaged and greater than 100 mm in length. Photo 18 and aerial imagery illustrates that the rural lots situated to the south-east comprise pasture grasses with sheds and outbuildings also visible in the background.			
			
			
			

Bushfire Management Plan

Abbey South Structure Plan Area



Table 2: Pre-development vegetation classification and/or exclusions, effective slope and future management (continued)




Photo ID:	19	Plot:	9
Vegetation Classification or Exclusion Clause			
Exclusion 2.2.3.2 (e)			
Description / Justification for Classification			
Plot 9 contains non-vegetated areas, which have been excluded in accordance with Clause 2.2.3.2 (e). Photo 19 illustrates a sealed bitumen road (Caves Road) and carparking area associated with a wastewater pump station. Class G (grassland) is present within the foreground of the photograph, which is associated with Plot 7.			
Photo ID:	20	Plot:	9
Vegetation Classification or Exclusion Clause			
Exclusion 2.2.3.2 (e)			
Description / Justification for Classification			
Plot 9 contains non-vegetated areas, which have been excluded in accordance with Clause 2.2.3.2 (e). Photo 20 illustrates a sealed bitumen road (Caves Road). Class A (Forest) vegetation, associated with Plot 1, is situated to the left within the photo.			
Photo ID:	21	Plot:	9
Vegetation Classification or Exclusion Clause			
Exclusion 2.2.3.2 (e)			
Description / Justification for Classification			
Plot 9 contains non-vegetated areas, which have been excluded in accordance with Clause 2.2.3.2 (e). Photo 21 illustrates a sealed bitumen road (Roberts Road and Dawson Avenue).			
			
			
			

Bushfire Management Plan

Abbey South Structure Plan Area



Table 2: Pre-development vegetation classification and/or exclusions, effective slope and future management (continued)

Photo ID:	22	Plot:	9
Vegetation Classification or Exclusion Clause			
Exclusion 2.2.3.2 (e)			
Description / Justification for Classification			
Plot 9 contains non-vegetated areas, which have been excluded in accordance with Clause 2.2.3.2 (e). Photo 22 illustrates a sealed bitumen road (Bussell Highway). Maintained vegetation is also present within the road reserve.			
Photo ID:	23	Plot:	9
Vegetation Classification or Exclusion Clause			
Exclusion 2.2.3.2 (e)			
Description / Justification for Classification			
Plot 9 contains non-vegetated areas, which have been excluded in accordance with Clause 2.2.3.2 (e). Photo 23 illustrates a sealed bitumen road (Caves Road). Maintained vegetation is also present within the road reserve.			
Photo ID:	24	Plot:	9
Vegetation Classification or Exclusion Clause			
Exclusion 2.2.3.2 (e)			
Description / Justification for Classification			
Plot 9 contains non-vegetated areas, which have been excluded in accordance with Clause 2.2.3.2 (e). Photo 24 illustrates a sealed carpark associated with the Shed Markets. Maintained gardens are also present. The large trees present within the rear of the photograph are associated with the woodland vegetation (Plot 2).			
			
			
			

Bushfire Management Plan

Abbey South Structure Plan Area



Table 2: Pre-development vegetation classification and/or exclusions, effective slope and future management (continued)



Photo ID:	25	Plot:	10
Vegetation Classification or Exclusion Clause			
Exclusion 2.2.3.2 (f)			
Description / Justification for Classification			
Plot 10 consists of low threat vegetation associated with large private landholdings and the RAC Busselton Holiday Park, which has been excluded in accordance with Clause 2.2.3.2 (f). Photo 25 illustrates that the grass and fine fuel load is maintained to a length less than 100 mm (foreground is within the site, associated with Plot 7).			
Photo ID:	26	Plot:	10
Vegetation Classification or Exclusion Clause			
Exclusion 2.2.3.2 (f)			
Description / Justification for Classification			
Plot 10 consists of low threat vegetation associated with the RAC Busselton Holiday Park, which has been excluded in accordance with Clause 2.2.3.2 (f). Photo 26 illustrates that the grass and fine fuel load is maintained to a length less than 100 mm (in background, foreground is within the site, associated with Plot 7).			
Photo ID:	27	Plot:	10
Vegetation Classification or Exclusion Clause			
Exclusion 2.2.3.2 (f)			
Description / Justification for Classification			
Plot 10 consists of low threat vegetation associated with the RAC Busselton Holiday Park, which has been excluded in accordance with Clause 2.2.3.2 (f). Photo 27 illustrates that the grass and fine fuel load is maintained (in the mid/background, foreground is within the site, associated with Plot 8) and numerous buildings/structures are established.			
			
			
			

Bushfire Management Plan

Abbey South Structure Plan Area



Table 2: Pre-development vegetation classification and/or exclusions, effective slope and future management (continued)


Photo ID:	28	Plot:	10
Vegetation Classification or Exclusion Clause			
Exclusion 2.2.3.2 (f)			
Description / Justification for Classification			
A small area of retained remnant vegetation contains a well-managed perimeter, with a regularly maintained understory/midstorey (including low pruning of branches), including footpaths and play areas. The portion within 150 m of the is identified as low threat, with a fenced unmanaged portion further east.			
Photo ID:	29	Plot:	4a
Vegetation Classification or Exclusion Clause and Effective Slope			
Woodland (Class B) - Flat/upslope			
Description / Justification for Classification			
Woodland vegetation has been identified external to the south of the site associated with areas of road reserve between Skiff Way and Caves Road. The area is dominated by a scattered overstorey of Agonis flexuosa and Eucalyptus rudis (flooded gum) up to 10 m in height with a foliage cover of approximately 30%. Grasses are present throughout the understory. Some management is evident with recent trimming of grasses and weed control visible, however the area has been conservatively assessed as woodland.			
			

Bushfire Management Plan

Abbey South Structure Plan Area



Table 2: Pre-development vegetation classification and/or exclusions, effective slope and future management (continued)

Photo ID:	30	Plot:	4b
Vegetation Classification or Exclusion Clause and Effective Slope			
Scrub (Class D) – Flat/upslope			
Description / Justification for Classification			
Scrub vegetation is identified south of the site within the Skiff Way/Caves Road reserve. The vegetation comprises native shrubs 3-4 m in height with scattered (less than 10%) <i>Agonis flexuosa</i> . There is evidence of some understory management, with recently trimmed grasses and weed control occurring. However, the plot contains some unmanaged fuel loads under dense vegetation and accordingly has been conservatively assessed as scrub vegetation.			
Photo ID:	31	Plot:	5
Vegetation Classification or Exclusion Clause and Effective Slope			
Scrub (Class D) – Flat/upslope			
Description / Justification for Classification			
Scrub vegetation is identified to the southeast of the site as part of a Caves Road/Bussell Highway road reserve. The vegetation comprises predominantly <i>Melaleuca</i> species and <i>Grevillea</i> species amongst <i>Agonis flexuosa</i> . Based on species identified, vegetation is anticipated to predominantly attain a height of 3-6 m. Some understory management was evident throughout the area, with mulch applied and weeds controlled. However due to the density of planting and a consistent vegetation structure the area has been conservatively assessed as scrub.			
			
			

3.2 Assessment outputs

3.2.1 BHL assessment

A BHL assessment has been prepared for the site and surrounding 150 m based on the existing vegetation conditions (see **Figure 2**), with the hazard ratings determined in accordance with Appendix Two of the Guidelines and shown in **Figure 3**.

The outcomes of the assessment indicate that the site and surrounding 150 m assessment area include predominantly moderate bushfire hazards, associated with existing unmanaged grassland. Patches of forest and scrub vegetation (largely associated with native vegetation within road reserves) are identified as an extreme hazard. The majority of the vegetation within the site will be

Bushfire Management Plan

Abbey South Structure Plan Area



modified, and following development, large portions of the site will be subject to a low bushfire hazard.

3.2.2 BAL assessment

3.2.2.1 Assumptions

The BAL assessment for the site has been undertaken in accordance with Method 1 of AS 3959 to determine the maximum heat flux to which future dwellings within the site are likely to be exposed.

The vegetation classification and effective slope applicable to vegetation within or nearby to the site in the post-development scenario have been summarised in **Table 3**. Overall, the BAL assessment criteria assumed includes:

- **Designated FDI:** 80
- **Flame Temperatures:** 1090 K
- **Vegetation classification:** forest (Class A), scrub (Class D) and grassland (Class G), see **Figure 4** and summarised in **Table 3**.
- **Effective slope beneath classified vegetation:** flat/upslope, as outlined in **Figure 4** and summarised in **Table 3**.
- **Setback distances:** as per **Table 2.5** in AS 3959 with the relevant distances used to inform the BAL contour plan summarised in **Table 4** with the BAL contour provided in **Figure 5**.
- Vegetation within the RAC Busselton Holiday Park appears well managed and is assumed to remain so given the ongoing use of the site, despite the tree canopy present along the western boundary. Vegetation situated within the southern portion of the holiday park is unmanaged and has been classified as scrub (Class D).
- Remnant native vegetation situated immediately north of the site is assumed to remain in the long term.
- POS areas, as per City of Busselton requirements, have been assumed to pose a bushfire hazard, even though future management of these spaces is likely.
- Public roads will be installed by the developer to the minimum standards required under Appendix Four of the Guidelines and maintained by the City of Busselton in the long term.
- Areas of low threat vegetation outside the site will continue to be managed and/or considered to achieve low threat (in accordance with Section 2.2.3.2 of AS 3959) based on the existing maintenance regimes, and/or as per the City of Busselton Fire Break Notice.
- Classified vegetation that has been identified outside of the proponent's landholdings has been assumed to remain in its current state (unless stated otherwise) and will therefore continue to be a bushfire hazard to development within the site.
- Areas of grassland can include up to 10% foliage cover from shrubs and trees, per AS 3959.

Bushfire Management Plan

Abbey South Structure Plan Area



Table 3: Summary of the assumed post-development vegetation classification and associated effective slope within the site and 150 m in accordance with Table 2.5 (AS3959)

Plot number	Pre-development vegetation classification	Post-development vegetation classification	Effective slope
Plot 1	Class A – Forest	Class A – Forest	Flat/upslope
Plot 2	Class B – Woodland	Exclusion 2.2.3.2 (e) – existing woodland will be cleared to support construction of roads and lots, or will be managed at the rear of future residential lots.	Not applicable
Plot 3	Class D – Scrub	Exclusion 2.2.3.2 (e) – existing scrub will be removed to support construction of roads and lots.	Not applicable
Plot 4a	Class B – Woodland	Class B – Woodland	Flat/upslope
Plot 4b	Class D – Scrub	Class D – Scrub	Flat/upslope
Plot 5	Class D – Scrub	Class D – Scrub	Flat/upslope
Plot 6	Class D – Scrub	Class D – Scrub	Flat/upslope
Plot 7	Class G – Grassland	Exclusion 2.2.3.2 (e) – including developed areas within the site.	Flat/upslope
Plot 8	Class G – Grassland	Class G – Grassland	Flat/upslope
Plot 9	Exclusion 2.2.3.2 (e)	Exclusion 2.2.3.2 (e) – including developed areas within the site.	Not applicable
Plot 10	Exclusion 2.2.3.2 (f)	Exclusion 2.2.3.2 (f) – associated with existing managed adjacent landholdings (including RAC Holiday Park)	Not applicable
Plot 11	Class B – Woodland / Class G – Grassland	Class D – Scrub – associated with POS areas that will include planted areas (including gardens, turf and hardscape/play elements) and retained paddock trees. This includes the stand of woodland, where the trees are retained but due to their height and potential future planting for screening purposes, will be more 'Scrub' vegetation. As per City of Busselton requirements, POS is required to be identified as a bushfire hazard, even though management of the POS is likely to occur. Scrub classification is suitable based on likely parkland/garden bed planting (height less than 6 m), and would not achieve a forest classification.	Flat/upslope
Plot 12	Class G – Grassland	Class G – Grassland – associated with the floodway and a small pocket parks. As per City of Busselton requirements, these areas are required to be identified as a bushfire hazard, even though management of the POS is likely to occur. Grassland classification is assumed based on the likely planting approach (grass and sedge planting with trees less than 10% foliage cover) and eventual public use of the space.	Flat/upslope

3.2.2.2 BAL outputs

The BAL assessment completed for the site indicates that the majority of the areas proposed for residential development (and therefore future habitable buildings) can achieve BAL-29 or below based on the proposed concept plan, as shown in **Figure 5**. Small portions of residential land are subject to BAL-40 and BAL-FZ, however the higher ratings are generally associated with temporary hazards (refer to **section 4.1**) or areas of public open space which is likely to include access trails (e.g. walking/bridle) and there is sufficient area to accommodate habitable buildings within BAL-29 or below using in-lot setbacks and can be addressed as part of the future detailed planning process.

Bushfire Management Plan

Abbey South Structure Plan Area



Table 4 provides a summary of the setback distances necessary from classified vegetation to achieve the indicated BAL ratings, with the BAL contour plan (**Figure 5**) being a visual representation of these distances. The setback distances are based on the post-development classified vegetation and effective slope (described in **Table 3** and shown in **Figure 4**), and are taken from Table 2.5 of AS 3959.

Table 4: Setback distances based on vegetation classification and effective slope and Table 2.5 of AS 3959, as determined by the method 1 BAL assessment

Plot number	Vegetation classification (see Figure 4)	Effective slope (see Figure 4)	Distance to vegetation (from Table 2.5 of AS 3959)	BAL rating (see Figure 5)
Plot 1	Forest (Class A)	Flat/upslope (0°)	< 16 m	BAL-FZ
			16 - < 21 m	BAL-40
			21 - < 31 m	BAL-29
			31 - < 42 m	BAL-19
			42 - < 100 m	BAL-12.5
			> 100 m	BAL-LOW
			Plot 4a	Woodland (Class B)
10 - < 14 m	BAL-40			
14 - < 20 m	BAL-29			
20 - < 29 m	BAL-19			
29 - < 100 m	BAL-12.5			
> 100 m	BAL-LOW			
Plot 4b, 5, 6 and 11	Scrub (Class D)	Flat/upslope (0°)		
			10 - < 13 m	BAL-40
			13 - < 19 m	BAL-29
			19 - < 27 m	BAL-19
			27 - < 100 m	BAL-12.5
			> 100 m	BAL-LOW
			Plot 8 and 12	Grassland (Class G)
6 - < 8 m	BAL-40			
8 - < 12 m	BAL-29			
12 - < 17 m	BAL-19			
17 - < 50 m	BAL-12.5			
> 50 m	BAL-LOW			

Bushfire Management Plan

Abbey South Structure Plan Area



4 Identification of Bushfire Hazard Issues

From a bushfire hazard management perspective, the key issues that are likely to require management and/or consideration as part of future development within the site include:

- Provision of appropriate separation distances from permanent bushfire hazards to ensure a BAL rating of BAL-29 or less can be achieved for future habitable buildings. This includes allowances for areas of existing remnant vegetation associated with the Class A forest to the north of the site, Class D scrub vegetation to the east and south-west and Class G grassland to the south and south-east of the site.
- Provision of appropriate vehicular access to ensure that when development within the site is fully constructed, egress to at least two different destinations will be available to future residents and emergency personnel. This may include the use of temporary no through roads and/or emergency access ways (EAWs) as part of internal staging of the subdivision, until the full road network associated with the development is constructed.
- Provision of appropriate water supply dedicated to firefighting purposes (i.e. reticulated water supply and associated hydrant network).

These issues are considered further in **Section 5**.

4.1 Temporary hazards

Grassland vegetation to the south-east of the site is considered a temporary hazard, associated with existing rural lots likely to be subject to future residential development. This vegetation has been identified as a bushfire hazard for the purposes of this assessment given timing for development is unknown.

As part of staged development within the site, temporary Class G grassland hazards may be present, however if a minimum 50 m-wide area around each stage (where within the proponent's landholding) is managed, resulting BAL ratings can be mitigated. Vegetation will need to be managed by the proponent until the long-term residential development progresses.

4.2 Permanent hazards

Within the site, the proposed POS areas have been assumed to be a bushfire hazard, with vegetation classifications of scrub (Class D) and grassland (Class G) assumed depending upon the pre-development and likely use (including screening function to Bussell Highway proposed where existing vegetation is present). The majority of the POS areas are assumed to achieve a 'scrub' classification, which is considered a conservative assessment of bushfire risk given these areas will contain a mix of turf, mulched garden beds, footpaths, hardscape areas and play areas. The floodway area is assumed to be grassland, to reflect likely grass/sedge planting to accommodate recreation and drainage (similar for the pocket parks in the east).

Bushfire Management Plan

Abbey South Structure Plan Area



Outside the site, the surrounding 150 m comprises areas of classified vegetation, with large areas of low threat vegetation and non-vegetated land. Classified vegetation surrounding the site includes:

- Class A – Forest vegetation situated immediately north of the site, adjacent to Caves Road.
- Class B – Woodland vegetation within a small area of vegetation in the Skiff Way/Bussel Highway road reserve.
- Class D – Scrub vegetation to the east and south-west, associated with vegetation in Bussel Highway that is subject to some management and unmanaged vegetation within the RAC Busselton Holiday Park.
- Class G – Unmanaged grassland vegetation to the south of the site, associated with a long-term cleared area identified as the Broadwater Nature Reserve Swamp and subject to heavy ongoing grazing and regular inundation.

Bushfire Management Plan

Abbey South Structure Plan Area



5 Assessment Against the Bushfire Protection Criteria

This BMP provides an outline of the mitigation strategies that will ensure that as development progresses within the site, an acceptable solution can be adopted for each of the bushfire protection criteria detailed within Appendix Four of the Guidelines. The bushfire protection criteria identified in the Guidelines and applicable/addressed as part of this BMP are:

- Element 1: Location of the development
- Element 2: Siting and design of the development
- Element 3: Vehicular access
- Element 4: Water supply.

As part of future development, it is likely that an ‘acceptable solution’ will be able to address the intent of all four bushfire protection criteria. A summary of how this can be achieved and an associated compliance statement for each has been provided in **Table 5**.

Table 5: Assessment against the bushfire protection criteria from the Guidelines

Bushfire protection criteria	Proposed bushfire management strategies
Element 1: Location	
A1.1 Development location	<p>Element 1 (through Position Statement: Planning in bushfire prone areas – Demonstrating Element 1: Location and Element 2: Siting and design (DPLH 2019b)) is an applicable consideration for Intensification of land use as part of strategic planning, to determine the appropriate allocation of land for various land uses. In this instance, the rezoning of the site from ‘rural’, ‘conservation’ and ‘tourism’ under the City of Busseton Local Planning Scheme No. 21 (LPS No.21) is intended to provide opportunities for future residential development of the site. This is in accordance with the Leuwin-Naturaliste Subregional Strategy (DPLH 2019a) which identifies the site for tourism, aged care, mixed use and/or medium density residential development.</p> <p>The majority of the site is identified as a moderate hazard, associated with the existing cleared paddocks identified as grassland vegetation. The site addresses Clause 6.2 (b) of SPP 3.7, which requires development to have a moderate hazard level rating or be able to achieve BAL-29 or less, either before or as part of implementing the proposed development. The future residential development cells will be in areas of low hazard once development is progressed and will be able to achieve BAL-29 or less. Small portions of some of the development cell may be subject to BAL-40 and BAL-FZ as a result of identified scrub and grassland bushfire hazards, either temporary hazards identified within adjacent rural lots, or assumed bushfire risk from vegetation within the POS areas (either associated with the floodway, or areas which will likely have some management and part of the setbacks will be accommodated outside the lots), however the development cell contains sufficient area to accommodate habitable buildings within BAL-29 or below using in-lot setbacks. This can be addressed as part of the future planning process. Consideration of achieving BAL-29 or less for development is addressed under Element 2 further below.</p> <p>Therefore, the proposal complies with A1.1.</p>

Bushfire Management Plan

Abbey South Structure Plan Area



Table 5: Assessment against the bushfire protection criteria from the Guidelines (continued)

Bushfire protection criteria	Proposed bushfire management strategies
Element 2: Siting and design	
A2.1 Asset Protection Zone	All proposed development areas that are intended to support habitable buildings are able to achieve an asset protection zone (APZ) with sufficient separation from classified vegetation to achieve BAL-29 or below. Separation from permanent bushfire hazards is provided within the structure plan through the management of future lots, and the strategic placement of public roads. Overall, the development cells within the site are suitably sized to accommodate the minimum separation distances (outlined in Table 4 and shown in Figure 5) required to achieve BAL-29 or less at future habitable buildings/developable land ² . Where within lots, this would be a maximum of 13 m-wide. As part of future detailed planning, consideration will need to be given to any identified bushfire hazards, and the spatial provisions to enable appropriate setbacks (which form the basis for the APZ) to be accommodated, including the provision of public roads and in-lot setbacks (as required).
Therefore, the proposal complies with A2.1 .	
Element 3: Vehicular access	
A3.1 Public roads	Surrounding public roads (i.e. Caves Road, Bussell Highway) and all new internal public roads can and will be able to comply with the minimum standards outlined in Appendix Four of the Guidelines (DPLH & WAPC 2021). The concept plan indicates road reserves will likely vary between 16 m and 20 m wide, meeting neighbourhood connectors and access street requirements, as per the IPWEA guidelines (refer to Plate 4 further below).
Therefore, the proposal complies with A3.1 .	
A3.2a Multiple access routes	The site has direct frontage to Caves Road to the north and Bussell Highway to the east, providing opportunities to accommodate egress to different destinations as shown in the structure plan and proposed concept plan provided in Appendix A . The site will connect to Caves Road via two access points, and to Bussell Highway via one access points, with connections generally shown in Figure 6 . Caves Road and Bussell Highway are major regional connectors, providing egress to the south, east and west (Vasse, Dunsborough and Busselton townsites respectively). Existing areas of residential development are located to the north and east. Following development of the site, the site will be part of a residential built out area. The proposed development complies with A3.2a .
As part of future planning, future residential development should provide for an interconnected road network which can connect with the existing public road network, ensuring two access routes to at least two different destinations is available to future occupants at all times, and may include the use of temporary emergency access ways (EAWs) as part of staged development. The specific layout for future internal roads and connections to the existing surrounding public roads will be determined as part of future subdivision stages and landowners that may progress subdivision at different times (and therefore subject to some variability in the specifics for implementation) however given the existing public road network surrounding the site, future development can comply with the requirements of the Guidelines.	

² Position Statement: Planning in bushfire prone areas - Demonstrating Elements 1: Location and Element 2: Siting and design Department of Planning, Lands and Heritage (DPLH) 2019b, Position Statement: Planning in bushfire prone areas - Demonstrating Element 1: Location and Element 2: Siting and design, Western Australian Planning Commission. has outlined that 'developable land' is "land that can accommodate a habitable dwelling and would not generally include areas of BAL-40 and/or BAL-FZ, areas within the local government setback and areas subject to environmental constraints".

Bushfire Management Plan

Abbey South Structure Plan Area



Table 5: Assessment against the bushfire protection criteria from the Guidelines (continued)

Bushfire protection criteria	Proposed bushfire management strategies
Element 3: Vehicular access (continued)	
A3.2b Emergency access way	<p>Given the development will be able to provide egress to at least two different destinations (in line with Acceptable Solution A3.2a), it is unlikely an emergency access way (EAWs) will be required.</p> <p>It is possible that the western-most development cell may have a single internal access road to/from the cell. This may be required to enable retention of existing vegetation and manage the drainage and floodway within the POS network. The provision of access to multiple destinations can be addressed through provision of a public road connection or emergency access way within the southern central portion of the site, as shown in Figure 6 and Appendix A. The use of an EAW, based on site constraints, would satisfy the requirements of the Guidelines.</p> <p>If any EAWs (including temporary EAWs as part of staged development) are proposed they will need to comply with the minimum technical requirements outlined in Appendix Four of the Guidelines, or as agreed with the City of Busselton, including trafficability, width and length of the road. It is acknowledged that temporary EAWs may need to be longer than 500 m in some instances (due to land ownership considerations and staging of development) however would not pose a significant variance to the Guidelines.</p> <p>The proposed development can comply with A3.2b.</p>
A3.3 Through-roads	<p>One permanent no-through roads is proposed in the site, as part of managing access to Bussel Highway as per the requirements of Main Roads WA. The proposed permanent no-through road is less than 200 m in length and can meet the acceptable solution (see Appendix A and Figure 6). One temporary no-through roads will be present as a result of undeveloped land to the south (see Appendix A and Figure 6), which has no determined timeframes for development at this stage. This no through road will not service any lots in the site (all will be serviced by the loop road) and is proposed to accommodate a road connection as requested by the Western Australian Planning Commission/City of Busselton. It is less than 200 m in length and can meet the acceptable solution.</p> <p>Where no through-roads are proposed, these will need to comply with the minimum requirements outlined in Appendix Four of the Guidelines, including provision of an appropriate turn-around area. Where temporary no through-roads are required as part of staged development, these should also comply with Appendix Four of the Guidelines or as agreed with the City of Busselton. The proposal is able to comply with A3.3.</p>
A3.4a Perimeter roads	<p>The structure plan and concept plan (see Appendix A) indicates internal perimeter roads will be provided around all areas identified as a possible bushfire hazard to future residential development cells, with the exception of residential cells adjoining areas of scrub and grassland vegetation to the south and south-east, associated with a future POS area or temporary hazards to the south-east. The required setbacks to these hazards can be accommodated within the development cell and as part of future lot design. In accordance with the Guidelines, a perimeter road is not required for grassland vegetation.</p> <p>The future development of the cell adjoining the scrub vegetation (in the POS) is anticipated to be deeper lots. There is sufficient area to provide suitable separation from classified vegetation in the lots. The setback is also likely to be partially accommodated in the POS area as part of a likely walking/bridle trail for the broader area (which can also provide access for fire-fighting if required). The design and management will be confirmed during detailed design. The proposed development complies with A3.4a.</p>

Bushfire Management Plan

Abbey South Structure Plan Area



Table 5: Assessment against the bushfire protection criteria from the Guidelines (continued)

Bushfire protection criteria	Proposed bushfire management strategies
Element 3: Vehicular access (continued)	
A3.4b Fire service access route	None proposed as this stage. As outlined above, the future road layout within the site will be designed as part of future planning stages. However, given the development will be able to provide egress to two different destinations (in line with Acceptable Solution A3.1), and the site is bounded by existing public roads that will provide firefighter access around the perimeter of the site (see Figure 6), as well as internal perimeter roads for the majority of the cells, it is unlikely that any fire service access routes (FSARs) will be required. If any FSARs are proposed in the future, they will need to comply with the requirements of the Guidelines (or as agreed with the City of Busselton).
A3.5 Battle-axe access legs	The existing residence that is accommodated by the structure plan within a single lot has a battle-axe leg type access arrangement proposed. This is required to accommodate the existing residence and balance the changes to the development layout requested by the Western Australian Planning Commission. This can satisfy the relevant requirements of the Guidelines.
A3.6 Private driveways	Elsewhere, none are proposed at this stage. As part of the future development of the site, while battle-axe access legs should be avoided where possible within designated bushfire prone areas, if proposed as part of future development, their inclusion will need to be justified and will need to address the minimum standards outlined in Appendix Four of the Guidelines which includes technical requirements in Table 6 (reproduced in Plate 4).
Element 4: Water	
A4.1 Identification of future water supply	The proposed development is located in an area that is serviced by reticulated water supply, which will be expanded to include the site, as confirmed by Busselton Water (Stantec 2021).
A4.2 Provision of water for fire fighting purposes	Not applicable at this stage in the process. The site will be serviced by a network of reticulated water hydrants as per the relevant water supply authority requirements (Busselton Water) (or as otherwise determined by a relevant approval authority).

Bushfire Management Plan

Abbey South Structure Plan Area



Table 6: Vehicular access technical requirements

TECHNICAL REQUIREMENTS	1 Public roads	2 Emergency access way ¹	3 Fire service access route ¹	4 Battle-axe and private driveway ²
Minimum trafficable surface (metres)	In accordance with A3.1	6	6	4
Minimum horizontal clearance (metres)	N/A	6	6	6
Minimum vertical clearance (metres)		4.5		
Minimum weight capacity (tonnes)		1.5		
Maximum grade unsealed road ³		1:10 (10%)		
Maximum grade sealed road ³	As outlined in the IPWEA Subdivision Guidelines	1:7 (14.3%)		
Maximum average grade sealed road		1:10 (10%)		
Minimum inner radius of road curves (metres)		8.5		

Notes:

¹ To have crossfalls between 3 and 6%.

² Where driveways and battle-axe bays are not required to comply with the widths in A3.5 or A3.6, they are to comply with the Residential Design Codes and Development Control Policy 2.2 Residential Subdivision.

³ Dips must have no more than a 1 in 8 (12.5% 7.1 degree) entry and exit angle.

Plate 4: Excerpt of Table 6 from The Guidelines (DPLH & WAPC 2021)

5.1 Additional management strategies

5.1.1 Future approval considerations

A BAL assessment has been prepared for the site to demonstrate that best practice management strategies can be adopted through future planning and implementation stages to ameliorate the bushfire hazards (i.e. habitable buildings can be located in areas of BAL-29 or less) that would otherwise impact upon its future development.

A BMP, bushfire statement and/or updated BAL contour plan, may be required to support future subdivision for the site, to detail how the proposed development layout has or will address the bushfire protection criteria based on the recommendations outlined within this BMP, as well as to determine the likely BAL ratings applicable to the future habitable buildings based on hazards applicable to that stage of development.

Where proposed to be constructed and within a designated bushfire prone area, future Class 1, 2, 3 and 10a buildings in an area subject to a BAL rating of BAL-12.5 or higher will need to satisfy higher construction standards in accordance with the National Construction Code (NCC) (i.e. AS 3959 or the National Association for Steel-framed Housing (NASH) Standard).

Bushfire Management Plan

Abbey South Structure Plan Area



5.1.2 Landscape management

5.1.3 Within the site

Public open space (POS) areas

In accordance with the requirements of the City of Busselton, all POS areas proposed as part of development within the site have been identified as classified vegetation and a bushfire hazard (scrub or grassland depending upon the pre-development scenario and expected use/purpose). No ongoing management has been assumed in these POS areas for bushfire purposes and the planting approach will ensure the predicted classification is achieved without further intervention by the City of Busselton. It is noted from an amenity, public use and community expectation perspective management is likely to occur but is not included in the assumptions for this BMP.

The design and construction of POS areas is generally a condition of subdivision approval, and the detailed design will be determined in collaboration with the City of Busselton as part of the standard development process (and based on typical maintenance requirements for urban/residential areas).

Managed areas

It is recommended that as part of the staged development within the site and to minimise the impacts of temporary (grassland) hazards on proposed lots, the proponent should manage a minimum 50 m-wide area immediately surrounding each subdivision stage (where within their broader landholding) to a low threat standard. This would include permanently removing the grass vegetation (the vegetation classification applicable to the site in its current condition) and/or regularly throughout any year mowing/slashing the grass to 100 mm in height or less. This would be maintained by the proponent until residential development progresses.

Within public road reserves

The proposed road reserves will be designed and maintained to achieve a low threat in accordance with Section 2.2.3.2 (e) and (f) of AS 3959, as shown in **Figure 4** and will be the responsibility of the proponent initially until handover to the City of Busselton. Road reserves will be managed as per current typical arrangements and do not require extra attention compared to existing residential areas and standards.

5.1.3.1 Surrounding the site

Public open space and road reserves

Areas of existing public open space will continue to be maintained by the City of Busselton and or Main Road Western Australia in accordance with the existing maintenance regimes.

Within private landholdings

The private landholdings surrounding the site are assumed to be managed by the applicable landowners in accordance with the City of Busselton firebreak notice in perpetuity.

Bushfire Management Plan

Abbeey South Structure Plan Area



5.1.4 City of Bussetton annual firebreak notice

The City of Bussetton releases a firebreak notice annually (or as required) to provide a framework for bushfire management within the City. The City of Bussetton is able to enforce this order in accordance with Section 33(1) of the Bush Fires Act 1954 and landowners will need to ensure compliance with the fire break notice, as published, or any directions provided by the City of Bussetton.

Following development for residential purposes, all lots will be required under the firebreak notice to:

- Remove all hazardous material from the whole of the land except living trees. In the area remaining, vegetation is to be maintained to a height no greater than 10 centimetres; this includes piles of timber, branches and other vegetation.
- Tree branches shall be removed or pruned to ensure a clear separation of at least 3 metres from the eaves of all buildings and 5 metres above the top of the roof. Branches that may fall on the house must also be removed.

In addition, all lots subject to an approved bushfire management plan through subdivision will be required to comply with that plan. Based on this BMP, and similar provisions applying, all areas within the site will need to be managed to achieve low threat in accordance with Section 2.2.3.2 of AS 3959.

5.1.5 Vulnerable or high-risk land uses

Currently, no high-risk land uses, as defined under SPP 3.7, are proposed within the site as part of the scheme amendment or structure plan.

Where high-risk or vulnerable land uses are proposed in the future, these will need to address the requirements of policy measure 6.6 of SPP 3.7, including the assessment of bushfire risk and/or the preparation of an emergency evacuation plan (for vulnerable land uses) or risk management plan (for high-risk land uses) where subject to a BAL rating greater than BAL-LOW. This will be dealt with as part of future detailed planning stages. The location of the site in an area of largely moderate bushfire hazard (which will transition to low with residential development) and connection to the public road network, including Caves Road and Bussett Highway, means key considerations such as separation from bushfire hazards and emergency access will be able to be addressed.

Bushfire Management Plan

Abbey South Structure Plan Area



5.1.6 Public education and preparedness

Community bushfire safety is a shared responsibility between individuals, the community, government and fire agencies. DFES has an extensive Community Bushfire Education Program including a range of publications, a website and Bushfire Ready Groups. The DFES website (<https://www.dfes.wa.gov.au/bushfire/prepare/>) provides a range of materials to help the community prepare for and survive the bushfire season.

The City of Busselton provides bushfire safety advice to residents available from their website. Professional, qualified consultants also offer bushfire safety advice and relevant services to residents and businesses in high-risk areas in addition that that provided in this BMP.

In the case of a bushfire in the area, advice would be provided to residents and businesses by DFES, the DBCA and/or the City of Busselton on any specific recommendations with regard to responding to the bushfire, including evacuation if required. It is recommended that future residents make themselves aware of their responsibilities with regard to preparing for and responding to a potential bushfire that may impact them, their family and property, regardless of the BAL rating their properties are subject to.

Bushfire Management Plan

Abbey South Structure Plan Area



6 Responsibilities for Implementation and Management of Bushfire Measures

Subject to the approval of the proposed scheme amendment and structure plan, development within the site for residential purposes will be implemented through the preparation of future subdivision application(s).

Table 6 outlines the future responsibilities of the proponent (developer) and the City of Busselton associated with implementing the proposed scheme amendment and structure plan, with reference to future mitigation measures to be accommodated as part of subdivision (in particular, consideration of spatial layout requirements). These responsibilities will need to be considered as part of the subsequent planning process.

Additional bushfire mitigation responsibilities will be required at subdivision for the residential development of the site, including responsibilities for future lot owners.

Table 6: Responsibilities for the implementation of this BMP

Proponent – to support the scheme amendment, structure plan and future subdivision		
No.	Implementation and management actions	Timing
1	Provide a copy of this BMP to the relevant decision makers to support the approval of the proposed scheme amendment and structure plan.	To support the scheme amendment and structure plan approval process.
2	Following approval of the scheme amendment, prepare a BMP or bushfire statement (as required) in accordance with SPP 3.7, the Guidelines (as updated) and AS 3959 to support future subdivision within portions of the site that are designated as bushfire prone areas under the Map of Bush Fire Prone Areas. This should be based on the proposed spatial layout of the development. Where the assumptions and outcomes of this BMP are met through subdivision design, the decision-maker may rely on this BMP for subdivision approval at their discretion.	To support future subdivision.
3	Where applicable, as part of the subdivision process, make spatial provisions for: <ul style="list-style-type: none"> • A suitable public road network that provides egress to at least two different destinations and meets the technical requirements of Table 6 within Appendix Four of the Guidelines (or as updated), or as otherwise determined by a bushfire consultant and relevant approval authority. Where required, this can include the use of emergency access ways (permanent or temporary) to address staged development considerations. • Where possible, avoid no through roads and battle-axe access legs as part of the spatial layout. If these are proposed as part of future development, they will need to be justified from a planning/development perspective and consistent with the minimum requirements outlined in Appendix Four of the Guidelines (or as updated), or as otherwise determined by a bushfire consultant and relevant approval authority. • Ensure future habitable buildings are able to be located in an area subject to BAL-29 or less. The minimum separation distances between habitable buildings and classified vegetation to achieve BAL-29 should be in accordance with Table 4 in this BMP or as specified in subsequent BAL assessments. These separation distances can be accommodated through locating public roads between the habitable building and classified vegetation and/or ensuring proposed residential lots are adequately sized to ensure BAL-29 is not exceeded at the future dwelling (and use of in-lot setbacks). • A water supply dedicated to firefighting purposes in the form of a reticulated network of water hydrants 	To support future structure planning and/or subdivision.

Bushfire Management Plan

Abbeey South Structure Plan Area



Table 6: Responsibilities for the implementation of this BMP (continued)

City of Busselton - ongoing		
No.	Implementation and management actions	Timing
1	Monitoring vegetation fuel loads in public reserves and liaising with relevant stakeholders to maintain fuel loads at minimal fuel levels, where required/applicable.	Ongoing, as required
2	Maintaining public road reserves under their management to appropriate standards, where required/applicable.	Ongoing, as required
3	Monitoring compliance with the City of Busselton annual firebreak notice and enforcing requirements as required.	Ongoing, as required

Bushfire Management Plan

Abbey South Structure Plan Area



7 Applicant Declaration

7.1 Accreditation

This BMP has been prepared by Emerge Associates who have a number of team members who have undertaken Bushfire Planning and Design (BPAD) Level 1 and Level 2 training and are Fire Protection Association of Australia (FPAA) accredited practitioners and/or in the process of obtaining accreditation. Emerge Associates have been providing bushfire risk management advice for more than 10 years, undertaking detailed bushfire assessments (and associated approvals) to support the land use development industry.

Anthony Rowe is a FPAA Level 3 BPAD accredited practitioner (BPAD No. 36690) in accordance with clause 6.12 of the Guidelines.

7.2 Declaration

I declare that the information provided is true and correct to the best of my knowledge.

Signature:

A handwritten signature in blue ink, appearing to read "AR", written over a light blue horizontal line.

Name: Anthony Rowe

Company: Emerge Associates/Envision Bushfire Protection

Date: 12 June 2024

BPAD Accreditation: Level 3 BPAD no. 36690

Bushfire Management Plan

Abbey South Structure Plan Area



8 References

8.1 General references

Department of Biodiversity, Conservation and Attractions (DBCA) 2020, Geomorphic Wetlands, Swan Coastal Plain (DBCA-019).

L. a. H. Department of Planning (DPLH) 2019a, Leeuwin-Naturaliste Sub-regional Strategy Western Australian Planning Commission, Perth.

Department of Planning, Lands and Heritage (DPLH) 2019b, Position Statement: Planning in bushfire prone areas - Demonstrating Element 1: Location and Element 2: Siting and design, Western Australian Planning Commission.

Department of Planning, Lands and Heritage, and Western Australian Planning Commission, (DPLH & WAPC) 2021, Guidelines for Planning in Bushfire Prone Areas Version 1.4, Perth, Western Australia.

Office of Bushfire Risk Management (OBRM) 2021, Map of Bush Fire Prone Areas. Landgate, <https://maps.slp.wa.gov.au/landgate/bushfireprone/>.

Standards Australia 2018, AS 3959:2018 Construction of buildings in bushfire-prone areas, Sydney.

Stantec 2021, Engineering Servicing Report, 36075, 2.

Western Australian Planning Commission (WAPC) 2015, State Planning Policy 3.7 Planning in Bushfire Prone Areas, Perth.

8.2 Online references

The online resources that have been utilised in the preparation of this report are referenced in **Section 8.1**, with access date information provided in **Table R-1**.

Table R 1 Access dates for online references

Reference	Date accessed	Website or dataset name
(OBRM 2021)	18 July 2022	Map of Bushfire Prone Areas

Figures



Figure 1: Site Location and Topographic Contours

Figure 2: Pre-development AS 3959 Vegetation Classifications

Figure 3: Pre-Development Bushfire Hazard Level

Figure 4: Post-development AS 3959 Vegetation Classifications and Effective Slope

Figure 5: Bushfire Attack Level Contour Plan

Figure 6: Spatial Representation of Bushfire Management Strategies

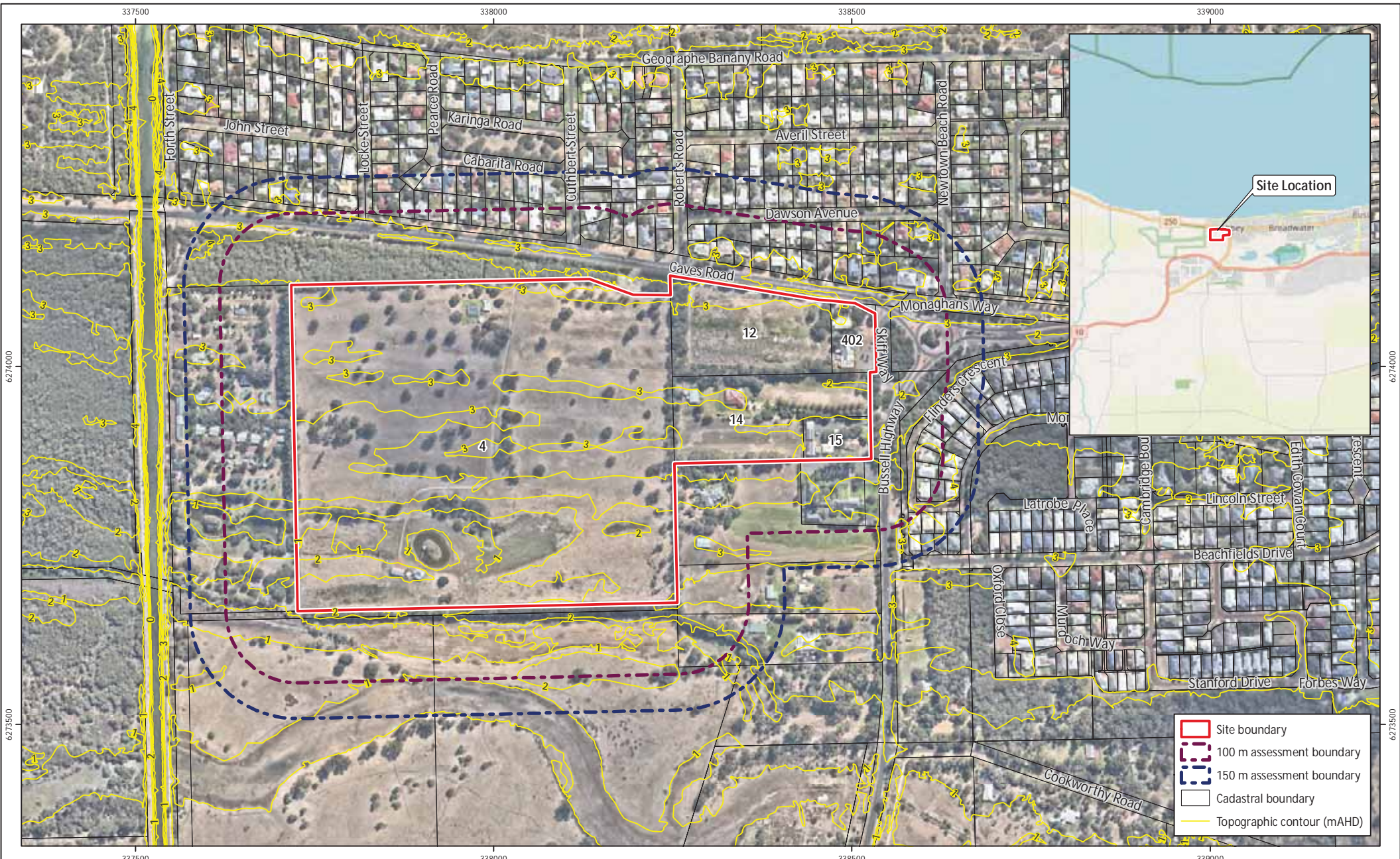


Figure 1: Site Location and Topographic Contours

Project: Bushfire Management Plan
Abbey South Structure Plan Area

Client: Various Landowners

Plan Number:
EP20-141(05)-F31

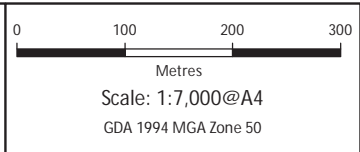
Drawn: GAR

Date: 18/07/2022

Checked: SJB

Approved: KK

Date: 28/07/2022



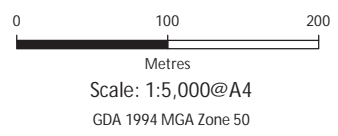
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Figure 2: Pre-Development AS 3959 Vegetation Classifications

Project: Bushfire Management Plan
Abbey South Structure Plan Area
Client: Various Landowners

Plan Number:
EP20-141(05)-F32a
Drawn: GAR
Date: 11/06/2024
Checked: KK
Approved: KK
Date: 11/06/2024



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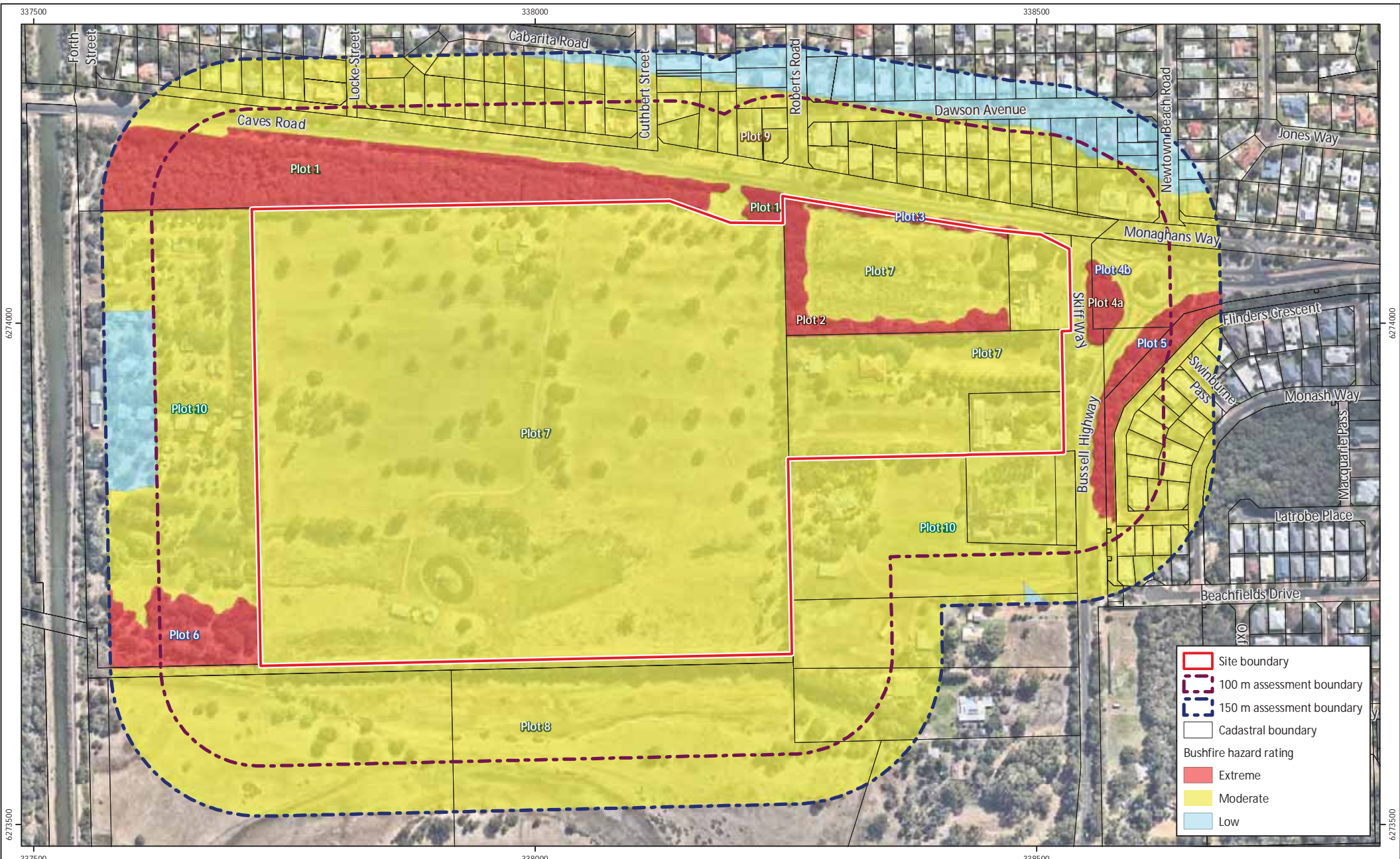
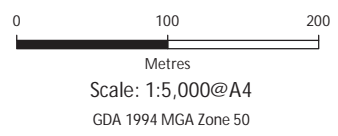


Figure 3: Pre-Development Bushfire Hazard Level

Project: Bushfire Management Plan
Abbey South Structure Plan Area
Client: Various Landowners

Plan Number:
EP20-141(05)--F33a
Drawn: GAR
Date: 11/06/2024
Checked: KK
Approved: KK
Date: 11/06/2024



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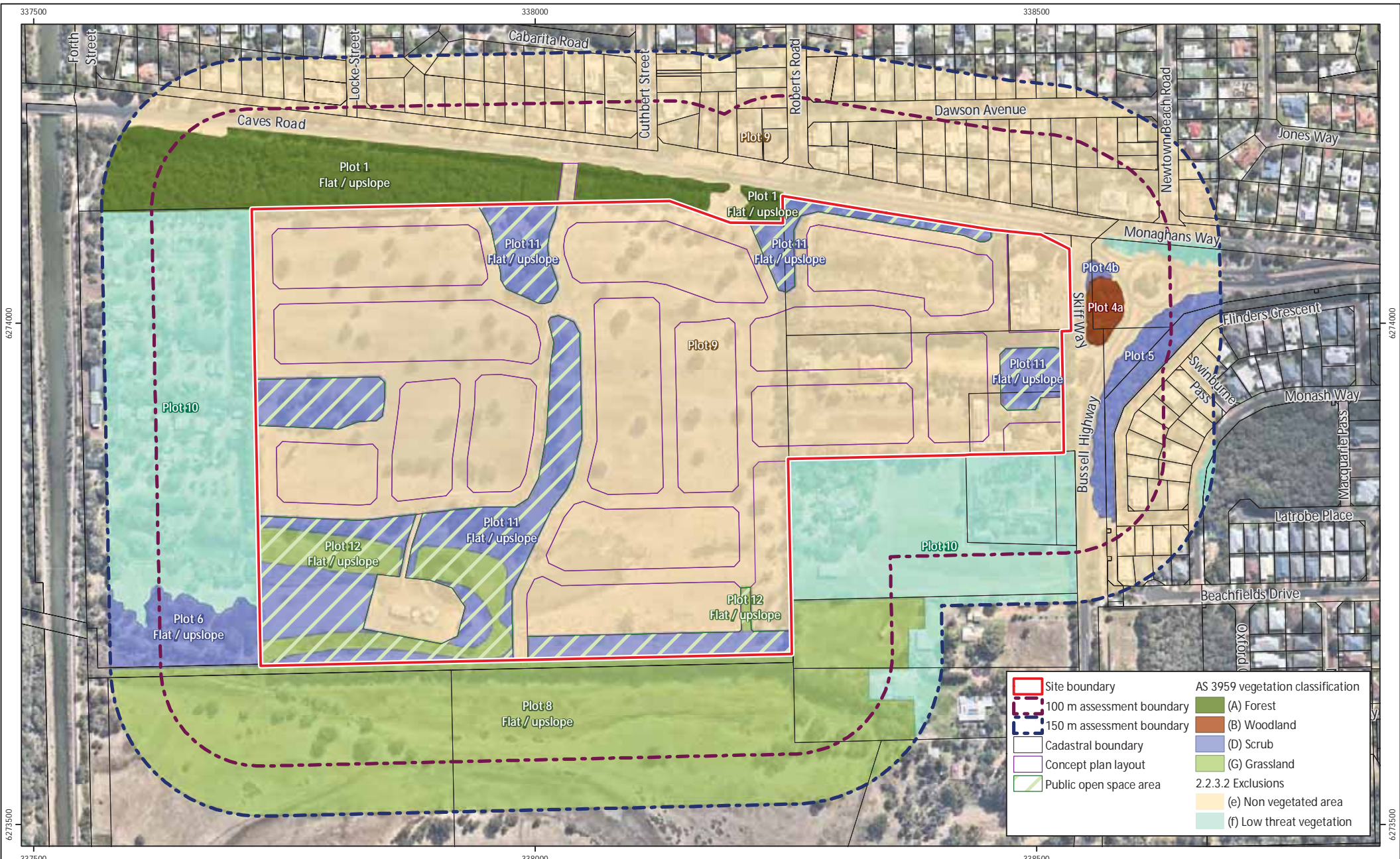
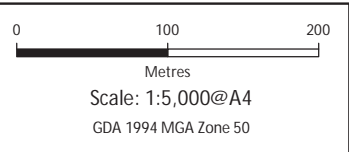


Figure 4: Post-Development AS 3959 Vegetation Classification and Effective Slope

Project: Bushfire Management Plan
Abbey South Structure Plan Area

Client: Various Landowners

Plan Number: EP20-141(05)--F34c
Drawn: GAR
Date: 11/06/2024
Checked: KK
Approved: KK
Date: 11/06/2024



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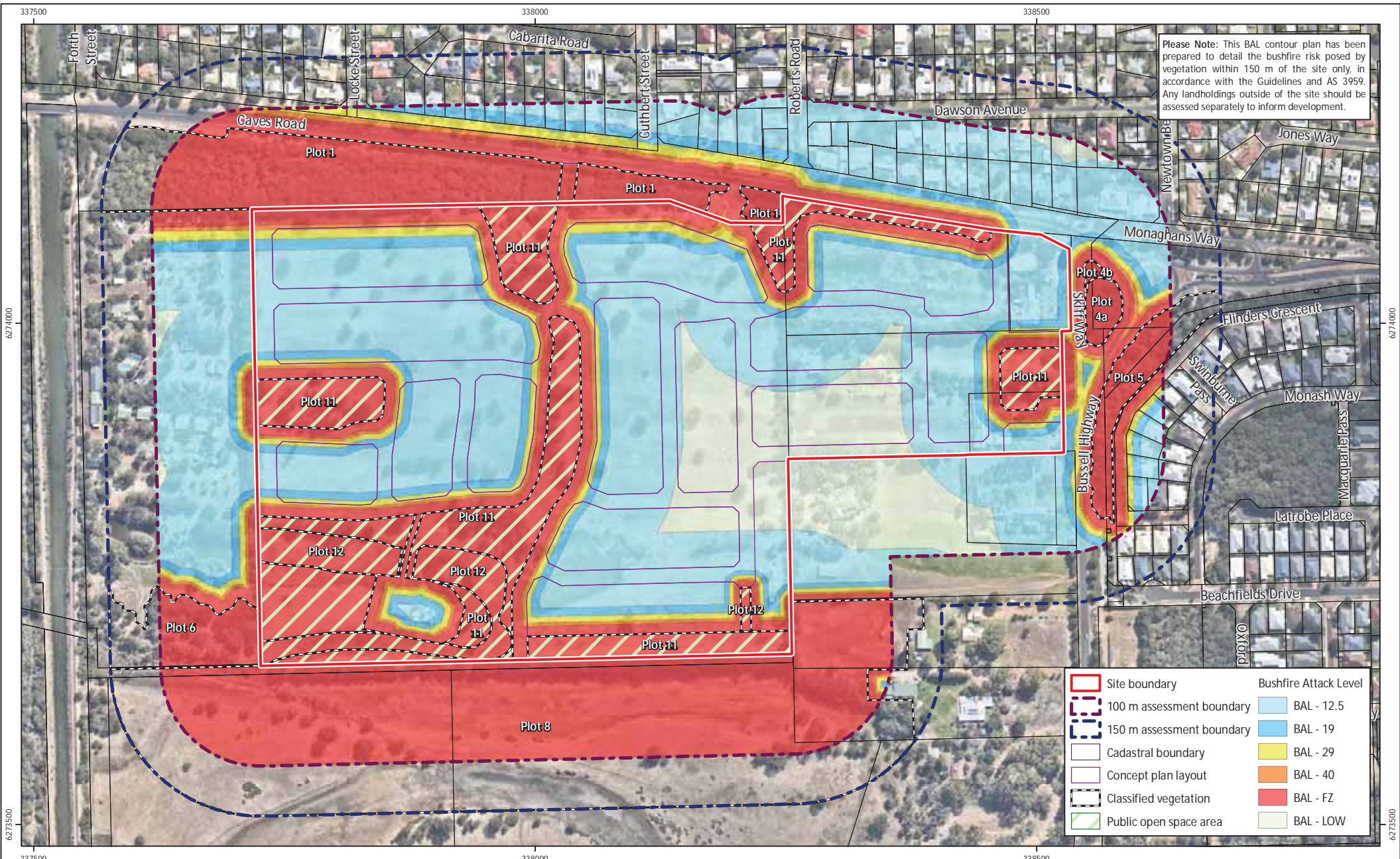
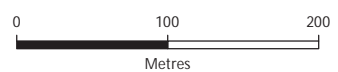


Figure 5: Bushfire Attack Level Contour Plan

Project: Bushfire Management Plan
Abbey South Structure Plan Area
Client: Various Landowners

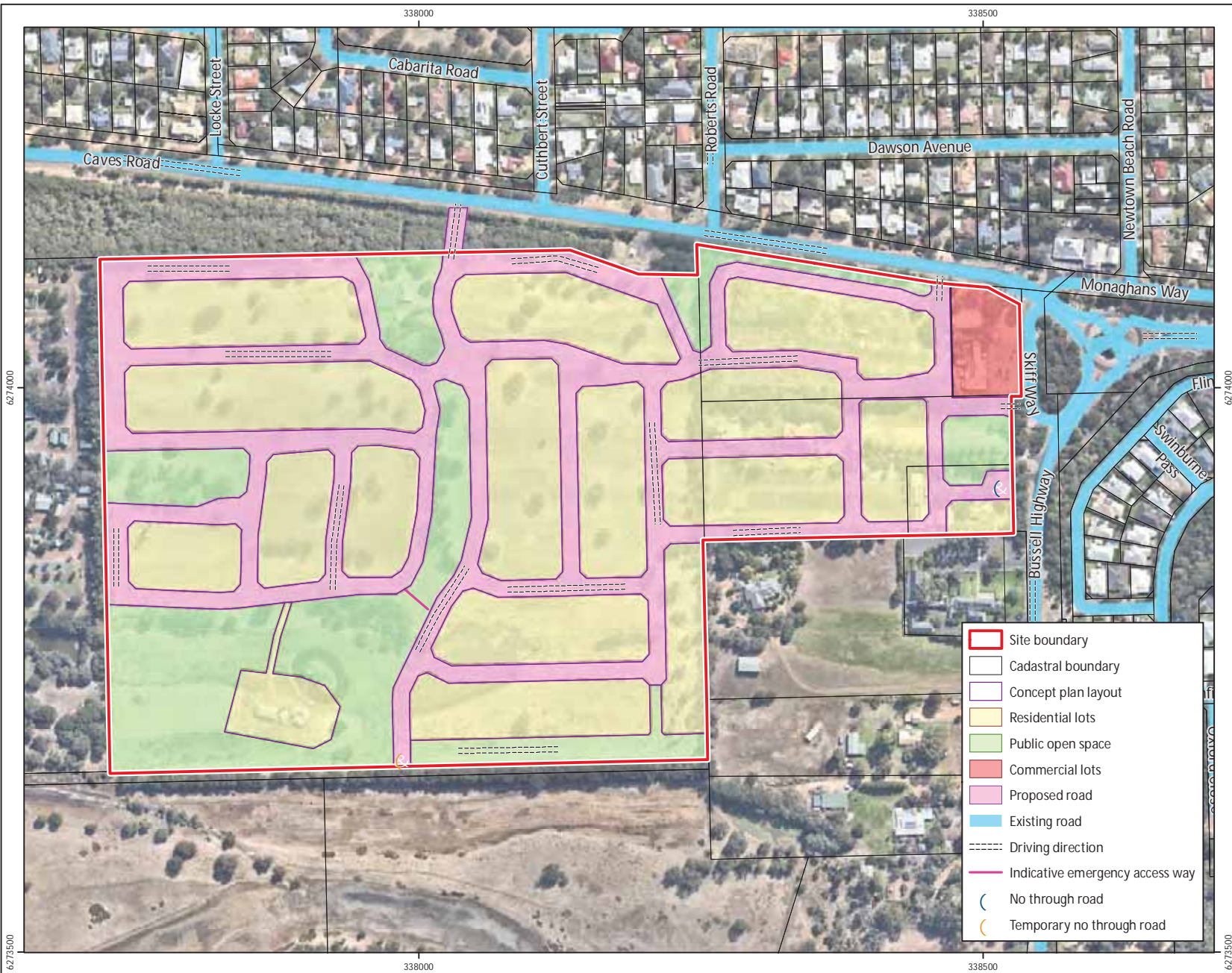
Plan Number:
EP20-141(05)--F35c
Drawn: GAR
Date: 11/06/2024
Checked: KK
Approved: KK
Date: 11/06/2024



Scale: 1:5,000@A4
GDA 1994 MGA Zone 50



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	Site boundary
	Cadastral boundary
	Concept plan layout
	Residential lots
	Public open space
	Commercial lots
	Proposed road
	Existing road
	Driving direction
	Indicative emergency access way
	No through road
	Temporary no through road

Asset protection zones (APZs)
 All habitable buildings should achieve BAL-29 or less. Asset protection zones will be required around future habitable buildings to achieve BAL-29 or lower. These will be installed within areas of managed public open space/public road reserves or within lots (e.g. as carparks, drive ways, manicured lawn/gardens etc).

Building construction requirements
 Where designated bushfire prone, future Class 1, 2, 3 and associated 10a buildings will need to be constructed in accordance with BAL ratings determined in accordance with AS 3959.

Vehicle access

- All public roads are to be constructed in accordance with the requirements of the Guidelines.
- All future development will be able to achieve two access routes upon completion of development. For the western residential cell, this can include use of an emergency access way (EAW). If required as part of subdivision design, the EAW should meet the minimum requirements of the Guidelines.
- As part of staged development, unless agreed otherwise with the City of Busselton, temporary access roads can be used, and can be longer than 500 m (in recognition that different landowners may progress development over different timeframes). This should be in accordance with the Guidelines.
- No-through roads will likely be required as part balancing constraints such as different land ownership, retention of vegetation and management of the floodway. Where required, these are to meet the requirements of Appendix Four of the Guidelines, including:
 - +Will be a maximum length of 200 m, unless agreed otherwise with the City of Busselton or connected with an EAW;
 - +Will achieve public road requirements as per A3.2 of Appendix Four in the Guidelines, unless agreed otherwise with the City of Busselton; and
 - +The turnaround area will achieve the dimensions outlined in Figure 24 of Appendix Four of the Guidelines.

Water supply
 The development will be serviced by a reticulated water supply and a network of hydrants.

Figure 6: Spatial Representation of Bushfire Management Features

Project: Bushfire Management Plan
 Abbey South Structure Plan Area
Client: Various Landowners

Plan Number:
 EP20-141(05)--F36b
Drawn: GAR
Date: 11/06/2024
Checked: KK
Approved: KK
Date: 11/06/2024



0 50 100 150
 Metres
 Scale: 1:5,000@A4
 GDA 1994 MGA Zone 50



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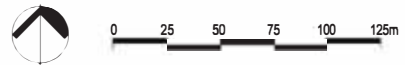
Appendix A

Structure Plan and Concept Plan





- STRUCTURE PLAN NOTES**
1. Future road connection to Vasse North to be constructed by others.
 2. The 2 stage T intersection to Caves Road is to be designed and located as to minimise impacts on existing vegetation within the Caves Road reserve.
 3. The future alignment of the pedestrian / cycle linkage to Buayanyup Drain is to be designed to minimise impacts on the floodway.
 4. Pedestrian access between the Local Centre and Monaghans Store is to be confirmed at the development application stage for the Local Centre (lot 402).
 5. Existing homestead is to be retained on 4,000m² (approximate) residential zoned lot with a density code of R2.5 to prevent further subdivision.



LOCAL STRUCTURE PLAN
 LOTS 4 & 12 CAVES ROAD & LOTS 14, 15 & 402 BUSSELL HIGHWAY, ABBEY.

NOTE:
 Base Data supplied by Landgate / Denada Surveys
 Aerial Photo - Jan 2023
 Projection - BCG84
 Areas and dimensions shown are subject to final survey calculations.

Revision	Date	Item
E	14/5/24	Revise as per COB comments
D	7/5/24	Revise as per most recent concept
C	15/1/22	Revise as per most recent concept
B	7/1/22	Revise as per most recent concept

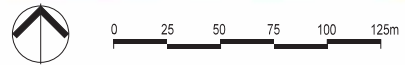
LEGEND	
	STRUCTURE PLAN BOUNDARY
	RESIDENTIAL R2.5
	RESIDENTIAL R10
	RESIDENTIAL R20
	RESIDENTIAL R20 - R40
	RESIDENTIAL R80
	RECREATION RESERVE
	LOCAL CENTRE (R80)
	FLOODWAY
	PERIMETER ROAD
	ACCESS STREET B
	HIGHER ORDER CYCLE PATH
	ACCESS STREET D (INDICATIVE ONLY)
	EMERGENCY SECONDARY EGRESS
	PEDESTRIAN LINK
	FUTURE PEDESTRIAN / CYCLE CONNECTION TO BUAYANYUP DRAIN CYCLE PATH
	POS NUMBER
	CUL DE SAC
	ROUNDBOUT
	2 STAGE "T" INTERSECTION
	LEFT IN / LEFT OUT INTERSECTION

A3@1:2,500	CLIENT
16 May 2022	SCALE
IA Abbey-2-001	DATE
E	PLAN No
C.L.	REVISION
B.L.	PLANNER
	DRAWN





ABBEY PLANNING INVESTIGATION AREA - CONCEPT PLAN
 LOTS 4 & 12 CAVES ROAD & LOTS 14, 15 & 402 BUSSELL HIGHWAY, ABBEY.



NOTE:
 Base Data supplied by Landgate / Denada Surveys
 Aerial Photo - Jan 2023
 Areas and dimensions shown are subject to final survey calculations.

Revision	Date	Item
A	7/05/21	Initial Issue

LEGEND
 SUBJECT LOT BOUNDARY
 ROAD RESERVE WIDTH

- : CLIENT
 A3@1:2,500 / A1@1:1,250 : SCALE
 7 May 2024 : DATE
 IA Abbey-1-020 : PLAN No
 A : REVISION
 C.L. : PLANNER
 B.L. : DRAWN





TRANSPORT IMPACT ASSESSMENT
Abbey Planning Investigation Area

15 December 2022

Prepared for:
Landowners Group

Prepared by:
Rodney Ding

Project Number:
300303385

Transport Impact Assessment

Revision	Description	Author	Date	Quality Check	Date	Independent Review	Date
a	Draft	RD	18/04/22	Tanya Moran	27/04/22		
b	Revised Draft based on updated concept	RD	29/07/22				
0	Final	RD	05/08/22	AO	8/8/2022	RD	08/08/22
1	Revised Final – address final comments	RD	16/08/22	SH	16/08/22	RD	19/08/22
2	Revised Final – address final edits	RD	22/08/22			RD	22/08/22
3	Revised Final – updated concept plan	RD	15/12/22			RD	15/12/22



Transport Impact Assessment

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Prepared by:



Signature

Rodney Ding

Reviewed by:



Signature

Alix Oakes

Approved by:



Signature

Rodney Ding



Table of Contents

EXECUTIVE SUMMARY	III
ACRONYMS / ABBREVIATIONS	IV
1 INTRODUCTION.....	1
1.1 Background & Proposal.....	1
1.2 Purpose of this Report.....	2
1.3 Summary of Key Findings	2
1.4 References	2
2 LOCAL STRUCTURE PLAN OUTLINE.....	4
2.1 Regional Context.....	4
2.2 Proposed Land Uses	4
2.3 Attractors or Generators of Traffic (non-residential).....	5
3 EXISTING SITUATION	6
3.1 Subject Site	6
3.2 Existing Movement Network.....	7
3.2.1 Roads	7
3.2.2 Pedestrian and Cycle Network.....	8
3.2.3 Public Transport	10
3.3 Existing Road Network (Within 2km)	10
3.4 Traffic Counts	10
4 PROPOSED INTERNAL & EXTERNAL TRANSPORT NETWORKS.....	12
4.1 Changes to Existing Road Network.....	12
4.1.1 Vasse-Dunborough Link (VDL) & Busseton Outer Bypass (BOB)	12
4.2 Proposed Road Layout and Access Points.....	13
4.3 Proposed Road Hierarchy, Road Reserve Widths and Speed Limits	14
4.3.1 Access Streets Cross Sections	16
4.4 Intersection Controls.....	18
4.5 Pedestrian/Cycle Networks and Crossing Facilities	18
5 INTEGRATION WITH SURROUNDING AREA.....	20
5.1 Surrounding Attractors.....	20
5.2 Proposed Changes to Land Uses within 800m	20
6 ANALYSIS OF INTERNAL AND EXTERNAL TRANSPORT NETWORKS	22
6.1 Structure Plan Traffic.....	22
6.1.1 Subject Site Traffic Generators	22
6.1.2 Internal Traffic ATtractors	22
6.2 Traffic Distribution.....	23
6.3 Extraneous (Through) Traffic	24
6.4 Design Traffic Flows (i.e., Total Traffic).....	24
6.5 Access Strategy.....	25
6.6 Pedestrian / Cycle Networks	28
6.7 Safe Routes to Schools	29
6.8 Access to Public Transport.....	30
6.9 Assessment of Intersections	30
6.9.2 Performance Assessment	31
7 CONCLUSION	33
LIST OF TABLES	
Table 3-1: Existing Public Transport Facilities within proximity to the subject site	10



Table 4-1: Liveable Neighbourhoods Road Characteristics 15

Table 4-2: Internal Road Network as per proposed Concept Plan 18

Table 4-3: Indicative Road Network as per Liveable Neighbourhood 2009 18

Table 6-1: Internal Road Network 22

Table 6-2: Traffic Generation by Zone 22

Table 6-3: Estimated Daily Traffic Distribution Percentage of Traffic Generated 23

Table 6-4: Estimated Daily Traffic Distribution of Traffic Generated 23

Table 6-5: Ultimate Intersection Performance – +20 years Approx. 2042 32

LIST OF FIGURES

Figure 1-1: City of Busselton Local Planning Strategy 2019 1

Figure 2-1: Site Location 4

Figure 2-2: Concept Plan Layout (July 2022) 5

Figure 3-1: Subject Site Aerial (Nearmap) 6

Figure 3-2: Land Zoning Map (City of Busselton Intramaps) 7

Figure 3-3: Road Network Hierarchy (Main Roads Road Information Map) 8

Figure 3-4: Cycle Path Network 9

Figure 3-5: Current Bus Network Map (PTA Bus Routes) 10

Figure 3-6: MRWA TrafficMap Traffic Counts 11

Figure 4-1: Regional Road Changes 13

Figure 4-2: Site Access Intersection Locations 14

Figure 4-3: Road Hierarchy within Development (Access Street B in red; Access Street D all others) 16

Figure 4-4: Access Street B Indicative Cross Section (Liveable Neighbourhoods 2009) 17

Figure 4-5: Access Street C Indicative Cross Section (Liveable Neighbourhoods 2009) 17

Figure 4-6: Access Street D Indicative Cross Section (Liveable Neighbourhoods 2009) 17

Figure 4-7: Proposed 2050 Cycling Network for Busselton 19

Figure 5-1: Planning Investigation Areas 21

Figure 6-1: Traffic Volumes and Distribution 24

Figure 6-2: Bussell Highway Access for Access 3 to Lots 14 & 15 26

Figure 6-3: Proposed Access Points 27

Figure 6-4: Proposed Access Points (in red) Location to Existing Intersections 28

Figure 6-5: Pedestrian Crossing Amenity – WAPC TIA Guidelines Volume 4 29

Figure 6-6: Desirable Crossing Spacing – WAPC TIA Guidelines Volume 4 29

LIST OF APPENDICES

APPENDIX A ROAD HIERARCHY ASSESSMENT 1

APPENDIX B STRUCTURE PLAN CONCEPT PLAN 2



Executive Summary

A proposed joint 'Scheme Amendment' and 'Local Structure Plan' on Lots 4 & 12 Caves Road and Lots 14, 15 & 402 Bussell Highway in Abbey (the 'subject site') has been prepared to guide the future subdivision and development of approximately 30.5Ha of currently zoned rural land. The subject site is bounded by Caves Road to the north and a short section of Bussell Highway to the east along with other adjacent properties to the west and south.

The proposed local structure plan includes an anticipated 350-400 residential dwellings and public open spaces.

This Transport Impact Assessment (TIA) report has been prepared by Stantec in support of the scheme amendment and local structure plan for Lots 4 & 12 Caves Road and Lots 14, 15 & 402 Bussell Highway.

The TIA addresses the transport aspects of the proposed land use in line with the following key objectives:

- To integrate with the district context. The subject site is directly adjacent to the main arterials of Caves Road and Bussell Highway.
- To assess the level of transport integration between the local structure plan area and the key adjoining transport network consisting of Caves Road and Bussell Highway.
- To determine the high-level impacts of the traffic generation, active transport needs and public transport needs by the local structure plan on the surrounding land uses and transport network.
- To determine the necessary road hierarchy and form to adhere to *Liveable Neighbourhoods 2009*.

Further to this executive summary, the transport investigation outcomes are provided in the Conclusion.



Acronyms / Abbreviations

ASP	Approved Structure Plan
DoT	Department of Transport
DSP	District Structure Plan
ITE	Institute of Transport Engineers
LTCN	Long-Term Cycle Network
MRWA	Main Roads Western Australia
PSP	Principal Shared Path
PTA	Public Transport Authority
SLK	Straight Line Kilometre
TIA	Transport Impact Assessment
WAPC	Western Australia Planning Commission



1 Introduction

1.1 Background & Proposal

Stantec has been engaged by private landowner groups to assist with the development of a local structure plan in conjunction with the submission of a scheme amendment for Lots 4 & 12 Caves Road and Lots 14, 15 and 402 Bussell Highway in Abbey. A Transport Impact Assessment (TIA) is required for the local structure plan to predict and assess the traffic generated by the development and the resulting impact to local roads as well as other transport related impacts.

Prior to this TIA, Stantec undertook a high-level traffic assessment of the impacts of the anticipated land use yields on the adjoining road network which has also informed this TIA. Refer Appendix A.

The development of the local structure plan for the subject site forms part of the *City of Busseton Local Planning Strategy 2019* as shown in Figure 1-1. The subject site is internally a greenfield site with the external accesses servicing adjacent brownfield sites, located just to the south of Abbey Beach, approximately 8.5km from the Busseton city centre and approximately 15km from the Dunsborough town centre.



Source: City of Busseton Local Planning Strategy 2019

Figure 1-1: City of Busseton Local Planning Strategy 2019

The City of Busseton currently has several approved structure plans (ASP) within or near the wider Abbey area. This includes Vasse Newtown ASP to the south near the intersection of Bussell Highway and the Busseton Bypass. To the south of the subject site is another Planning Investigation Area, this for Vasse North.

Future regional road planning in the vicinity involves the development of the Vasse-Dunsborough Link (VDL), being an extension of the Busseton Bypass from west of Vasse Newtown to Dunsborough. Access to the subject site is proposed to be direct from Caves Road, where traffic flows are expected



Transport Impact Assessment

1 Introduction

to decrease significantly with the introduction of the VDL providing the main link to Dunsborough to service key through regional traffic (rather than structure plan traffic).

1.2 Purpose of this Report

Volume 2 of the *Western Australian Planning Commission Transport Assessment Guidelines* (WAPC Guidelines) provides direction on the preparation of a TIA for Planning Schemes, Structure Plans and Activity Centre Plans. The WAPC Guidelines identify that a TIA for a scheme amendment and/or structure plan, is to provide an assessment of a wider area within a district and demonstrate overall conformity with any overarching District Structure Plan or similar.

The current WAPC Guidelines requires planning scheme amendments and structure plans to be supported by a transport impact assessment.

This TIA details the methodology and findings, which was prepared in line with the WAPC Guidelines and takes account of the City of Busselton's planning policies. This TIA considers the integration of the subject with the existing and proposed transport networks including walking, cycling, public transport, and vehicular travel and considers the potential impact of the proposed development.

In preparing this TIA, consideration was given to the impact of the VDL and nearby subdivision plans (where available) to determine the impact of those developments on the subject site and vice versa. Specifically, these relate to the objectives of the WAPC Guidelines, which are:

- assess the proposed internal transport networks with respect to accessibility, circulation, and safety for all modes, that is, vehicles, public transport, pedestrians and cyclists;
- assess the level of transport integration between the structure plan area and the surrounding land uses;
- determine the impacts of the traffic generated by the structure plan area on the surrounding land uses; and
- determine the impacts of the traffic generated by the structure plan area on the surrounding transport networks.

1.3 Summary of Key Findings

From a traffic and transport point of view, the following key provisions are immediately identified for this TIA:

- Appropriate connections are provided to the external road network that carries traffic fit-for-its function, including proximity to existing intersections.

1.4 References

In preparing this report, reference has been made to the following:

- WAPC Transport Assessment Guidelines for Development, August 2016
- Concept Plan for the proposed development prepared by Rise Urban dated 18/07/2022



Transport Impact Assessment

1 Introduction

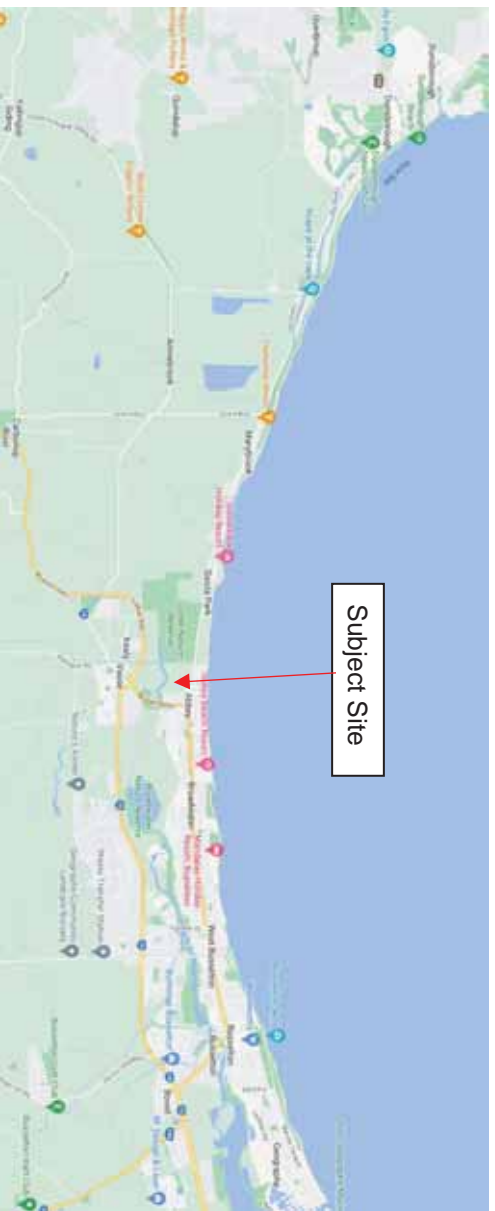
- Liveable Neighbourhoods Guidelines 2009
- City of Busselton Local Planning Scheme No. 21
- various technical data as referenced in this report and other documents as nominated.



2 Local Structure Plan Outline

2.1 Regional Context

The subject site is in the suburb of Abbey, within the City of Busselton. The site is approximately 8.5km west of the Busselton city centre and approximately 15km from the Dunsborough townsite (see Figure 2-1).



Source: Google Maps

Figure 2-1: Site Location

2.2 Proposed Land Uses

It is proposed that there will be approximately 350-400 residential lots, mostly single residential. These lots range from 180m² to 2,000m², with majority being approximately 500m². There are four Public Open Space areas proposed, with a main north-south POS located central to the structure plan area. A breakdown of the local structure plan land use allocation is provided below:

- 350-400 Residential lots
- 4.6Ha Public Open Space.

The concept layout plan is shown in Figure 2-2 and Appendix B.





Figure 2-2: Concept Layout Plan (December 2022)

2.3 Attractors or Generators of Traffic (non-residential)

The general non-residential traffic attractors or generators to the structure plan area involve only the public open spaces (POS).

The POS open these spaces to various opportunities including playgrounds, dog parks and other recreational activities such as tennis, skateboarding and soccer. Some on-street parking abutting the POS is recommended to facilitate the full use of the area. There may be a small amount of non-structure plan traffic attracted to these areas, but this is not considered significant.



3 Existing Situation

3.1 Subject Site

The subject site comprises of the area bounded by Caves Road to the north and Bussell Highway to the east. No direct road accesses are proposed to adjoining development to the west and as there are wetlands to the south, no street connectivity is proposed through it.

The site is currently zoned “Rural” under the Local Planning Scheme 21 and is intended to be rezoned “Urban Development” via a Scheme amendment to provide a head of power for this local structure plan.

North of the site is existing residential development between Caves Road and Geographie Bay beach. To the west and south of the site is rural development, although there is another Urban Expansion Area on the south side of the wetlands area. At the eastern side of the subject site there are presently small commercial uses fronting Bussell Highway.

The latest aerial image of the subject site from Nearmap is shown in Figure 3-1, with the Land Zoning map provided in Figure 3-2.



Figure 3-1 : Subject Site Aerial (Nearmap)





Figure 3-2: Land Zoning Map (City of Busseton Intramaps)

3.2 Existing Movement Network

3.2.1 ROADS

The subject site lies at the gateway to the south-west region of Western Australia, beyond the Busseton township. There are two key road linkages to this south-west region, and these are Caves Road (east-west) and Bussell Highway (north-south). These are summarised below with a regional overview shown in Figure 2.

Caves Road

- Access to Dunsborough
- Access to Yallingup
- Currently carrying ~9,700 vehicles per day (vpd) in 2021/22
- Speed Zone at 70km/h
- Cape to Cape connection.
- No crashes recorded along the local structure plan frontage in the last 5 years to 2020.

Bussell Highway

- Major road
- Access to Vasse
- Access to Margaret River
- Currently carrying ~10,100vpd in 2021/22



Transport Impact Assessment

3 Existing Situation

- Speed Zone at 70km/h near roundabout, 80km/h further to south
- Two crashes have been reported on Bussell Highway frontage in the last 5 years to 2020.

Additionally, there has been three crashes reported at the Caves Road / Bussell Highway roundabout in the last 5 years to 2020.

The current road network hierarchy within the vicinity is shown in Figure 3-3.



Figure 3-3: Road Network Hierarchy (Main Roads Road Information Map)

3.2.2 PEDESTRIAN AND CYCLE NETWORK

The key corridors indicated on the *City of Busselton Key Bicycle Routes Map* are Bussell Highway to the east of the subject site connecting Vasse to the Geographe Path running along the Geographe Bay foreshore. This Geographe Path connects Busselton City Centre with Dunsborough, refer to Figure 3-4 on the following page.

In addition to these dedicated paths, Caves Roads has 1.5m wide sealed shoulders on both sides of the roadway. While not ideal under Safe System Engineering principles, cycling on these shoulders adjacent to vehicles travelling greater than 30k/hr speeds without a physical separation, these shoulders are used by experienced cyclists if desired when riding on the road.





Figure 3-4: Cycle Path Network



Transport Impact Assessment

3 Existing Situation

3.2.3 PUBLIC TRANSPORT

Currently, the closest public transport services or facilities operating near the subject site are immediately in front of the site on Caves Road as shown in Table 3-1.

Table 3-1: Existing Public Transport Facilities within proximity to the subject site

Service	Route No.	Route Description	Distance to Nearest Stop	Significant Destinations on Route	Frequency On/Off Peak
Bus	815	Busselton to Dunsborough	In front of subject site	Busselton & Dunsborough and local schools along Bussell Highway	1-3 hours

The bus network map for bus service 815 is shown in Figure 3-5.



Figure 3-5: Current Bus Network Map (PTA Bus Routes)

3.3 Existing Road Network (Within 2km)

The existing higher order roads (Main Roads WA Local Distributor or above) within 2km of the subject site include Caves Road which connects Dunsborough with the roundabout at the intersection of Bussell Highway and Caves Road, and Bussell Highway which runs from this same roundabout southwards through various towns along Bussell Highway as it extends all the way through to Augusta, as shown previously in Figure 3-3.

As such, Bussell Highway is carrying and intended to carry a high proportion of regional through traffic. Main Roads WA access policy is that access intersections to lower order roads should be provided wherever possible, in lieu of to/from higher speed, higher volume, higher order (highway) roads.

3.4 Traffic Counts

Nearby traffic counts available are on Caves Road west of the subject site and Bussell Highway between Caves Road and the Busselton Bypass. Figure 3-6 shows the 7-day average daily traffic counts for 2021/22 available through the MRWA TrafficMap. This shows approximately 9,700vpd on Caves Road and 10,100vpd on Bussell Highway.



Transport Impact Assessment 3 Existing Situation

Traffic flows on Caves Road (the current main connecting road between Dunsborough and Bussellton) have increased at a linear rate of approximately 162vpd per annum or approximately 1.8% per annum based on traffic counts from 2011/12 to 2020/21.

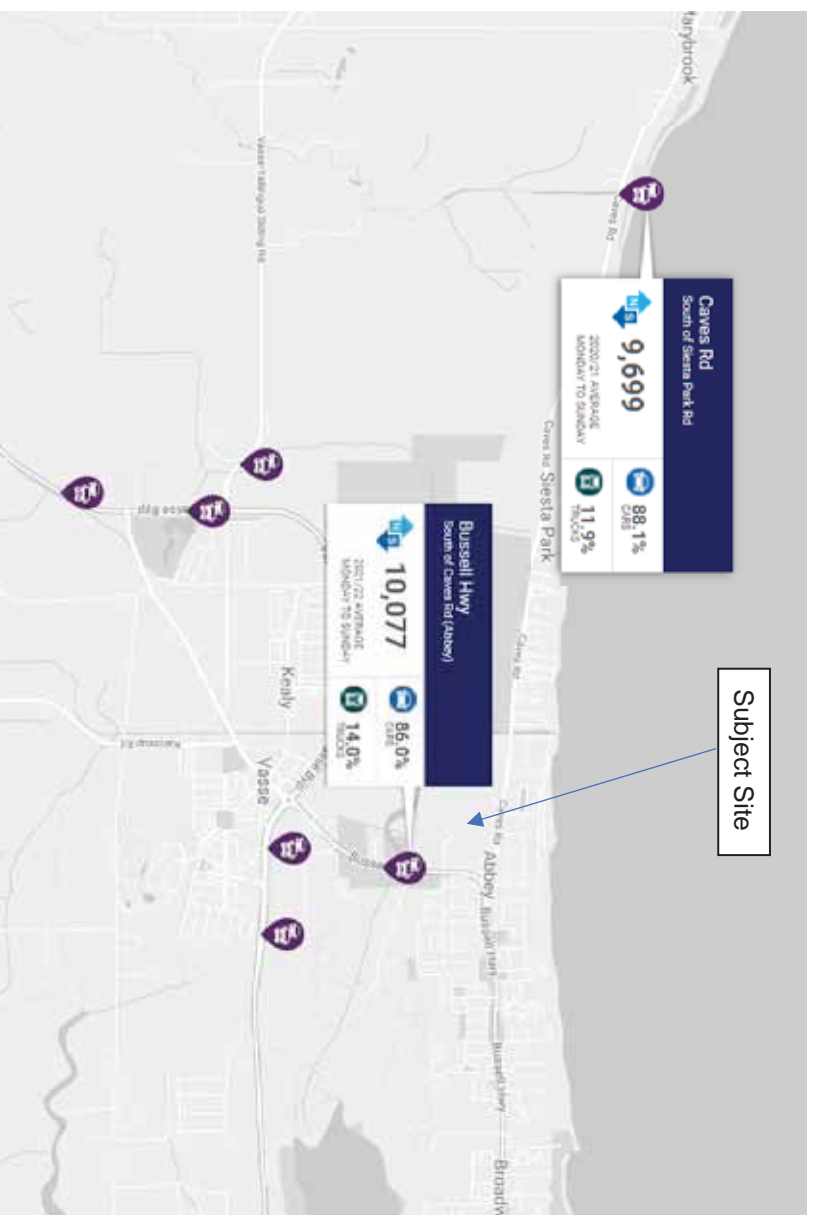


Figure 3-6: MRWA TrafficMap Traffic Counts



4 Proposed Internal & External Transport Networks

4.1 Changes to Existing Road Network

4.1.1 VASSE-DUNSBOROUGH LINK (VDL) & BUSSELLTON OUTER BYPASS (BOB)

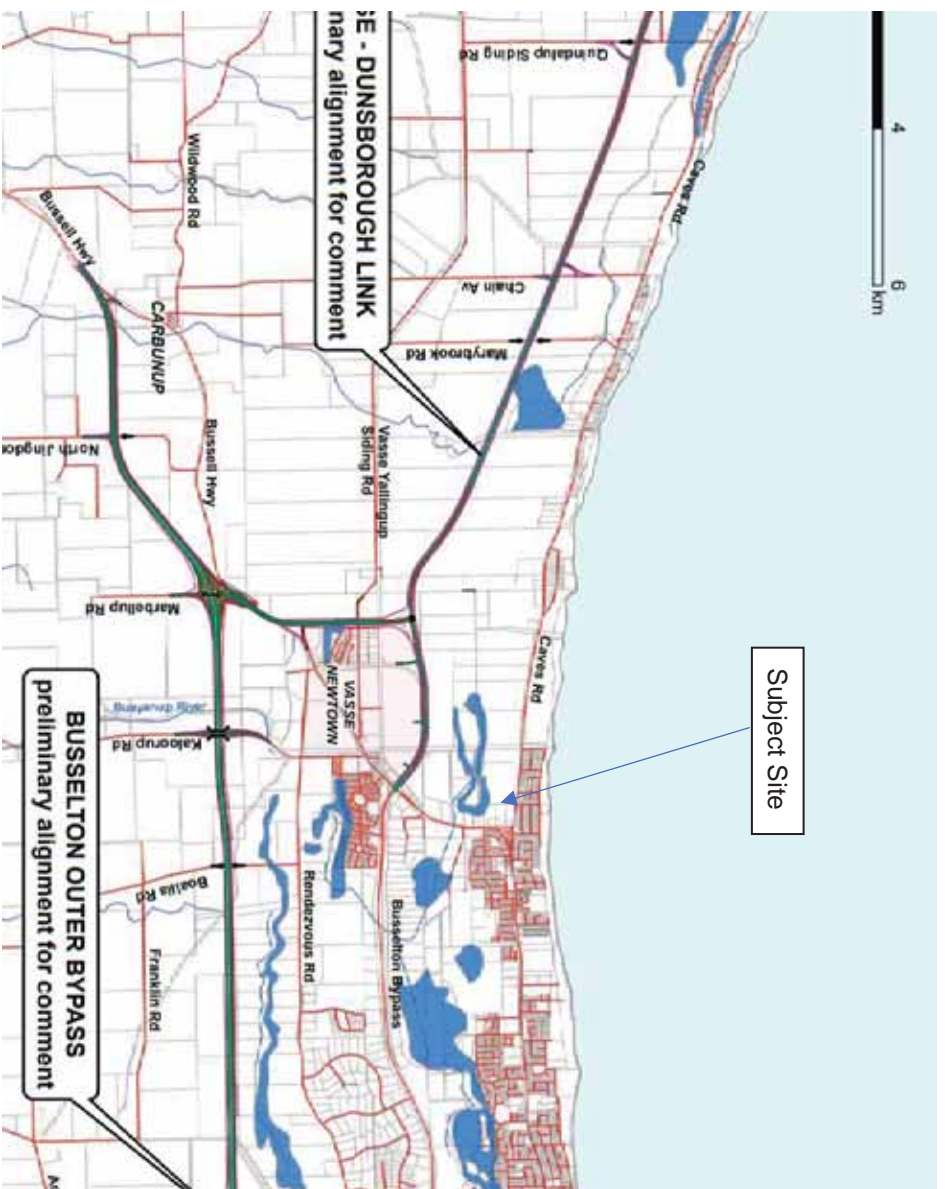
Early consultation with Main Roads WA has confirmed that the VDL & BOB are two key regional projects near the subject site. They are in the early planning stages and have not been included on any near-term construction programs (within the next 5 years). However, planning is such that the VDL is proposed to connect Dunsborough to Vasse whilst the BOB is proposed to provide an outer bypass of Busselton and the current Busselton Bypass. Refer to Figure 4-1.

Some of the traffic impacts of these regional planned projects have been assessed and are summarised below:

- The VDL & BOB will greatly alter regional traffic flows, reducing Caves Road traffic significantly and increasing traffic on Bussell Highway
- Modelling by others for MRWA has shown VDL & BOB are expected to decrease traffic volumes on Caves Road by ~80% to ~1,600-2,000vpd
- Bussell Highway traffic is expected to increase due to redistribution from ~10,000vpd to possibly ~15,000 to 20,000vpd in the immediate term (i.e. up to double the current volumes)
- Currently neither VDL & BOB projects are in Main Roads' 5-year forward budget.

For the above reasons the proposed local structure plan avoids direct access to Bussell Highway where traffic flows are expected to increase by an amount which is significant. Conversely, traffic flows on Caves Road are expected to decrease significantly. This is appropriate, given the function of Bussell Highway in a regional context when compared with Caves Road.





(Source: Main Roads WA)

Figure 4-1: Regional Road Changes

4.2 Proposed Road Layout and Access Points

The indicative concept plan for the local structure plan indicates the following.

1. The main northern entrance to the subject site is via the western all movement intersection connecting to Caves Road.
2. A secondary all movement access is proposed on Caves Road between Roberts Road and Bussell Highway.
3. A minor access is proposed onto Bussell Highway south of Skiff Way providing left-in/left-out access at Bussell Highway.
4. Caves Road provides the northern boundary of the site area, and the Bussell Highway becomes the eastern boundary.
5. Future development of Lots 6 and 8 Bussell Highway will allow an additional access through to Bussell Highway (as was requested by Main Roads WA South West Region in early consultation) intersecting much further south along Bussell Highway.



Transport Impact Assessment 4 Proposed Internal & External Transport Networks

- There are a total of 3 proposed intersection connections of the local structure plan to the external road network. These three accesses are proposed to allow each landowner group to develop individually without reliance of the provision of access through adjacent undeveloped lots.



Figure 4-2: Site Access Intersection Locations

4.3 Proposed Road Hierarchy, Road Reserve Widths and Speed Limits

The road hierarchy within the subject site area can be determined in accordance with Element 2 of *Liveable Neighbourhoods 2009* focusing on the function of the streets within a local structure plan as well as predicted traffic volumes. As such, the concept plan features a higher order local access street, being the main north to south connection, and other lower order local access streets for the remainder of the internal street network.

Liveable Neighbourhoods 2009 categorises streets into *Arterials*, *Neighbourhood Connectors*, and *Local Access Streets* dependant on traffic volumes, intended operation and functionality. Arterial roads are primarily for the connection of district and regional traffic, providing wider road carriageways to facilitate the safe and effective movement of vehicular traffic as a priority and as such are not consistent with the requirements of the road network within the site area.

The higher order roads within the site area will fall into the *Neighbourhood Connector* category of road. Neighbourhood Connector A roads have a theoretical maximum of 7,000vpd, typically with embayed on-street parking, and pedestrian and cycle facilities within a shared path or footpath.



Transport Impact Assessment 4 Proposed Internal & External Transport Networks

Neighbourhood Collector B roads have a maximum of 3,000vpd typically with on-street parking and shared path facilities.

Access Streets generally provide direct access to fronting properties and can cater for up to 3,000vpd in various formats. Within the context of this proposed local structure plan, most traffic flows are expected to be below 1,000vpd throughout.

Table 4-1 details the road types that are most appropriate to be applied to the roads within the subject site area, noting the street width is indicative only and subject to leniencies where certain criteria is met.

Table 4-1: Liveable Neighbourhoods Road Characteristics

Road Type	Classification	Target Speed (km/h)	Max Volumes (vpd)	Indicative Road Reserve Width	Indicative Street Width
Access Streets	Access Street B	40	3,000	16.5-17.9m	6.0m
	Access Street C	40	3,000	15.4m	7.2m
	Access Street D	30	1,000	14.2m	6.0m

The traffic volumes to assist determination of the road hierarchy is based upon the expected traffic generated from within the subject site plus any external influences (background traffic) for any through roads.

The main north to south connection, south of the proposed roundabout will need to accommodate traffic volumes just below the limit of an Access Street D, this the same for all other street sections throughout the site. The section of street north of the proposed roundabout intersection with Caves Road is expected to have traffic flows above 1,000vpd but less than 3,000vpd. Given this, the street cross section should be as that for an Access Street B or C in this section. Being the main link into the local structure plan area, it is recommended that an Access Street B cross section be adopted and allow embayed parking on one or both sides of the street.

All other roads within the site area can be allocated as Access Street D, with an indicative road reserve width of up to 14.2m. It is not expected that the daily volumes will exceed 1,000 on the proposed Access Streets fronting residential dwellings. Refer to Figure 4-3. The Access Street B cross section is denoted in **red** and all other streets are to be Access Street D.

The City's *Engineering & Works Services Standards & Specifications* suggests for Access Ways a reserve width of 12-16m, these being very much the same as Access Streets in Liveable Neighbourhoods. So, it appears there is opportunity to reduce the road reserves and maximise developable land. It is noted that the road reserves in the development areas such as Vasse Newtown are typically 16m.





Figure 4-3: Road Hierarchy within Development (Access Street B in red; Access Street D all others)

4.3.1 ACCESS STREETS CROSS SECTIONS

The Local Access Streets within the site area provide a maximum cross section of 20m fronting bush land as a means of bush fire buffer, other streets within the site provide 15-16m wide road reservations. This generally adheres to the requirement of higher order Access Street C and therefore satisfy for Access Street D, considering potential leniencies that could be applied through the design process dependent on the level of pedestrian and cyclist path connections/facilities, on road parking provisions and due to local practices within the City noted above.

Example cross sections of Access Street B, C and D are shown below in Figure 4-4 to Figure 4-6.



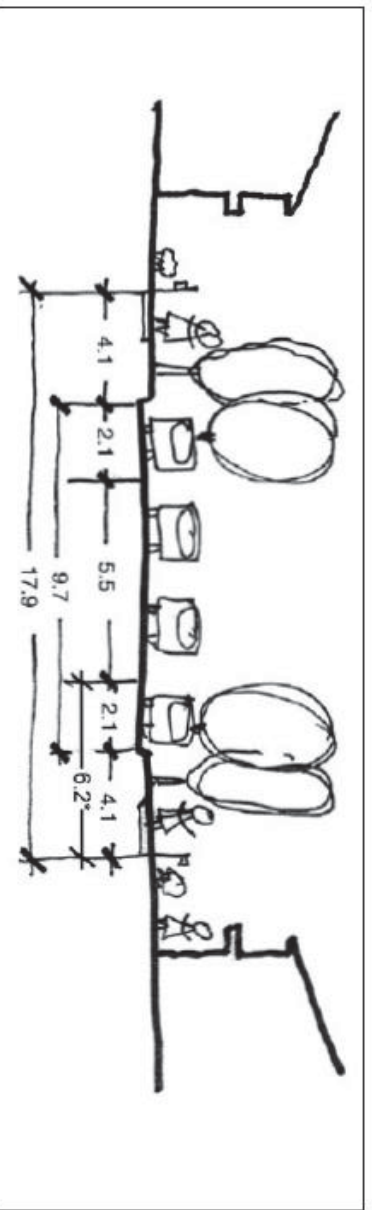


Figure 4-4: Access Street B Indicative Cross Section (Liveable Neighbourhoods 2009)

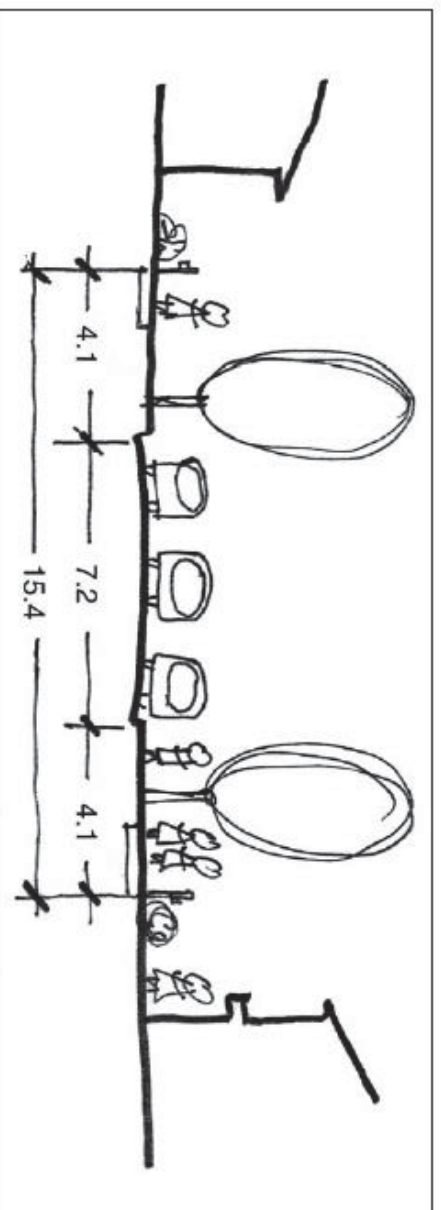


Figure 4-5: Access Street C Indicative Cross Section (Liveable Neighbourhoods 2009)

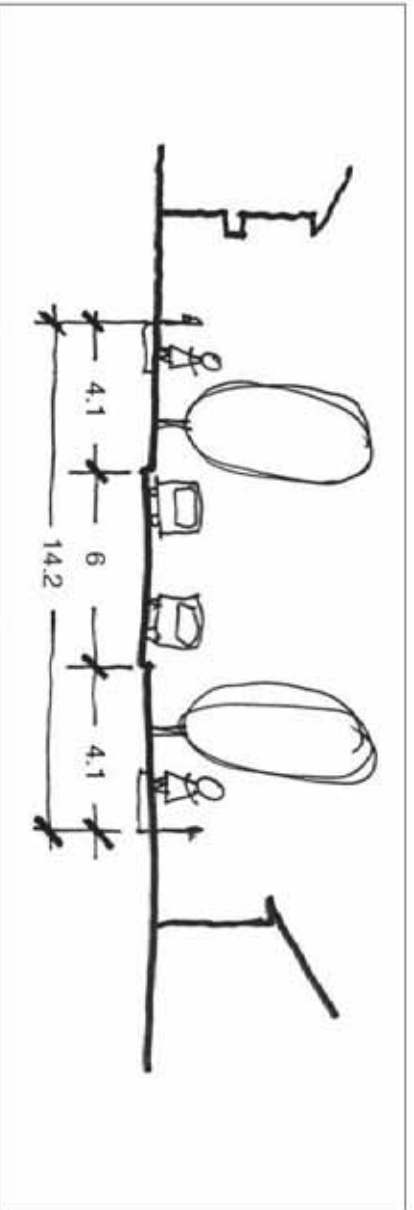


Figure 4-6: Access Street D Indicative Cross Section (Liveable Neighbourhoods 2009)

The road reserve widths proposed within the provided concept plan are deemed acceptable overall with potential opportunities to further refine/reduce the proposed widths as discussed above. A more detailed assessment will be undertaken post the scheme amendment and local structure plan approval, on further development of the cross sections, path connections and lot frontages.



Transport Impact Assessment

4 Proposed Internal & External Transport Networks

The internal road network consists of two types of roads and cross section configurations, detailed in Table 4-2.

Table 4-2: Internal Road Network as per proposed Concept Plan

Road Type	Road Reserve Width (m)	Verge (m)	Carriageway including Parking (m)	Median (m)	Verge (m)
Alongside POS	13	4.5	6.0	-	2.5
15m wide Streets	15	4.5	6.0	-	4.5
16m wide Streets	16	5.0	6.0	-	5.0
Fronting Bushland	20	5.0	6.0	-	9.0

Table 4-3: Indicative Road Network as per Liveable Neighbourhood 2009

Road Type	Road Reserve Width (m)	Verge (m)	Carriageway including parking (m)	Median (m)	Verge (m)
Alongside POS	13.2	4.1	6.0	-	3.1
Access Street B	17.9	4.1	9.7 (p/r/p)	-	4.1
Access Street C	15.4	4.1	7.2	-	4.1
Access Street D	14.2	4.1	6.0	-	4.1

The above widths are indicative with flexibility to be reduced based on the discussions provided within Section 4.3.

4.4 Intersection Controls

The concept plan proposes that all intersections onto the current adjoining road network to be all-movement intersections, except for the left-in/left-out at the Bussell Highway intersection. The intersection controls are expected to be either formalised Give Way or Stop control, based on assessment of the available sight distances at next stages of design.

There may be channelisation required to provide for left and right turn pockets either exiting the subject site or turning from Caves Road.

Internal intersection controls are proposed to include one roundabout at the intersection of the main north-south access street and the first main east-west street. All other intersections will be priority-controlled T-intersections.

4.5 Pedestrian/Cycle Networks and Crossing Facilities

The *Draft Leeuwin-Naturaliste 2050 Cycling Strategy* outlines the provision of a Primary Route along Caves Road from its current intersection with Bussell Highway and the current Geographie Path near



**Transport Impact Assessment
4 Proposed Internal & External Transport Networks**

Forth Street. In addition, a local path is proposed along Cuthbert Street connecting the Geographer Path with the new Caves Road Primary Route, refer to Figure 4-7below.

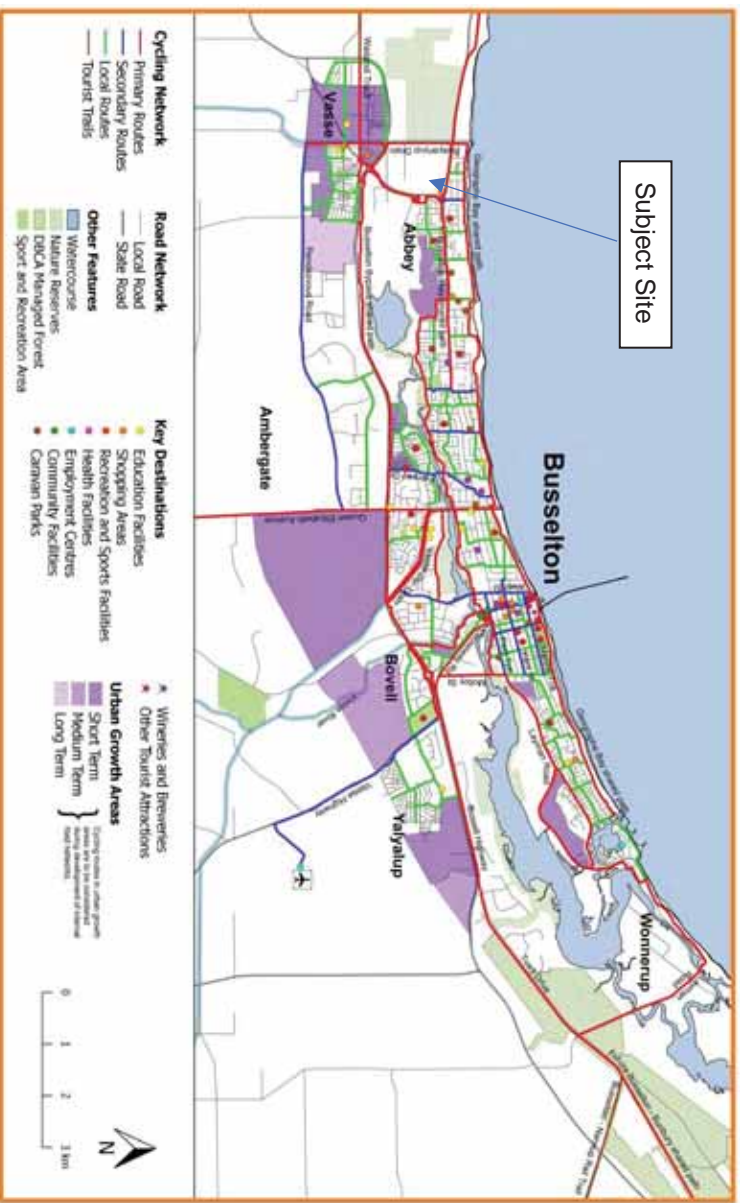


Figure 4-7: Proposed 2050 Cycling Network for Busselton



5 Integration with Surrounding Area

5.1 Surrounding Attractors

The predominant land use surrounding the subject site is residential development or other currently rural development. The major trip attractions for residents of the subject site will be located beyond a 5km radius from the centre of the development. There are other smaller secondary attractions closer.

The attractions include:

- Busselton city centre (~8.5km)
- Dunsborough town centre (~15km)
- Vasse Newtown (~2km)
- Vasse Primary School (~2.5km)
- Abbey Beach (~0.5km).
- “The Shed” (~0.1km)

Access to both Abbey Beach and The Shed will likely be via pedestrian or cyclist routes/facilities. To provide access to these attractions, appropriate facilities (footpaths/shared paths and crossing points) will need to be provided internally and across Caves Road near Cuthbert Street (to connect to the future Cuthbert Street cycling link).

5.2 Proposed Changes to Land Uses within 800m

The concept layout plan includes the following developments to take place within the subject site:

- 350-400 residential lots with an average size of 500m²
- 4 separate public open spaces from 565m² to 2.1Ha.

In addition to the internal developments, there is a Future Urban Area under consideration south of the subject site on the other side of the southern wetlands, refer to Figure 5-1 below, noted as Vasse North. This development is assumed to be a similar residential development and thus there is expected to be little in the way of attractions between the subject site and Vasse North.



**Transport Impact Assessment
5 Integration with Surrounding Area**



Figure 5-1 : Planning Investigation Area & Subject Site



6 Analysis of Internal and External Transport Networks

6.1 Structure Plan Traffic

6.1.1 SUBJECT SITE TRAFFIC GENERATORS

The estimated traffic generation and distribution to the internal road network has been undertaken, applying typical generation rates to the land uses within the site area based on those provided in the *WAPC Transport Impact Assessment Guidelines*. The rates shown in Table 6-1 have been applied to the land uses. These rates are 25% higher than the typical daily generation rate of 8 trips per dwelling and corresponding peak hour rates, to provide a robust assessment of the traffic impacts.

Table 6-1: Internal Road Network

Land Use	Units	Daily Trip	AM Trip	PM Trip	Source
Residential Dwellings	Dwelling	10*	0.75*	1.0*	WAPC

Note: Rates are 25% more than typical generation rates

The site area was divided into traffic generating 'zones', and an approximate distribution applied to the internal and then onto the adjoining surrounding roads. Refer to Table 6-2.

Table 6-2: Traffic Generation by Zone

Area	Daily Traffic** (vpd)	AM (vph)	AM In (vph)	AM Out (vph)	PM (vph)	PM In (vph)	PM Out (vph)
W	2,100	160	40	120	210	140	70
NE	700	50	15	35	70	45	25
E	700	50	15	35	70	45	25
Total*	3,500	260	70	190	350	230	120

Rounded to the nearest 5/10, totals may differ from above due to rounding

The residential traffic will be distributed to the north and east via the main road connections, with most of the traffic entering the subject site from the north via the main north-south street proposed to/from Caves Road. Assessing the relating proximity of the major attractors of traffic external to the local structure plan (Busselton city centre, Dunsborough town centre and Vasse Newtown commercial centre) the expected distribution from the subject site has been assessed as approximately:

- 10% to/from the west
- 90% to/from the east/south along Caves Road/Bussell Highway.

6.1.2 INTERNAL TRAFFIC ATTRACTORS

The only attractor of trips to the local structure plan possible are the POS proposed within the structure plan area. The expected amount of traffic to be generated to this is expected to be minimal as the areas of POS are not district level, are wholly passive and therefore the 25% increase in



Transport Impact Assessment 6 Analysis of Internal and External Transport Networks

standard traffic generation rates being applied in this assessment is expected to be more than counted for in the traffic generation for the POS.

6.2 Traffic Distribution

The traffic distribution of the roads within and surrounding the subject site area can be broadly assumed to determine a high-level 'bracket' of likely traffic volumes. A summary of the distribution applied to establish likely traffic volumes is provided in Table 6-3 and Table 6-4 and takes into consideration internal and external traffic attractors and commuter routes.

Table 6-3: Estimated Daily Traffic Distribution Percentage of Traffic Generated

Area	West	East	South
W	10%	60%	30%
NE	10%	60%	30%
E	10%	60%	30%

Table 6-4: Estimated Daily Traffic Distribution of Traffic Generated

Area	West	East	South
W	210	1,060	630
NE	70	420	210
E	70	420	210

Consideration of current rates of growth in traffic flows on affected roads over a 20-year period, the cumulative impact of the above traffic volumes results in:

- Caves Road west of the subject site carrying in the order of 13,300vpd
- Caves Road near the subject site carrying in the order of 15,300vpd
- Bussell Highway to the south carrying in the order of 14,300vpd
- Bussell Highway to the east carrying in the order of 17,900vpd.

The above assumes that neither the VDL nor the BOB are constructed. If these are constructed and noting the previously discussed redistribution in traffic flows, the expected traffic flows on the same external roads are in the order of:

- Caves Road west of the subject site carrying in the order of 2,350vpd
- Caves Road near the subject site carrying in the order of 4,300vpd
- Bussell Highway to the south carrying in the order of 16,000 to 21,000vpd
- Bussell Highway to the east carrying in the order of 17,900vpd.



6.3 Extraneous (Through) Traffic

With the nature of the street connections proposed to the adjoining road network there is not expected to be any desire for through traffic through the local structure plan. There is only expected to be the structure plan generated traffic, which is very low (refer Figure 6-1), travelling to and from the subject site via the connecting streets onto Caves Road and Bussell Highway.

6.4 Design Traffic Flows (i.e., Total Traffic)

With the finished local structure plan, the main entry to the subject site is expected to be via the main western north-south street connecting with Caves Road between Locke Street and Cuthbert Street. A secondary access onto Caves Road will carry significantly less traffic where it connects to Caves Road between Roberts Road and the Caves Road/Bussell Highway roundabout. Finally, a minor left-in/left-out connection onto Bussell Highway south of the roundabout is expected to carry similar traffic flows to the previous intersection.

The transport network of the local structure plan area is permeable to the north and east. The structure plan area does not rely solely on a single road or access point to spread the traffic volumes through to the external network.



Figure 6-1: Traffic Volumes and Distribution



6.5 Access Strategy

The access arrangements to and from the structure plan area need to consider the wider area when considering the strategy for access, such as access to the Busselton city centre and other major external attractors. These include:

North of the Site

- **Access 1** – a full movement intersection at the connection of Caves Road and the main proposed north-south street, providing access to/from the western portion of the structure plan area¹.
- **Access 2** – a full movement intersection at the connection of Caves Road and the connecting street from the north-east cell.².

East of the Site

- **Access 3** - a left-in/left-out proposed for intersection where it intersects with Bussell Highway. It is proposed to extend the median island on the southern approach to the Caves Road roundabout further south so as to limit the movements to left-in/left-out. Refer to Figure 6-2 below.

¹ This access will allow Lot 4 to commence development independent of any other lots within the structure plan area.

² This access will allow Lot 12 to commence development independent of any other lots within the structure plan area.





Figure 6-2: Bussell Highway Access for Access 3 to Lots 14 & 15



Transport Impact Assessment 6 Analysis of Internal and External Transport Networks



Figure 6-3: Proposed Access Points

Regarding the Access 1 and 2 intersections on Caves Road, the off-sets of the proposed intersections are approximately 175m from the current location of Roberts Road and 215m from Locke Street on the north side of Caves Road. These off-sets will allow the provision of right turn lanes on Caves Road on the western approaches to each of the intersections. This length of turn lane is based on the current 70km/h speed limit and the current 85th percentile speeds of vehicles, which are in the 65 to 69km/h during daylight periods where there are higher traffic flows. For a 70km/h speed of approach for vehicles, the right turn and left turn pockets with a stop condition at the end are required to be 75m in length. Providing back-to-back right turn pockets (the case suggested in this case) a separation of approximately 170m would be required to account for intersection set-back and separation of the back-to-back turn pockets. This arrangement would thus fit within the approximate 175m off-set between Roberts Road and Access 2 and 215m between Locke Street and Access 1. Refer to Figure 6-4 showing the proposed location of the structure plan area intersections on Caves Road and the current intersections on Caves Road.

The provision of the back-to-back turn pockets may require limiting some access to properties on north side of Caves Road to left-in/left-out access, but that would achieve a safety improvement with reducing unmanaged turns to and from Caves Road.





Figure 6-4: Proposed Access Points (in red) Location to Existing Intersections

6.6 Pedestrian / Cycle Networks

The structure plan area has been designed with all new streets as two-lane streets, and when assessing the internal road streets for pedestrians and cyclists, there are no streets that are identified as being difficult to cross due to the expected traffic volumes. WAPC Guidelines notes for a two-lane divided (or with pedestrian refuge islands) road, traffic volumes of above 2,800 vpd will affect the ability for pedestrians to cross. With the maximum total expected traffic volume on the main north-south street in the order of 2,000vpd at its northern end near Caves Road, the peak hour traffic volumes will be less than this specified guide.

All other local access streets are expected to have traffic volumes significantly less than 1,000vpd. At this level, on-street cycling will be relatively safe with if the low target design speeds of 30-40km/h are implemented/achieved. In addition to this, footpaths are expected to be provided on at least one side of every street in the local structure plan area. This is important for access for the structure plan area to the existing commercial centre the near the NE corner of the site (The Shed) at the intersection of Caves Road and Bussell Highway. This may require the provision of footpath connections along the southern side of Caves Road and within Skiff Way to complete the connection from within the structure plan area to the commercial area on Skiff Way.

The proposed footpath network will also facilitate access to the bus stops on Caves Road and the Abbey Beach/Geographie Bay foreshore, access through Roberts Road or Cuthbert Street on the north side of Caves Road. Finally, the structure plan provides for a future connection to the shared path along the Buanyanyup Drain, which connects the Caves Road PSP to the Vasse Town Centre via a cycleway along the Buanyanyup Drain bund.



Table 3: Traffic volumes affecting pedestrian crossing amenity

Road cross-section	Traffic volume affecting ability of pedestrians to cross* (vehicles per hour – two-way)
2 lane undivided	1,100 vph
2 lane divided (or with pedestrian refuge islands)	2,800 vph
4 lane undivided (without pedestrian refuge islands)	700 vph
4 lane divided (or with pedestrian refuge islands)	1,600 vph

Figure 6-5: Pedestrian Crossing Amenity – WAPC TIA Guidelines Volume 4

Table 4: Maximum desirable spacings for safe pedestrian crossings

Road type	Maximum spacing of safe pedestrian crossing facilities*
Arterial – minimal frontage activity	400 metres
Arterial – significant frontage activity	200 metres
Local distributor/Neighbourhood connector	100 metres

Figure 6-6: Desirable Crossing Spacing – WAPC TIA Guidelines Volume 4

The future detailed design of the roads should incorporate and prioritise the movements of pedestrians and cyclists at the streets and intersections, while still providing acceptable level of service for vehicle traffic. Connectivity across Caves Road for bus stop access and access to the foreshore will also need to be considered in the future detailed design of the access points onto Caves Road.

6.7 Safe Routes to Schools

There are no schools proposed within the local structure plan area nor are there any within a walkable catchment 800m distance of the structure plan area. The nearest school is Vasse Primary School, located approximately 2.5km from the structure plan area. As such, access to this school will be required to be provided by private vehicles or coach/public transport. As discussed in Section 6.6 it is reiterated that the structure plan provides for a future connection to the shared path along the Buayanyup Drain, which connects the Caves Road PSP to the Vasse Town Centre via a cycleway along the Buayanyup Drain bund.

Older children may ride to the school and if they do decide to, there is the Busselton Byway located on the eastern side of Bussell Highway, this will be ultimately extended further along the eastern side of Bussell Highway, near Skiff Way. Access to this can be gained through Access 3 and then across Bussell Highway where there is an approximate 3m wide traffic island. This wide island provides pedestrians refuge for crossing Bussell Highway to allow for a two-stage crossing.



6.8 Access to Public Transport

Current bus routes use Caves Road with stops immediately in front of the local structure plan area. There are presently no footpaths along Caves Road to facilitate access to these stops, although there is a proposal to provide a shared path as identified in the *Draft Leeuwin-Naturaliste 2050 Cycling Strategy*. To facilitate access to these stops from the structure plan area, safe crossing points should be provided on Caves Road, and these could be detailed in the future detailed planning stage.

6.9 Assessment of Intersections

6.9.1 LEVEL OF SERVICE CONCEPTS

The Level of Service (LoS) concept describes the quality of traffic service in terms of six levels, designated A to F, with LoS A representing the best operating condition (i.e., at or close to free flow), and LoS F being the poorest (i.e., forced flow). More specifically:

LoS A: Primarily free flow operations at average travel speeds, usually about 90% of the FFS (free flow speed) for the given street class. Vehicles are completely unimpeded in their ability to manoeuvre within the traffic stream. Control delay at signalised intersections is less than 10 seconds. At non-signalised movements at intersections, the average control delay is less than 10 seconds;

LoS B: Reasonably unimpeded operations at average travel speeds, usually about 70% of the FFS for the street class. The ability to manoeuvre within the traffic stream is only slightly restricted, and control delays at signalised intersections are between 10 and 20 seconds. At non-signalised movements at intersections the average control delay is between 10 and 15 seconds;

LoS C: Stable operations; however, ability to manoeuvre and change lanes in mid-block locations may be more restricted than at LoS B, and longer queues; adverse signal coordination, or both may contribute to lower average travel speeds of about 50% of the FFS for the street class. Signalised intersection delays are between 20 and 35 seconds. At non-signalised movements at intersections the average control delay is between 15 and 25 seconds;

LoS D: A range in which small increases in flow may cause substantial increases in delay and decreases in travel speed. LoS D may be due to adverse signal progression, inappropriate signal timing, high volumes, or a combination of these factors. Average travel speeds are about 40% of FFS. Signalised intersection delays are between 35 and 55 seconds. At non-signalised movements at intersections the average control delay is between 25 and 35 seconds;

LoS E: Characterised by significant delays and average travel speeds of 33% of the FFS or less. Such operations are caused by a combination of adverse progression, high signal density, high volumes, extensive delays at critical intersections (between 55 and 80 seconds), and inappropriate signal timing. At non-signalised movements at intersections the average control delay is between 35 and 50 seconds; and,



Transport Impact Assessment

6 Analysis of Internal and External Transport Networks

LoS F: Characterised by urban street flow at extremely low speeds, typically 25% to 33% of the FFS. Intersection congestion is likely at critical signalised locations, with high delays (more than 80 seconds), high volumes, and extensive queuing. At non-signalised movements at intersections the average control delay is greater than 50 seconds.

In addition to the above:

Average Delay: is the average of all travel time delays for vehicles through the intersection; and,

Queue: is the queue length below which 95% of all observed queue lengths fall.

Degree of Saturation (DoS): Ratio of the traffic flow to the capacity for that lane/movement.

The above has been summarised below.

Level of Service	Control delay per vehicle in seconds (d)	
	Sign Control	Signals
A	d ≤ 10	d ≤ 10
B	10 ≤ d ≤ 15	10 ≤ d ≤ 20
C	15 ≤ d ≤ 25	20 ≤ d ≤ 35
D	25 ≤ d ≤ 35	35 ≤ d ≤ 55
E	35 ≤ d ≤ 50	55 ≤ d ≤ 80
F	50 < d	80 < d

6.9.2 PERFORMANCE ASSESSMENT

Within the traffic assessment it has been assumed that all intersections will follow the arrangement detailed in the current concept plan, being two full movement intersections on Caves Road and a left-in/left-out intersection on Bussell Highway.

To allow the development of the land across each of the separate lots independently, the local structure plan proposes these three access points as a minimum.

All bordering higher-order roads are expected to have traffic volumes within the typical maximum recommended traffic flows as provided in *Liveable Neighbourhoods 2009*. Caves Road and Bussell Highway have a maximum daily traffic carrying capacity of approximately 15,000vpd.

The site accesses on Caves Road will be offset approximately 175m and 215m from the current intersections on the north side of Caves Road (being Roberts Road and Locke Street respectively). These offsets will allow for sufficient right turn pocket lengths plus taper, on the western approach to the new proposed intersection.

The Access 3 intersection is proposed to intersect as a left-in/left-out with Bussell Highway. This access will allow all movements though the use of the well-located roundabout. It will allow a left turn out from the local structure plan area onto Bussell Highway.

As a worst case, the impact of ALL local structure plan traffic using a single access point on Caves Road was assessed, based on the worst-case scenario of the VDL and BOB not constructed and thus



Transport Impact Assessment 6 Analysis of Internal and External Transport Networks

traffic flows on Caves Road is modelled to be the highest possible. The result of this assessment is shown below in Table 6-5.

Table 6-5: Ultimate Intersection Performance – +20 years Approx. 2042

Location	Approach Crit. Mvt.	DOS	LOS	Ave. Delay	95 th %ile Q
Access 1 (AM)	Site (South) – RT	0.56 [#]	C [#]	21s	19m [#]
	Caves Rd (East) – LT	0.03	A	7s	1m
	Caves Rd (West) – RT	0.01	A	8s	0m
	Intersection	0.56	C	3s	19m
Access 2 (PM)	Site (South) – RT	0.40 [#]	C [#]	21s	12m [#]
	Caves Rd (East) – LT	0.10	A	7s	4m
	Caves Rd (West) – RT	0.02	A	8s	1m
	Intersection	0.40	C	3s	12m

As can be seen, there is expected to be minimal to no queuing on Caves Road as most vehicles will be turning to and from the east in the direction of the Busselton city centre. Also, there is expected to be acceptable delays for vehicles turning right from the local structure plan area onto Caves Road with delays in the order of 21s in both the AM and PM peaks, a low DoS and overall LOS C for this movement in both peaks.

Based on the above, the other proposed Access 2 onto Caves Road is expected to operate at a significantly better manner in both the AM and PM and traffic flows are expected to be about one-fifth (700vpd versus the 3,500vpd) assessed in the results above.

The main internal intersection roundabout is expected to carry traffic flows well within the capacity of a roundabout, with the maximum flows of approximately 1,800vpd on the northern leg and no more than 800vpd on any other leg. At these levels of traffic flows, there is expected to be minimal queuing and delays at the roundabout and thus no queuing back onto Caves Road.



7 Conclusion

Based on the analysis and discussions presented within this report, the following conclusions are made for the Scheme Amendment and Local Structure Plan application for Lots 4 & 12 Caves Road and Lots 14 & 15 Bussell Highway in Abbey (subject site):

- The subject site covers approximately 30.5Ha of land area located immediately south of Caves Road and southwest of the intersection roundabout of Caves Road and Bussell Highway.
- It is proposed that the area will be developed into approximately 350-400 residential lots and public open space.
- The site is bound by:
 - Bussell Highway to the east
 - Wetlands to the south
 - Rural and tourism development to the west
 - Caves Road to the north.
- No through traffic is designed for or expected within the local structure plan area.
- The future VDL and BOB projects will affect the traffic flows on both Caves Road and Bussell Highway, but that will only lead to improved operation of the proposed new access for Caves Road to the local structure plan area. The Bussell Highway access is limited to left turn movements from Caves Road and left turn movements to Bussell Highway via Skiff Way, as per existing and therefore would not have any significant detrimental traffic impact.
- The local structure plan area will need to be developed in accordance with the requirements of *Liveable Neighbourhoods*, specifically regarding the provision of pedestrian and cycle paths and connections, and road cross sections that adequately accommodate the anticipated traffic volumes. Providing direct connections between the subject site and bus stops, the existing vibrant commercial precinct on the SW corner of Caves Road / Bussell Highway, the foreshore and bike paths will ensure pedestrian and cyclist desire lines are catered for and reduce the travel distance between main attractors.
- Vehicle access to and from the local structure plan area has been confirmed to be able to operate as a single intersection with full traffic flows in 20 years' time on Caves Road assuming no VDL or BOB projects. This is an unlikely scenario given VDL and BOB projects are planned for beyond the next 5 years; however, it indicates how low the traffic generating characteristics are of this private landowner group's development proposal under the Planning Investigation Area.
- Intersections on Caves Road are proposed to be T-junctions with sufficient right turn pocket lengths between current intersections on the north side of Caves Road.



Transport Impact Assessment

7 Conclusion

- The Bussell Highway connection is proposed through a new left-in/left-out intersection near a current all movement crossover. This will require extension of a traffic island southwards from the Caves Road roundabout so to limit movements to left-in/left-out.
- Overall, the local structure plan area is proposed to generate approximately 3,500 vehicle trips per day. This traffic will be mostly dispersed to the north to access Caves Road, with less traffic accessing Bussell Highway via the loop road.
- The road network hierarchy within the structure plan area has been determined based on daily flows and in accordance with *Liveable Neighbourhoods 2009*. Given the very low generating characteristics of the proposal, traffic volumes will be accommodated for in the surrounding road network. Caves Road and Bussell Highway are able to cater for the ultimate traffic flows in 20 years' time being a combination of current traffic growth on these roads and expected traffic flows from the local structure plan area.
- Internally all streets within the local structure plan area will be designated as Access Streets of varying levels dependant on their traffic flows and function. Only a single higher order street (Access Street B) is noted at the northern end of the main north-south access street near Caves Road.
- Although the existing public transport services are limited in the area there is direct access to these services. Access to these for patrons will need to be considered in more detail at a later subdivision stage with footpaths and traffic islands provided on Caves Road for crossing refuge.

The high-level determination of this TIA is that the development this local structure plan, under the assumed traffic generation and distributions noted is not expected to significantly compromise the surrounding movement transport network. It can be concluded from the information presented in this TIA that the proposed Scheme Amendment and Local Structure Plan should be supported by the future traffic network. Accordingly, overall, the transport characteristics of the local structure plan are considered acceptable.



Appendix A Road Hierarchy Assessment



Appendix B Structure Plan Concept Plan



Lots 4 & 12 Caves Road and
Lots 14, 15 & 402 Bussell Highway,
Abbey
Civil, Electrical and Communications
Engineering Servicing Report

Revision 005 – 09 December 2022

Ref: 301250161

PREPARED FOR:

Venelia Ariane Stewart Testamentary Trust and
Michael Andrew St Patrick Stewart Testamentary Trust and
Lowe Pty Ltd and Phil Lukin Pty Ltd
c/- Rise Urban Attn: Cameron Leckey

PREPARED BY:

Richard Martin/Rhys Fowler

Revision

Revision	Date	Comment	Prepared By	Approved By
001	21 January 2021	Original issue	R. Martin	R. Martin
002	08 March 2021	Secondary area added	R. Martin	R. Martin
003	26 May 2022	Updated servicing advice. Report template updated.	R. Fowler	R. Martin
004	26 July 2022	Staging section added. Earthworks section added. Concept plan updated. Study area updated	R. Fowler	R. Martin
005	09 December 2022	Updated concept plan 003g	M. Kottaram	R. Martin

Contents

Executive Summary	1
1. General	2
1.1 Introduction	2
1.2 Site Description	2
2. Earthworks	4
3. Sewerage	5
3.1 Existing Infrastructure	5
3.2 Proposed Development Servicing	6
4. Potable Water	7
4.1 Existing Infrastructure	7
4.2 Proposed Development Servicing	7
5. Underground Power	8
5.1 Existing Infrastructure	8
5.2 Infrastructure Capacity / Proposed Upgrades	8
6. Communications	9
7. Gas	10
7.1 Existing Infrastructure	10
7.2 Proposed Development Servicing	10
8. Noise	11
9. Development Staging	12

Contents

Appendix A Concept Development Layout	_____
Appendix B Water Corporation Correspondence	_____
Appendix C Busselton Water Correspondence	_____
Appendix D ATCO Gas Correspondence	_____

Executive Summary

Stantec Australia Pty Ltd (Stantec) has been commissioned to prepare a desktop engineering servicing report for the area comprising Lots 4 & 12 Caves Road and Lots 14, 15 & 402 Bussell Highway, Abbey (the Site) within the City of Busselton.

A concept subdivision layout has been prepared by Rise Urban and is included as *Appendix A*. The information presented in this report is based on the concept subdivision layout, preliminary advice from the relevant service providers/authorities, and their available strategic planning information.

The desktop review has identified that infrastructure exists within close proximity to the Site which can be extended to provide the proposed development with the services discussed within this report.



1. General

1.1 Introduction

Stantec Australia Pty Ltd (Stantec) has been commissioned to prepare a desktop engineering servicing report for the area comprising Lots 4 & 12 Caves Road and Lots 14, 15 & 402 Bussell Highway, Abbey (the Site) within the City of Busselton. Figure 2 below provides an overview of the Site.

A concept subdivision layout has been prepared by Rise Urban and is included as *Appendix A*. The information presented in this report is based on the concept subdivision layout, preliminary advice from the relevant service providers/authorities, and their available strategic planning information.

1.2 Site Description

1.2.1 Site Location, Topography, and Existing Features

The Site is located near the intersection of Caves Road and Bussell Highway, Abbey within the City of Busselton, approximately 8km west of the Busselton CBD.



Figure 1: Site Location

Figure 2 on the following page indicates that the Site is typically parkland cleared of vegetation, with several small pockets of trees remaining. A number of dwellings and structures exist across the Site, particularly to the east where various businesses are also located. Ground levels across cleared portions of the Site range between approximately 3.60mAHD and 1.00mAHD, with ground levels generally being highest at a central 'ridge' that runs approximately east-west. There are lower lying areas to the north (up to Caves Road) and particularly to the south (down to the Vasse Estuary). An existing dam is located in the south-west corner of the Site, in a low-lying area that is within the 1% AEP floodplain of the Vasse Estuary.

Acid Sulfate Soil (ASS) risk mapping published by the Department of Water and Environmental Regulation, as presented in *Figure 3*, indicates most of the Site sits within an area identified as having 'moderate to low risk of ASS occurring within 3m of natural soil surface...'. The southern portion of the site is within an area identified as having 'high to moderate risk of ASS occurring within 3m of the natural soil surface'.





Figure 2: Site Overview (Imagery: Nearmap, dated 06/04/2022)

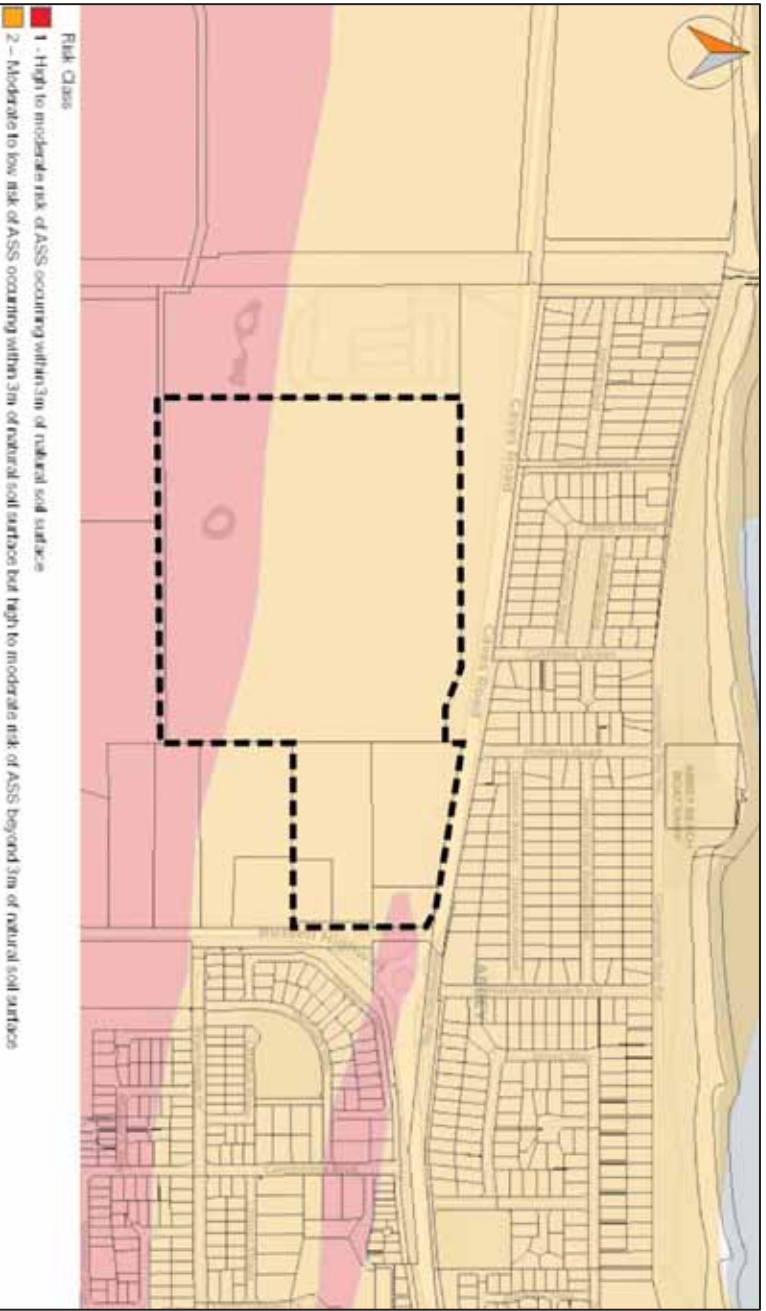


Figure 3: ASS Risk Mapping (Department of Water and Environmental Regulation)



2. Earthworks

Earthworks will be required to facilitate the proposed development of the Site. It is understood that, in general, earthworks will be designed and undertaken to achieve the following:

- Align with the overall drainage strategy for the Site as outlined in a Local Water Management Strategy.
- Aim to mimic the pre-development shaping and catchment flow of the land.
- Retain trees across the Site where it is feasible to do so.
- Allow for a minimum habitable finished floor level of 3.00mAHD to address coastal inundation risk.
- No filling is proposed to be undertaken within the designated floodway.

An existing dam within the Site may require filling depending on the proposed development layout. If filling of the dam is necessary, it is recommended that specific geotechnical advice is sought on the requirements for doing so.



3. Sewerage

3.1 Existing Infrastructure

Water Corporation operates a gravity sewerage network in the area surrounding the Site, with their existing infrastructure depicted in *Figure 4*. The existing gravity sewerage network is predominantly located north of Caves Road and gravitates to an existing wastewater pump station (WWPS), Busselton PS24, on the southern side of Caves Rd adjacent the Site.

Busselton PS24 discharges via a DN200 pressure main that pumps to an existing WWPS south of the Site adjacent the Vasse Bypass, and from there ultimately east to Water Corporation's wastewater treatment plant on Queen Elizabeth Avenue.

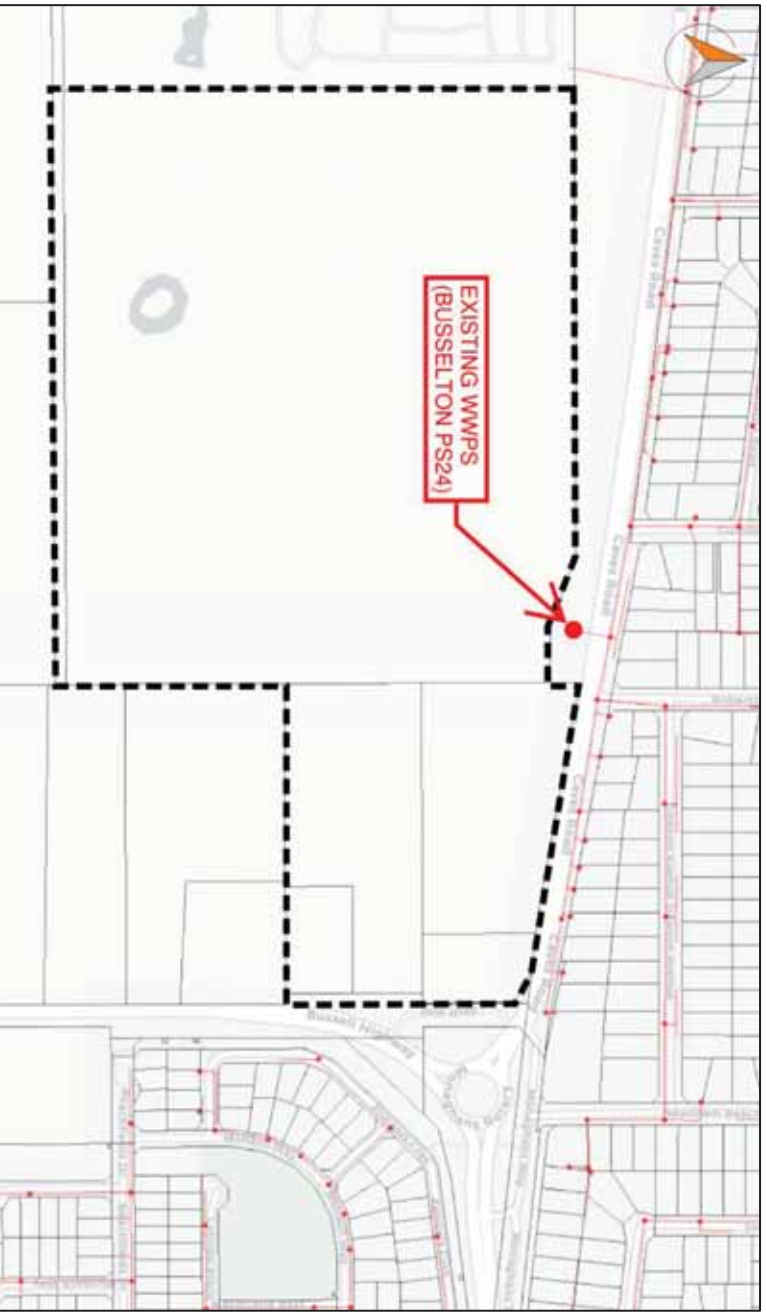


Figure 4: Existing Water Corporation Sewerage Infrastructure



3.2 Proposed Development Servicing

The proposed development area is located within Water Corporation's SD090 Busselton Long Term Sewer Planning (SD090) scheme boundary. This scheme planning shows that the Site is located within the catchment of an existing pump station (Busselton PS24) and will be serviced via DN150 gravity sewers extending from the PS24 site.

An extract from Water Corporation's SD090 document is included as *Figure 5*.

Water Corporation's ESInet system indicates the existing gravity sewers at the Busselton PS24 site are approximately 7m deep, which should be sufficient to service the proposed development of the Site.

Starterc contacted the Water Corporation as part of these investigations, who confirmed the proposed development can be serviced via gravity sewers extending from the existing Busselton PS24 site. A copy of correspondence with Water Corporation is included as *Appendix B*.

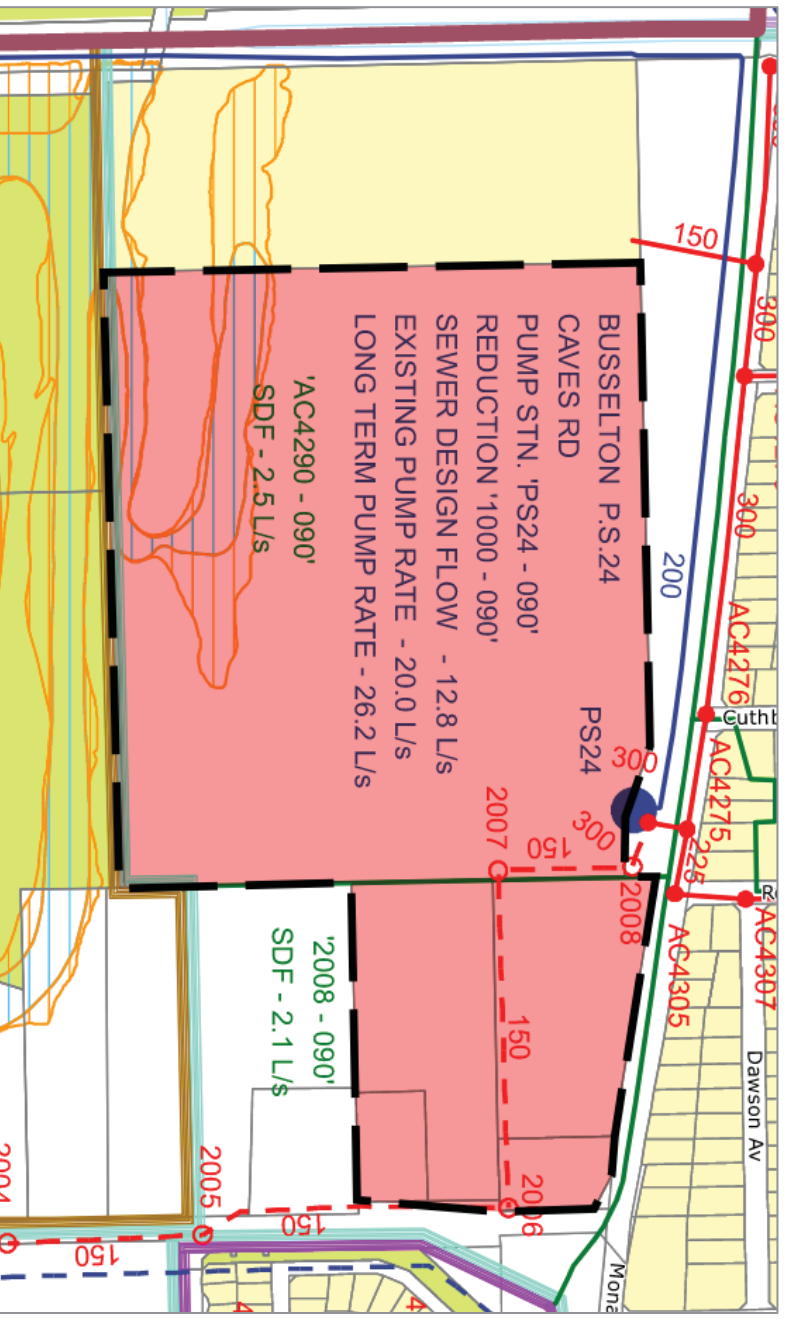


Figure 5: Extract from Water Corporation SD090



4. Potable Water

4.1 Existing Infrastructure

Busseton Water operates a reticulated potable water network in the area surrounding the Site. As indicated in *Figure 6*, Busseton Water has an existing DN250 water main on the northern side of Caves Road, and an existing DN375 main on the eastern side of Bussell Highway. Busseton Water also has smaller diameter water mains servicing the surrounding areas which are not shown in *Figure 6* for clarity.



Figure 6: Existing Water Main Locations (smaller reticulation mains not shown)

4.2 Proposed Development Servicing

Busseton Water was contacted to provide advice on the requirements for servicing the proposed development of the Site with potable water. Busseton Water advised that the existing DN250 main on the northern side of Caves Road is unlikely to have sufficient capacity to service the proposed development, however this can only be confirmed by detailed investigations and hydraulic modelling. Busseton Water advised that if the existing DN250 main does not have sufficient capacity, an extension from the existing DN375 main east of Bussell Highway is likely to be required.

Stantec queried Busseton Water on whether only the initial stage(s) of development, or a certain number of lots, could be serviced from the DN250 main, with extension from the DN375 main undertaken as further development continues. Busseton Water advised that this was unlikely to be possible, but a hydraulic review at the Developer's cost would be required to be able to confirm this.

Busseton Water also advised that an extension from their DN375 main is not part of their capital works program in the next ten years and would likely need developer funding. Stantec has queried Busseton Water on the process for having this mains extension included within their capital works program sooner, however at the time of preparing this report a response has not yet been received.

A copy of correspondence with Busseton Water is included as *Appendix C*.



5. Underground Power

5.1 Existing Infrastructure

An analysis of Western Power's DFIS system has been conducted to determine the existing power supply configuration surrounding the development. The existing Western Power network surrounding the site consists of the following:

- High voltage (HV) underground cables from the Caves Rd / Bussell Hwy intersection, in a westerly direction through to the Bussellton Holiday Park. This HV line is located within the Caves Rd reserve up to Roberts Rd, after which it deviates south and then west to the southern side of the native landscape strip. The existing underground cable can remain in place, provided the alignment does not clash with any proposed services or roads within the proposed subdivision.
- HV underground cable from the south-western corner of the Site to the existing residence. It is likely that Western Power will require that this cable be removed, and that the existing residence be re-supplied from the new internal power network.
- HV underground cable from the Caves Rd / Bussell Hwy intersection, in a southerly direction (eastern corner of the Site in vicinity of the existing market site). Provided this cable is in the correct alignment and does not clash with any proposed services, it is likely that Western Power will allow this cable to remain in place as it currently services the market site.
- Existing supply to Ice Factory. We are unable to locate the power supply for this site, but it is likely to be an underground low voltage connection from either the market site, or from the existing overhead line on the eastern side of Bussell Hwy. It is likely that Western Power will allow this service to remain in place.

5.2 Infrastructure Capacity / Proposed Upgrades

Based on the proposed development, it is likely that the site power demand will be in the vicinity of 1.5-2 MVA. This is based on the standard Western Power load allocation of 4.7kVA per lot for residential lots and 200kVA/ha for commercial lots.

The Western Power Network Capacity Mapping Tool indicates that the forecasted remaining capacity for this area for 2021 is in the order of 15-20MVA (20/01/2021). This figure indicates that capacity is available at the zone substation, however we are unable to confirm whether any off-site feeder upgrades may be required to service the development. This can only be confirmed via a formal Western Power Feasibility or Design Information Package application.

In order to service the proposed subdivision, it is likely that a new switchgear site will be established near the new entrance (opposite Roberts Rd). The new HV switch will be supplied by cutting into the existing HV underground cable and will supply two transformers within the subdivision. Transformers should be installed within public open spaces as they have fire exclusion zones that significantly reduce usable space within residential lots.

It should be noted that due to the dynamic nature of Western Power's network, infrastructure requirements and connection points referred above may differ when applications are placed in the future. It is recommended that a planning study be undertaken closer to the date of proposed load uptake to determine if the existing network has the capacity to service the proposed development.



6. Communications

The proposed development will require a fibre ready pit and conduit network to be installed at the Developer's cost.

The pit and conduit will be designed in accordance with NBN standards and will be installed in the telecommunications alignment within the internal road reserves. Once installed and inspected, ownership of the pit and conduit network will be transferred to NBN.

An analysis of NBN's DBYD has been conducted in order to determine the location of the existing NBN network that would supply the proposed pit and conduit network. The nearest existing NBN network is located within the road reserve on the Northern side of Caves Road. Based on the proposed development, it is likely that the connection will initially originate from existing pits along Caves Road (opposite Roberts Rd). Minor works (relocations) may be required in this vicinity to accommodate the new connection to the subdivision.

It should be noted that due to the dynamic nature of NBN's network, infrastructure requirements and connection points referred above may differ when applications are placed in the future.

In addition to the new pit and conduit network, the developer will be required to remove all existing telecommunications infrastructure that may be located within the proposed new lots.



7. Gas

7.1 Existing Infrastructure

ATCO Gas operates a reticulated gas network in the area surrounding the Site. The closest infrastructure to the Site is an existing DN160 main located on the eastern side of Bussell Highway as indicated in *Figure 7*. ATCO Gas does not currently have infrastructure north of Caves Road or west of Bussell Highway.



Figure 7: Existing Gas Main Location (other gas reticulation not shown)

7.2 Proposed Development Servicing

ATCO Gas was contacted to provide advice on the requirements for servicing the proposed development of the Site with reticulated gas. ATCO Gas advised that their existing DN160 main has capacity to service the proposed development of the Site. ATCO Gas also advised that a new DN160 main would need to be extended to the Site from the existing Bussell Highway main. The location and length of the required mains extension will depend on staging of the proposed development.

When the scope of the mains extension is known ATCO Gas would prepare a business case and assess whether they would contribute towards any of the mains extension cost or whether the Developer would be required to fully fund costs. Internally to the development, ATCO Gas would design the gas reticulation network. It is anticipated that they may fund the installation of the internal gas reticulation into a common trench provided by the Developer (as is common for developments in the area), however this can only be confirmed by ATCO Gas at the time of detailed design.

A copy of correspondence with ATCO Gas is included as *Appendix D*.



8. Noise

Based on the proximity of the Site to Caves Road and Bussell Highway, it is recommended that the potential noise and acoustic impacts on the proposed development are considered. It is recommended that a suitably qualified acoustic specialist be consulted to determine whether specific acoustic treatments may be warranted (e.g. noise bund / noise wall, setbacks, building requirements, notices on titles etc.).



9. Development Staging

Development of the Site will be undertaken in a staged manner with an indicative staging layout shown in *Figure 8* below. Development is likely to commence in the northern portion of the Site adjacent Caves Road where services can be extended into the Site from their existing locations.

The initial stages of development will likely include the two proposed entry points from Caves Road, with development then continuing south in an orderly and logical manner to allow extensions of constructed infrastructure.

It should be noted that, depending on the final staging layout and the staged construction of roads, temporary emergency access tracks may be required to provide additional access/egress routes until a sufficient number of road connections are constructed.



Figure 8: Indicative Development Staging



Appendix A

Concept Development Layout





Appendix B

Water Corporation Correspondence



Fowler Rhys

From: Rajiv Narendranathan <Rajiv.Narendranathan@watercorporation.com.au>
Sent: Wednesday, 25 May 2022 5:06 PM
To: Rob Pettersson
Subject: FW: SEWER SERVICES TO RESIDENTIAL (300L's) DEVELOPMENT PROPOSAL: Caves Rd, Abbey (SF0009373)
Attachments: caves rd abbey.pdf; SEWER SERVICES TO RESIDENTIAL (300L's) DEVELOPMENT PROPOSAL: Caves Rd, Abbey (SF0009373)

Hi Rob,

Following this email and the original one attached, the development for 300 residential houses residential houses can be accommodated by the proposed DN150 gravity network feeding into the proposed AC#2008.

Please let me know if you have any questions/comments.

Thanks,

Rajiv Narendranathan

Principal, WW Conveyance (acting)

Customer Networks (Regional)

Water Corporation

T : (08) 9420 2860

M : 0424 757 372

From: Rob Pettersson <Rob.Pettersson@watercorporation.com.au>

Sent: Wednesday, 18 May 2022 10:24 AM

To: Customer Networks Regional Inbox <CustomerNetworksRegionalInbox@watercorporation.com.au>

Subject: FW: SEWER SERVICES TO RESIDENTIAL (300L's) DEVELOPMENT PROPOSAL: Caves Rd, Abbey (SF0009373)

Further details from consultant - Stantec

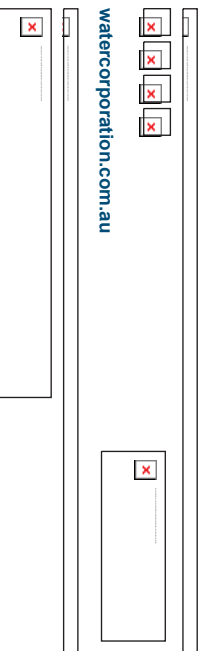
Rob Pettersson

Adv - Network Expansion

Development Services

E Rob.Pettersson@watercorporation.com.au

T (08) 9420 3970



🚩 Please consider the environment before printing this email.

From: Fowler, Rhys <rhys.fowler@stantec.com>

Sent: Wednesday, 18 May 2022 9:52 AM

To: Rob Pettersson <Rob.Pettersson@watercorporation.com.au>

Subject: RE: SEWER SERVICES TO RESIDENTIAL (300L's) DEVELOPMENT PROPOSAL: Caves Rd, Abbey (SF0009373)

Hi Rob,

Thanks for your email.

The attached concept plan is all that is currently available.

We are preparing a servicing report which will support a structure plan, so at this stage just needing confirmation that the site would be serviced via extension of DN150 sewers from the existing PS24 WWPS on Caves Rd as per SD090.

The only query would be the area circled below, which is shown outside the catchment of PS24? Is there a reason this area couldn't be included within the catchment?

Just to clarify – the first stage of development could start within the next few years but the development as a whole would be over a longer period.

Thanks,



Rhys Fowler

Civil Engineer

Direct: +61 8 9717 6103

rhys.fowler@stantec.com

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From: Rob Pettersson <Rob.Pettersson@watercorporation.com.au>

Sent: Wednesday, 18 May 2022 9:08 AM

To: Fowler, Rhys <rhys.fowler@stantec.com>

Subject: SEWER SERVICES TO RESIDENTIAL (300L'S) DEVELOPMENT PROPOSAL: Caves Rd, Abbey (SF0009373)

Hi Rhys,

Can you please provide any further details for this 2 year development. That is, WAPC reference, Structure/rezoning plan, Development plan,

Thanks

Rob Pettersson

Adv - Network Expansion
Development Services

E Rob.Pettersson@watercorporation.com.au

T (08) 9420 3970

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Appendix C

Busselton Water Correspondence



From: Peter Campbell Hicks <peter.campbellhicks@busseltonwater.wa.gov.au>
Sent: Wednesday, 25 May 2022 3:17 PM
To: Fowler, Rhys; Chris Temple
Cc: Martin, Richard
Subject: RE: Servicing Advice - Lot 4 Caves Rd, Abbey and adjacent lots

Hi Rhys,

Please see below.

Kind regards,

Peter Campbell-Hicks
Planning Coordinator
0407 086 948 | busseltonwater.wa.gov.au | 1 Fairbairn Road Busselton WA 6280 | PO Box 57
Busselton WA 6280

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From: Fowler, Rhys <rhys.fowler@stantec.com>
Sent: Wednesday, 25 May 2022 2:31 PM
To: Peter Campbell Hicks <peter.campbellhicks@busseltonwater.wa.gov.au>; Chris Temple <chris.temple@busseltonwater.wa.gov.au>
Cc: Martin, Richard <richard.martin2@stantec.com>
Subject: RE: Servicing Advice - Lot 4 Caves Rd, Abbey and adjacent lots

Hi Peter & Chris,

Thanks for the call to discuss this project. I've summarised the main points below – can you please confirm this is as discussed.

- The existing DN250 main in Caves Rd is close to capacity. It is unlikely this main would have the ability to service the proposed development (but this can only be confirmed by detailed investigations and hydraulic modelling)
- **If the existing DN250 is not adequate, an extension from the existing DN375mm trunk main East of Bussell Hwy is likely to be required. It is likely the proposed development would instead need to be serviced from the existing DN375 main east of Bussell Hwy.**
- **The extension is not part of Busselton Water's Capital program in the next 10 years and would likely need developer funding. It is unlikely that the extension from the existing DN375 main to service the site would be part of Busselton Water's capital works program, and would likely need to be developer funded.**
- The above is all subject to more detailed investigations and the timing of development.

Given that the first stages of development would likely be adjacent Caves Rd, would there be potential for the initial stage(s) or a certain number of lots to be serviced from the existing DN250 main? With the extension from the DN375 main undertaken as development of further stages continues and moves east to Bussell Hwy? **Unlikely, given how close it is to capacity, however a hydraulic review would be required to answer, a quote would be provided for works.**

Thanks,

Rhys Fowler
Civil Engineer

Direct: +61 8 9717 6103
rhys.fowler@stantec.com
Stantec Australia Pty Ltd

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From: Fowler, Rhys

Sent: Wednesday, 25 May 2022 1:29 PM

To: Peter Campbell Hicks <peter.campbellhicks@busseltonwater.wa.gov.au>

Cc: Martin, Richard <richard.martin2@stantec.com>

Subject: RE: Servicing Advice - Lot 4 Caves Rd, Abbey and adjacent lots

Hi Peter,

Thanks for the email.

Unfortunately at this stage the only additional information I have is that the development could yield approx. 300 residential lots in total.

The first stage could commence in the second half of next year, and then rate of development would be market driven. If you needed an estimate, then could potentially assume one stage of maybe 30-40 lots per year.

We are unsure of their plans for re-zoning etc. but we've been asked to investigate the entire area as shown on the concept plan.

Hope this helps.

Regards,

Rhys Fowler

Civil Engineer

Direct: +61 8 9717 6103

rhys.fowler@stantec.com

Stantec Australia Pty Ltd

Better Together, Even If We're Apart. [Read more about Stantec's COVID-19 response, including remote working and business continuity measures.](#)

From: Peter Campbell Hicks <peter.campbellhicks@busseltonwater.wa.gov.au>

Sent: Wednesday, 25 May 2022 12:17 PM

To: Fowler, Rhys <rhys.fowler@stantec.com>

Cc: Martin, Richard <richard.martin2@stantec.com>

Subject: RE: Servicing Advice - Lot 4 Caves Rd, Abbey and adjacent lots

Hi Rhys,

Apologies for the delay.

Do you have a few more rough details at this stage of number of services and rough project timeline you are referring?

The 250mm trunk main is very close to capacity currently on peak days (particularly in the summer we've just had) and only at the hydraulic review stage will we be able to give final confirmation.

The new drawing/ concept plan, is also over a bigger area than the City of Busselton's Local Planning Scheme, which we'd previously anticipated. Is this likely to be the size of the scheme?

Kind regards,

Peter Campbell-Hicks

Planning Coordinator

0407 086 948 | busseltonwater.wa.gov.au | 1 Fairbairn Road Busselton WA 6280 | PO Box 57 Busselton WA 6280

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From: Fowler, Rhys <rhys.fowler@stantec.com>

Sent: Wednesday, 25 May 2022 8:53 AM

To: Peter Campbell Hicks <peter.campbellhicks@busseltonwater.wa.gov.au>

Cc: Martin, Richard <richard.martin2@stantec.com>

Subject: RE: Servicing Advice - Lot 4 Caves Rd, Abbey and adjacent lots

Hi Peter,

We are needing to finalise our report for the Developer by the end of this week – are you please able to advise when Busselton Water's advice/confirmation of the below will be available?

Regards,

Rhys Fowler

Civil Engineer

Direct: +61 8 9717 6103

rhys.fowler@stantec.com

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From: Fowler, Rhys

Sent: Thursday, 12 May 2022 3:18 PM

To: Peter Campbell-Hicks <peter.campbellhicks@busseltonwater.wa.gov.au>

Cc: Martin, Richard <richard.martin2@stantec.com>

Subject: Servicing Advice - Lot 4 Caves Rd, Abbey and adjacent lots

Hi Peter,

We have been asked to obtain updated servicing advice for the proposed development indicated on the attached sketch.

Jarrad has previously provided the below advice.

Can you please advise if Jarrad's previous advice is still current, and that the proposed development area can be serviced from the existing Caved Rd DN250 main without need for network upgrades or reinforcement?

[Google Maps link to location](#)

Thanks,

Rhys Fowler

Civil Engineer

Direct: +61 8 9717 6103

rhys.fowler@stantec.com

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From: Jarrad Leaver <jarrad.leaver@busseltonwater.wa.gov.au>

Sent: Wednesday, 13 January 2021 9:05 AM

To: Martin, Richard <richard.martin2@stantec.com>

Subject: RE: Lot 4 Caves Road, Abbey

Hi Richard,

There is provision for the water to come from the 250mm Main on the north side of Caves road, on the map provided there will be two connections from this main near 17 and 7 as depicted numerically on the map. The 250mm main will be sufficient to supply the area

As per usual when the time comes this would need to be hydraulically designed by BW.

Thanks

Jarrad Leaver

Planning / Safety Officer

+61 8 9781 0516 | 0417 910 637

busseltonwater.wa.gov.au | 1 Fairbairn Road Busselton WA 6280 | PO Box 57 Busselton WA 6280



From: Martin, Richard <richard.martin2@stantec.com>

Sent: Wednesday, 13 January 2021 8:17 AM

To: Jarrad Leaver <jarrad.leaver@busseltonwater.wa.gov.au>

Subject: Lot 4 Caves Road, Abbey

Hi Jarrad,

I am doing a servicing report for the landholding shown on the attached plan and need to have a look at where the water will come from and if there are any potential infrastructure upgrades etc.

Are you able to please provide some advice.

Cheers

Richard Martin

Group Leader - Principal, Busselton

Office: +61 8 9754 4244

Direct: +61 8 9717 6101

Mobile: +61 423 232 963

richard.martin2@stantec.com

Stantec Australia Pty Ltd

PO Box 1276, 10/44-48 Queen Street, Busselton

Western Australia 6280

Australia



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Appendix D

ATCO Gas Correspondence



From: Asset Services <Asset.Services@atco.com>
Sent: Tuesday, 17 May 2022 5:36 PM
To: ATCO Gas AU – Land Development; Fowler, Rhys
Cc: Deacon, Lee; See, Mabel; Enquiries; Martin, Richard; Hoyne, Ben
Subject: RE: [ATCO Ref - 8902] - Lots 4 and 12 Caves Rd, + Lots 14, 15, + 402 Bussell Hwy, Abbey

Hi Rhys

Based on modelling, the PEHP network for the area has available capacity for the new lots and a proposed main extension of DN160PE is required from the existing DN160PE mains on Bussell Highway. We will design the gas supply network within the lots once the estate plan is available which will branch out from the proposed DN160PE main.

Assumptions:

PEHP Busselton 30 – Severe Winter

Thank you.

Regards

Sophia Henry

Asset Planning Engineer
ATCO, Gas Division, Australia

P. +61 8 6163 5073

A. 81 Prinsep Road, Jandakot, Western Australia, 6164

[atco.com.au](#) [Facebook](#) [Twitter](#) [LinkedIn](#)



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From: ATCO Gas AU – Land Development <Land.Development@atco.com>
Sent: Monday, 16 May 2022 10:54 AM
To: Fowler, Rhys <rhys.fowler@stantec.com>
Cc: Deacon, Lee <Lee.Deacon@atco.com>; See, Mabel <Mabel.See@atco.com>; Enquiries <Enquiries@atco.com>; Martin, Richard <richard.martin2@stantec.com>; Asset Services <Asset.Services@atco.com>; Anak Henry, Sophia <sophia.anakhenry@atco.com>
Subject: RE: [ATCO Ref - 8902] - Lots 4 and 12 Caves Rd, + Lots 14, 15, + 402 Bussell Hwy, Abbey

Hi Rhys

ATCO will be in touch with you soon to provide your requested servicing advice.

Thanks

Lewis Searle
GIS Analyst

Gas, Australia

P. +61 8 6163 5160

A. 81 Prinsep Road, Jandakot, Western Australia, 6164

[atco.com.au](#) [Facebook](#) [Twitter](#) [LinkedIn](#)



From: Fowler, Rhys <rhys.fowler@stantec.com>

Sent: Friday, 13 May 2022 4:56 PM

To: ATCO Gas AU – Land Development <Land.Development@atco.com>

Cc: Deacon, Lee <Lee.Deacon@atco.com>; See, Mabel <Mabel.See@atco.com>; Enquiries <Enquiries@atco.com>; Martin, Richard <richard.martin2@stantec.com>

Subject: RE: Lots 4 and 12 Caves Rd, Abbey - Gas Servicing Advice - Please pass on all available up-to-date information on this project

****Caution – This email is from an external source. If you are concerned about this message, please forward it to spam@atco.com for analysis.****
Hi Lewis,

Thanks for your email.

This project is in early stages so there is not yet a precal or water plans available, and unfortunately I'm unsure when or by who the previous advice from ATCO came from.

The provided concept plan is all that is currently available. The development would yield approximately 300 residential lots.

At this stage we not requiring any design, and are just seeking advice on whether ATCO's existing network has capacity to service the proposed development from the existing main to the east in Bussell Hwy.

Have a great weekend.

Thankyou,

Rhys Fowler

Civil Engineer

Direct: +61 8 9717 6103

rhys.fowler@stantec.com

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From: ATCO Gas AU – Land Development <Land.Development@atco.com>

Sent: Friday, 13 May 2022 4:23 PM

To: Fowler, Rhys <rhys.fowler@stantec.com>; Martin, Richard <richard.martin2@stantec.com>

Cc: Deacon, Lee <Lee.Deacon@atco.com>; See, Mabel <Mabel.See@atco.com>; ATCO Gas AU – Land Development <Land.Development@atco.com>; Enquiries <Enquiries@atco.com>

Subject: RE: Lots 4 and 12 Caves Rd, Abbey - Gas Servicing Advice - Please pass on all available up-to-date information on this project

Importance: High

Hi, we would need to see all available up-to-date information on this project before this previous undertaking given to you could be positively endorsed (not sure when ATCO made this statement?).

Please pass on the latest, up to date **common trenching water plans in pdf format, plus the precal cadastral CAD file in .dwg or .dgn format**, so we can update our GIS to show the latest lot configuration. Using the water plan and the latest cadastre we with then be able to get a better idea of exactly how the lots within your project may be serviced, and any associated servicing costs that may be applicable.

Please continue to address future communication to Land.Development@atco.com

Lewis Searle
GIS Analyst
Gas, Australia

P. +61 8 6163 5160

A. 81 Prinsep Road, Jandakot, Western Australia, 6164
atco.com.au [Facebook](#) [Twitter](#) [LinkedIn](#)



From: See, Mabel <Mabel.See@atco.com>

Sent: Friday, 13 May 2022 3:56 PM

To: ATCO Gas AU – Land Development <Land.Development@atco.com>

Cc: Deacon, Lee <Lee.Deacon@atco.com>

Subject: FW: Lots 4 and 12 Caves Rd, Abbey - Gas Servicing Advice

Hi Lewis and Lee,

I believe this sits with your team? Please see email below.

Regards,

Mabel See

Senior Asset Planning Engineer
ATCO, Gas Division, Australia

P. +61 8 6163 5042

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From: Enquiries <Enquiries@atco.com>

Sent: Friday, 13 May 2022 3:37 PM

To: *AGA GAS AU – Asset Services escalation <AssetServicesEscalation@atco.com>; Engineering Services <eservices@atco.com>

Cc: Enquiries <Enquiries@atco.com>
Subject: FW: Lots 4 and 12 Caves Rd, Abbey - Gas Servicing Advice

Hi,

Please see below email

Kind Regards,

Alex

Senior Customer Service Representative
ATCO, Gas Division, Australia

P. +61 13 13 56

ATCO acknowledges Aboriginal people as the Traditional Custodians of country throughout Australia including Torres Strait Islander peoples.

From: Fowler, Rhys <rhys.fowler@stantec.com>
Sent: Thursday, 12 May 2022 3:38 PM
To: Enquiries <Enquiries@atco.com>
Cc: Martin, Richard <richard.martin2@stantec.com>
Subject: Lots 4 and 12 Caves Rd, Abbey - Gas Servicing Advice

****Caution - This email is from an external source. If you are concerned about this message, please forward it to spam@atco.com for analysis.****
Hi,

We have been commissioned to investigate servicing requirements for the attached proposed development.

[Google Maps link to location](#)

I understand ATCO has a DN160 main to the east of the site along Bussell Hwy.
The below excerpt from a previous report on this landholding mentions verbal discussions with ATCO where it was advised that the development could be serviced from this existing main.

Can you please confirm if this advice is still current, and that the proposed development could be serviced with gas from the existing main without need for network upgrades or reinforcements?

Thankyou,

There are existing gas mains east of the proposed development site within Bussell Highway. No network upgrades or reinforcement required.

At the time of preparing this desktop assessment, ATCO had verbally advised Stantec that a connection to the existing 160 PE 350Kpa main in the eastern verge of Bussell Highway could provide a supply for the proposed development. No network upgrades or reinforcement required.

Regards,

Rhys Fowler
Civil Engineer

Office: +61 8 9754 4244
Direct: +61 8 9717 6103
rhys.fowler@stantec.com

Stantec Australia Pty Ltd
PO Box 1276, 10/44-48 Queen Street
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ABBEY SOUTH STRUCTURE PLAN

LANDSCAPE REPORT

JANUARY 2023

REV E

emerge
ASSOCIATES



CONTENTS

1.0	LANDSCAPE MASTERPLAN.....	3
2.0	POS 1 AND 6 LANDSCAPE CONCEPT PLAN.....	4
3.0	POS 4 LANDSCAPE CONCEPT PLAN.....	5
4.0	POS 2 AND 5 LANDSCAPE CONCEPT PLAN.....	6
5.0	POS 3A LANDSCAPE CONCEPT PLAN.....	7
6.0	POS 3B AND 3C LANDSCAPE CONCEPT PLAN.....	8
7.0	DRAINAGE STRATEGY.....	9
8.0	STREETSCAPE MASTERPLAN.....	10
9.0	ROAD RESERVE TYPICAL SECTION.....	11
10.0	IRRIGATION STRATEGY.....	12
11.0	MAINTENANCE STRATEGY.....	13



POS 1

- Existing Large Trees
- Basin & Swales
- Picnic Setting
- Drink Fountain
- Youth Facility
- Turf Mounding
- Bike Path
- Emergency Access
- Entry Feature

POS 2

- Existing Large Trees
- Basin & Swales
- Picnic Setting
- Drink Fountain
- Youth Facility
- Turf Mounding
- Bike Path
- Emergency Access
- Entry Feature

POS 3C

- Existing Large Trees
- Basin & Swales
- Picnic Setting
- Drink Fountain
- Youth Facility
- Turf Mounding
- Bike Path
- Emergency Access
- Entry Feature

POS 3B

- Existing Large Trees
- Basin & Swales
- Picnic Setting
- Drink Fountain
- Youth Facility
- Turf Mounding
- Bike Path
- Emergency Access
- Entry Feature

POS 6

- Existing Large Trees
- Basin & Swales
- Picnic Setting
- Drink Fountain
- Youth Facility
- Turf Mounding
- Bike Path
- Emergency Access
- Entry Feature

POS 4

- Existing Large Trees
- Basin & Swales
- Picnic Setting
- Drink Fountain
- Youth Facility
- Turf Mounding
- Bike Path
- Emergency Access
- Entry Feature

POS 5

- Existing Large Trees
- Basin & Swales
- Picnic Setting
- Drink Fountain
- Youth Facility
- Turf Mounding
- Bike Path
- Emergency Access
- Entry Feature

POS 3A

- Existing Large Trees
- Basin & Swales
- Picnic Setting
- Drink Fountain
- Youth Facility
- Turf Mounding
- Bike Path
- Emergency Access
- Entry Feature
- Public Art Opportunity
- Park Shelter
- BBQ
- Fitness Node

LEGEND

	EXISTING LARGE TREES		BASIN & SWALES		PICNIC SETTING		DRINK FOUNTAIN		YOUTH FACILITY		TURF MOUNDING		BBQ		FITNESS NODE		EMERGENCY ACCESS		FLOOD WAY		ROADSIDE SWALE		EXISTING TREE
	OPEN TURF		DUAL USE PATH		PLAYGROUND		COMPOSITE TIMBER DECKING		BENCH SEAT		BIKE PATH		PUBLIC ART OPPORTUNITY		PARK SHELTER		EMERGENCY ACCESS		FUTURE PATH CONNECTION		BRA		FSA

ABBAY SOUTH STRUCTURE PLAN
ABBAY LANDSCAPE MASTERPLAN

DWG EMG-60-3
REV E
DATE 06-01-23
SCALE 1:2500 @ A3

emerge ASSOCIATES

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U:\CURRENT PROJECTS\EMG60-Abbey PA023-Concept & Reports\EMG60-Abbey PA11\NCD\EMG60-Abbey PA11 Masterplan REV E.dwg (mgd)



PUBLIC OPEN SPACE 1

POS TYPOLOGY

- Feature park

SIZE

- POS 1 = 6520m²

BRA-03

- 1%AEP TWL (m2) 110
- Volume (m3) 41
- Slope 1:6
- Depth (m) 0.5

FSA-03

- 1%AEP TWL (m2) 540
- Volume (m³) 309
- Slope 1:6
- Depth (m) 1.0

CONCEPT

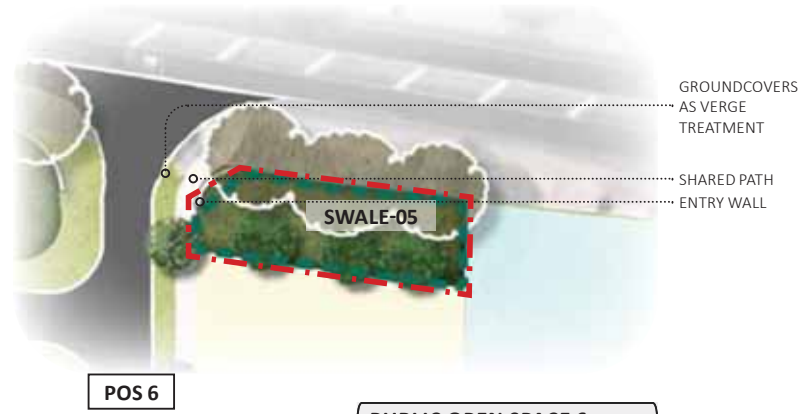
- Feature park immediately west of the main entry providing a strong sense of arrival playful open space under retained existing vegetation
- Community focal area with space for small events.

FUNCTIONS / MATERIALS

- Passive turf recreation under existing tree shade
- Combination of nature play and custom play under tree canopy
- Shade structure and picnic facilities
- Part of the cycle/jogging network to the beach

ENVIRONMENTAL CONSIDERATIONS

- Source local materials where possible
- Large grouping of existing trees to be retained for shade and fauna habitat
- Water-wise native planting selection
- Flood storage provision



PUBLIC OPEN SPACE 6

POS TYPOLOGY

- Entry POS

SIZE

- POS 6 = 286 m²

SWALE-05

- 1%AEP TWL (m2) 262.298
- Volume (m3) 88.477
- Slope 1:6
- Depth (m) 0.5

CONCEPT

- Pocket park and main entry, closest to the Bussell Highway providing a strong sense of arrival
- Area of retained existing vegetation

FUNCTIONS / MATERIALS

- Maximise shade with tree retention
- Landscape treatment interface to water treatment swale
- Part of the cycle/jogging path network and connection to broader precinct
- Vegetation buffer to screen off Caves Road

ENVIRONMENTAL CONSIDERATIONS

- Large grouping of existing vegetation to be retained for shade and fauna habitat
- Water treatment planting selection to swale



LEGEND

	BRA		MULCH ONLY
	FSA		SWALE PLANTING
	SWALE		PROPOSED TREES
	FEATURE PAVING		EXISTING TREES
	NETWORK PATH		PUBLIC ART
	TURF / PASSIVE RECREATION		
	FEATURE PLANTING		





PUBLIC OPEN SPACE 4
POS TYPOLOGY

- Local POS

SIZE

- POS 4 = 3455 m²

BRA-09

- 1%AEP TWL (m²) 204
- Volume (m³) 83.405
- Slope 1:6
- Depth (m) 0.5

FSA-09

- 1%AEP TWL (m²) 728
- Volume (m³) 451
- Slope 1:6
- Depth (m) 1.0

CONCEPT

- Provide a local park to cater for residents within a 200-400m walkable catchment .
- Large area of retained trees.

FUNCTIONS / MATERIALS

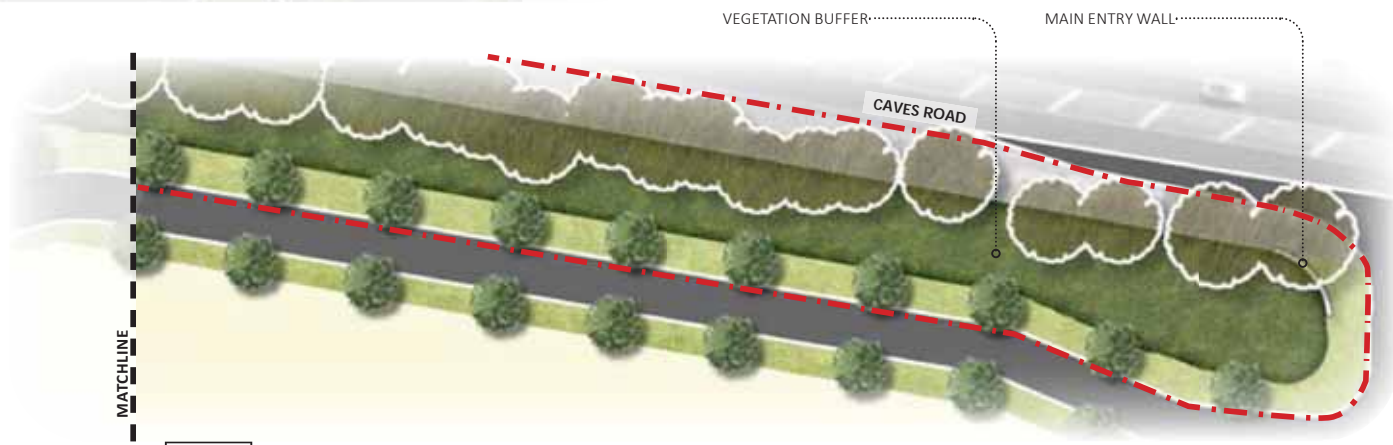
- Truf- informal kick-about area
- Maximise shade with tree retention
- Picnic facilities for family/friends gatherings
- Part of the cycle/jogging path network and connection to broader precinct
- Vegetation buffer to screen off Caves Road

ENVIRONMENTAL CONSIDERATIONS

- Large grouping of existing vegetation to be retained
- Water treatment planting selection to Bio-Retention Basin
- Water-wise native planting selection
- Flood storage provision



POS 4



POS 4





- PLAY AREA
- PICNIC SETTING
- PUBLIC ART
- SHARED PATH
- TURF / PASSIVE RECREATION

POS 5



PUBLIC OPEN SPACE 5
POS TYPOLOGY

- Local POS
- SIZE**
- POS 5 = 3420 m²
- BRA-08**
- 1%AEP TWL (m2) 137.906
- Volume (m3) 52.855
- Slope 1:6
- Depth (m) 0.5
- FSA-08**
- 1%AEP TWL (m2) 503
- Volume (m³) 281
- Slope 1:6
- Depth (m) 1.0

CONCEPT

- Provide a local park to cater for residents within a 200-400m walkable catchment. Provision of play elements to service commercial uses to the south.

FUNCTIONS / MATERIALS

- Turf- informal kick-about area
- Maximise shade with tree retention
- Picnic facilities for family/friends gatherings
- Play elements

ENVIRONMENTAL CONSIDERATIONS

- Water-wise native planting selection
- Water treatment planting selection to Bio-Retention Basins
- Flood storage provision



LEGEND

	BRA		MULCH ONLY
	FSA		SWALE PLANTING
	FEATURE PAVING		PROPOSED TREES
	NETWORK PATH		EXISTING TREES
	PLANTING AREAS		PUBLIC ART
	GROUNDCOVERS		



- TURF / PASSIVE RECREATION
- SHARED PATH
- SHELTER WITH PICNIC SETTING

POS 2

PUBLIC OPEN SPACE 2
POS TYPOLOGY

- Local POS
- SIZE**
- POS 2 = 6034m²
- BRA-06**
- 1%AEP TWL (m2) 123
- Volume (m3) 46
- Slope 1:6
- Depth (m) 0.5
- FSA-06**
- 1%AEP TWL (m2) 589.21
- Volume (m³) 345.139
- Slope 1:6
- Depth (m) 1.0

CONCEPT

- Provide a local park to cater for residents within a 200-400m walkable catchment. Park of the green network on the East – West alignment.

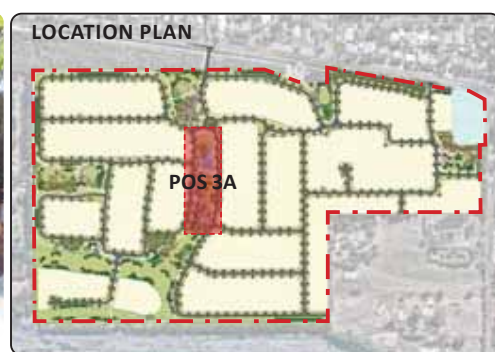
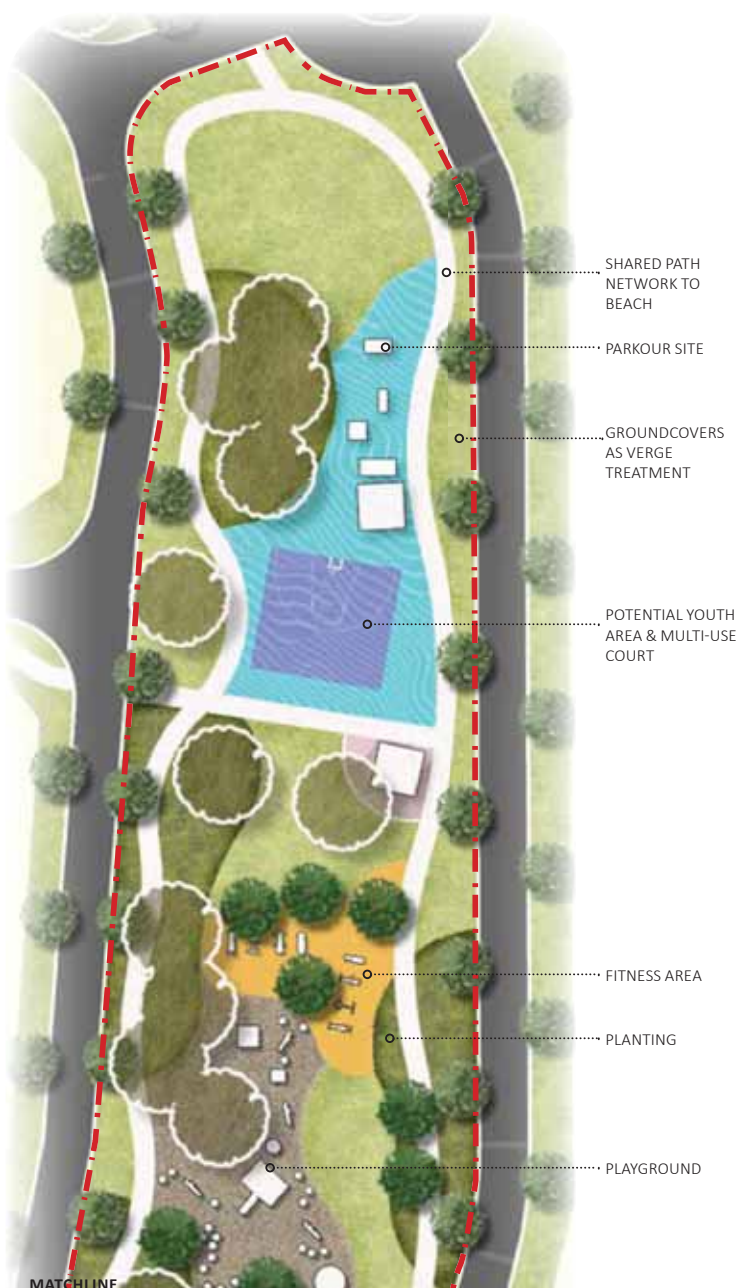
FUNCTIONS / MATERIALS

- Large active turf- informal kick-about area
- Maximise shade with tree retention
- Shelter and picnic facilities for family/friends gatherings
- Part of the cycle/jogging path network and connection to broader precinct.

ENVIRONMENTAL CONSIDERATIONS

- Large grouping of existing trees to be retained for shade and fauna habitat provision
- Water-wise native planting selection
- Water treatment planting selection to Bio-Retention Basin
- Flood storage provision
- Vegetation to meet low threat requirements under AS 3959 with ongoing management to maintain minimal fuel load





LEGEND

	BRA		MULCH ONLY
	FSA		SWALE PLANTING
	FEATURE PAVING		PROPOSED TREES
	NETWORK PATH		EXISTING TREES
	PLANTING AREAS		PUBLIC ART
	GROUNDCOVERS		



PUBLIC OPEN SPACE 3A

POS TYPOLOGY	BRA-10
• Neighbourhood POS	• 1%AEP TWL (m ²) 244
	• Volume (m ³) 100
SIZE	• Slope 1:6
• POS 3A, 3B & 3C = 27,000 m ²	• Depth (m) 0.5

CONCEPT

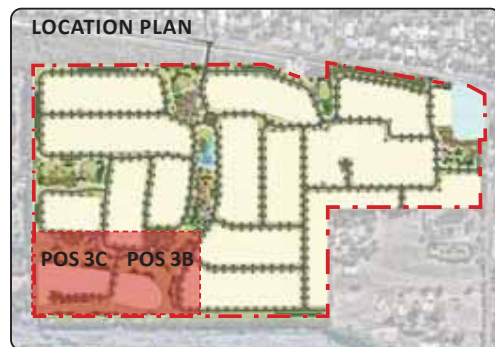
- Part of the central linear POS that connects through the residential area linking to the coast providing active recreational park catering for ages include youth ranges
- Providing a large accessible play space with interest for all ages
- Fitness-centric space to promote well-being and active lifestyle playing sports or parkour elements
- Existing tree to be protected and retained

FUNCTIONS / MATERIALS

- Turf- informal kick-about area
- Maximise shade with tree retention
- Active play spaces. Combination of nature play and custom play for all ages under
- Shade structures, picnic amenities and barbecues
- Part of the cycle/jogging network and connection to the wider precinct path network

ENVIRONMENTAL CONSIDERATIONS

- Large grouping of existing trees to be retained for shade and fauna habitat
- Water-wise native planting selection
- Water treatment planting selection to Bio-Retention Basin
- Flood storage provision
- Vegetation to meet low threat requirements under AS 3959 with ongoing management to maintain minimal fuel load



LEGEND

	BRA		MEADOW GRASSES
	FSA		SWALE PLANTING
	FLOOD WAY		PROPOSED TREES
	FEATURE PAVING		EXISTING TREES
	NETWORK PATH		PUBLIC ART
	PLANTING AREA		
	GROUNDCOVERS		

PUBLIC OPEN SPACE 3B & 3C

<p>POS TYPOLOGY</p> <ul style="list-style-type: none"> Neighbourhood POS and flood way area <p>SIZE</p> <ul style="list-style-type: none"> POS 3A, 3B & 3C = 27,000 m² <p>SWALE-12</p> <ul style="list-style-type: none"> 1%AEP TWL (m²) 276.632 Volume (m³) 94.064 Slope 1:6 Depth (m) 0.5 	<p>BRA-13A</p> <ul style="list-style-type: none"> 1%AEP TWL (m²) 105 Volume (m³) 38 Slope 1:6 Depth (m) 0.5 <p>BRA-13B</p> <ul style="list-style-type: none"> 1%AEP TWL (m²) 77 Volume (m³) 27 Slope 1:6 Depth (m) 0.5
---	--

- CONCEPT**
- Provide a soft landscaped interface on the western edge with a large meadow grasses
 - Provision of a maintained parkland interface for residences, retaining existing vegetation allowing for flood way considerations
- FUNCTIONS / MATERIALS**
- Landscape treatment interface to flood storage area and water treatment swale
 - Picnic facilities for family/friends gathering
 - Passive turf recreation areas
 - Part of the cycle/jogging network and connection to the broader cycle path network
- ENVIRONMENTAL CONSIDERATIONS**
- Water-wise native planting selection to Bio-retention areas
 - Floodway and storage provision
 - Vegetation to meet low threat requirements under AS 3959 with ongoing management to maintain minimal fuel load

PATH CONNECTION INTO ADJACENT NETWORK FEATURE PLANTING SHELTER WITH PICNIC SETTING PUBLIC ART CULVERT TO ALLOW FLOOD WAY CONVEYANCE TURF / PASSIVE RECREATION SHELTER WITH PICNIC SETTING FLOOD WAY AREA SHARED PATH EMERGENCY ACCESS





DRAINAGE STRATEGY

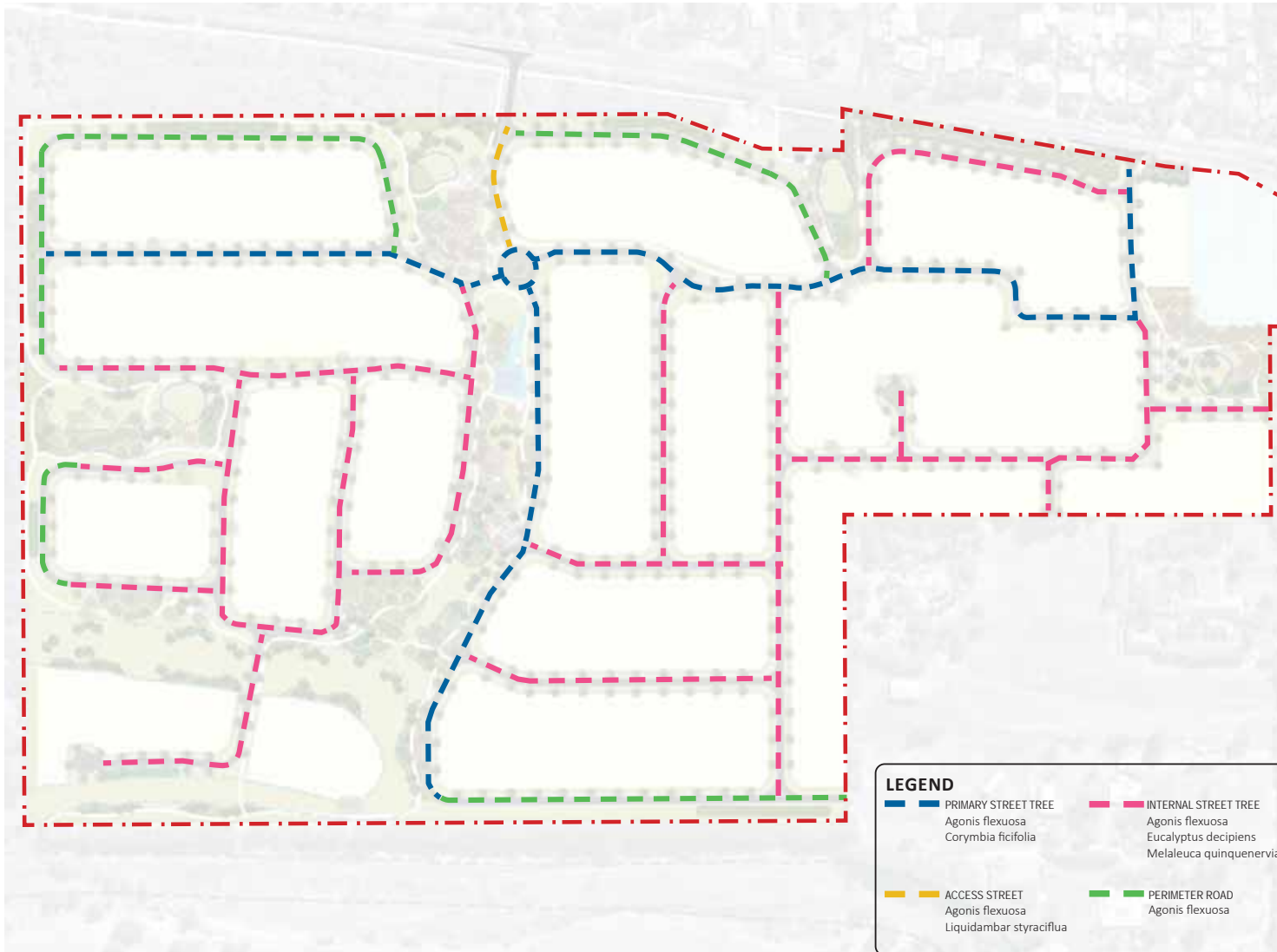
All stormwater from the development will be directed into a system of bio-retention treatment areas constructed along the edges of the POS. These devices will be sized to treat the flows from the small rainfall event in accordance with the principles of the Department of Water and Environmental Regulation. Storm events in excess of these will be directed into flood storage areas also typically located within POS. Flood storage areas will be planted with native species. Bio-retention areas will be located outside of Floodways.



STREETSCAPE PLAN

The Streetscape Planting Strategy design will be translated through different palettes of street trees providing legibility through the development.

Tree species selected are waterwise, fast growing, reliable and readily available whilst providing shade and amenity to each street. The proposed species below offer consistencies in appearance with differences in size and scale. Larger, taller trees are shown around POS areas and along north-south roads as the major connector roads through the development. A consistent mix of tree species are shown on minor local roads.



LEGEND	
— PRIMARY STREET TREE	— INTERNAL STREET TREE
Agonis flexuosa	Agonis flexuosa
Corymbia ficifolia	Eucalyptus decipiens
	Melaleuca quinquenervia
— ACCESS STREET	— PERIMETER ROAD
Agonis flexuosa	Agonis flexuosa
Liquidambar styraciflua	



Agonis flexuosa
WA Peppermint



Corymbia ficifolia
Red flowering gum



Liquidambar styraciflua
Star-leaved gum

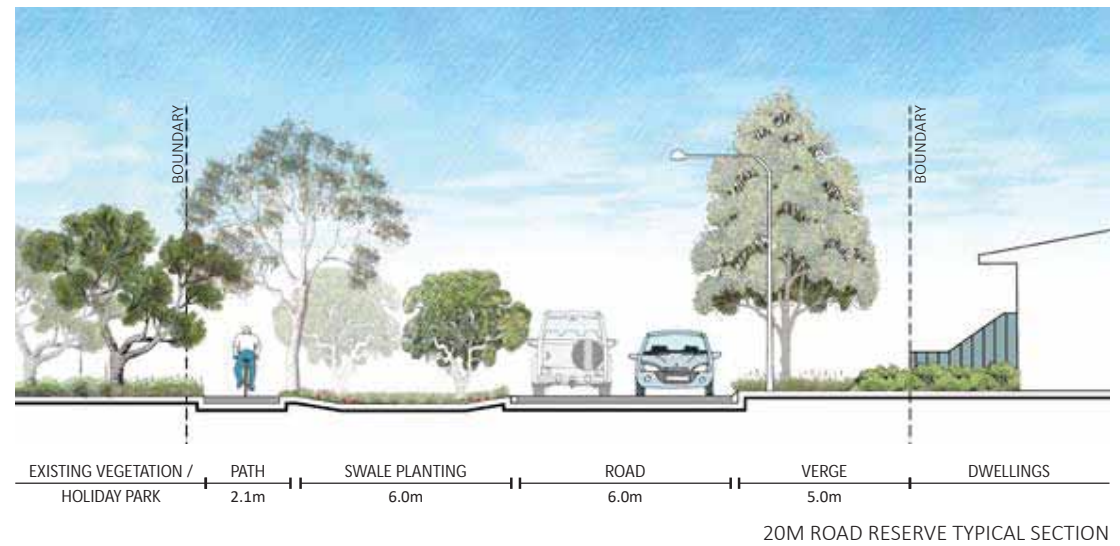
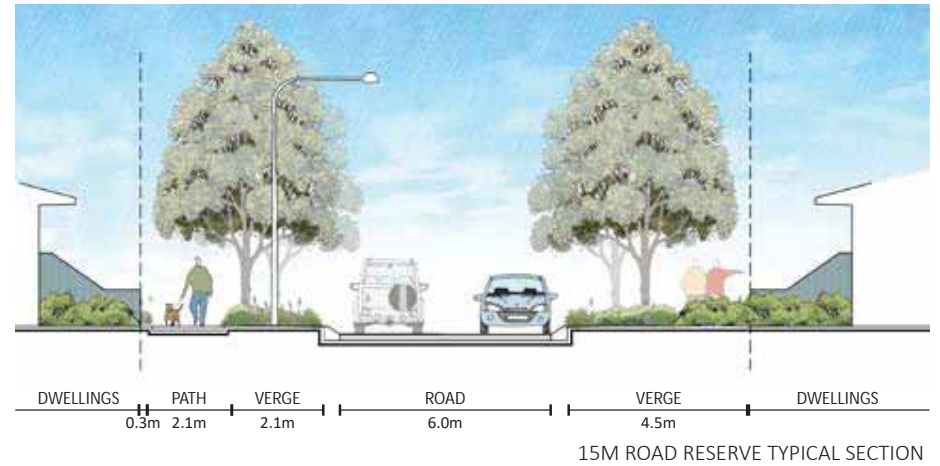


Eucalyptus decipiens
Redheart moit



Melaleuca quinquenervia
Broad-leaved paperbark





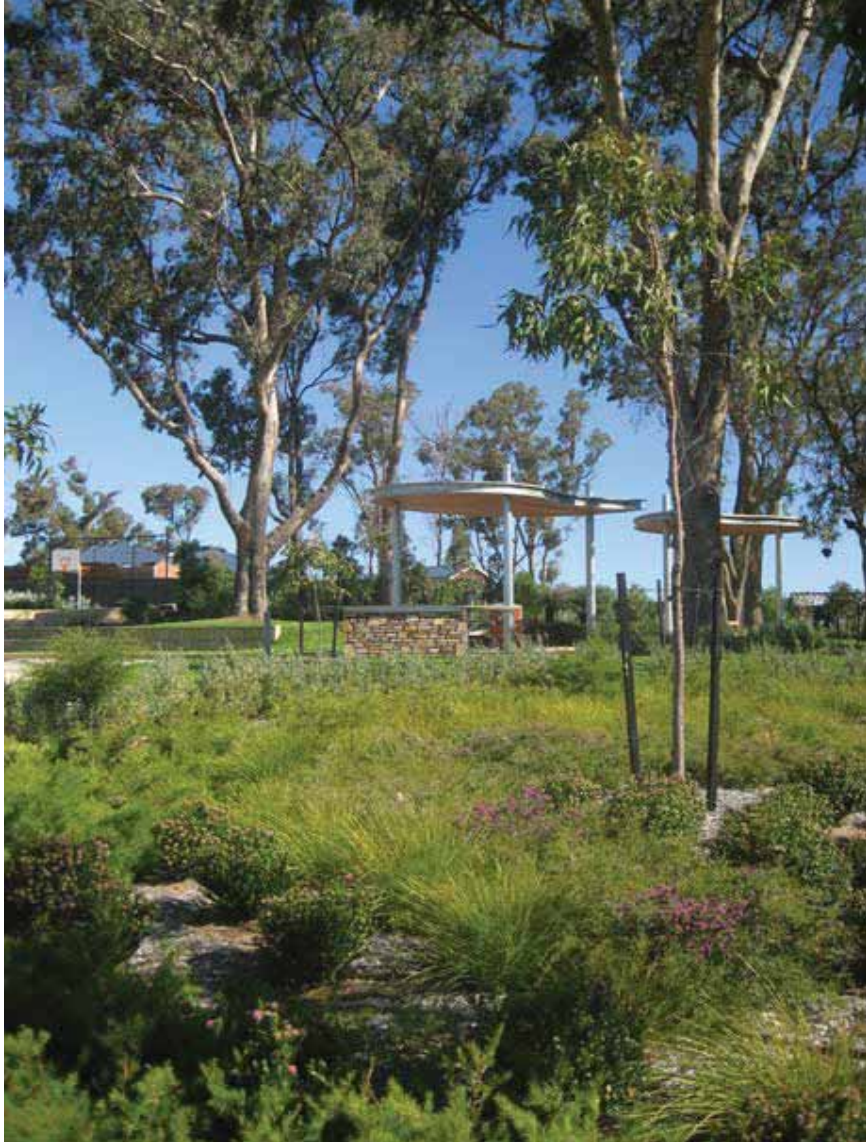
IRRIGATION STRATEGY

The planting design of all Streetscape and Public Open Space areas will consist of predominantly native species. Planting design is proposed to include a water sensitive design approach and will also seek to reduce irrigation rates over the long term to planting areas to promote a longer term water saving strategy for the development.

Hydrozoning will also provide a supplementary design principle whereby groups of plants with similar irrigation demand needs will be grouped together. This will facilitate irrigation efficiencies that can be made across the scheme.

Areas within the drainage swales, retention basins and revegetation areas are proposed to be in the main non-irrigated. Swales and basins will be planted with native sedges and rushes to facilitate with the drainage engineering required for the site. The water table in these areas will be close to the surface particularly in winter months possibly limiting the need for irrigation within swale. Revegetation areas will be planted with endemic native species.





MAINTENANCE STRATEGY

In all cases, a maintenance regime will be in place inclusive of general maintenance minimisation through design practices and will aim to use sustainable maintenance practices. This includes, but is not limited to, defined edges and borders, minimal and preferably alternate approaches to pesticides, controlled and minimized fertilizer use.

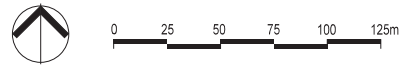
Maintenance will be undertaken via general access to all public accessible areas. Light maintenance vehicles can access all public areas and can adjoin all private areas within the development. This will occur initially via the road system and then by careful access over landscaped grass areas and select areas of the pedestrian path system. Use of removable bollards will limit and control unauthorized access to link areas between roads.

Maintenance will be managed by the development for the first 2 years minimum. The 2 year maintenance timeframe may be extended in certain locations at the developer's discretion in liaison with the City.





- STRUCTURE PLAN NOTES**
1. Future road connection to Vasse North to be constructed by others.
 2. The 2 stage T Intersection to Caves Road is to be designed and located as to minimise impacts on existing vegetation within the Caves Road reserve.
 3. The future alignment of the pedestrian / cycle linkage to Buayanyup Drains is to be designed to minimise impacts on the floodway.
 4. Pedestrian access between the Local Centre and Monaghans Store is to be confirmed at the development application stage for the Local Centre (lot 402).
 5. Existing homestead is to be retained on 4,000m² (approximate) residential zoned lot with a density code of R2.5 to prevent further subdivision.



DRAFT

LOCAL STRUCTURE PLAN
 LOTS 4 & 12 CAVES ROAD & LOTS 14, 15 & 402 BUSSELL HIGHWAY, ABBEY.

NOTE:
 Base Data supplied by Landgate / Denada Surveys
 Aerial Photo - Jan 2023
 Projection - BCG94
 Areas and dimensions shown are subject to final survey calculations.

Revision	Date	Item
F	26/7/24	Remove POS rib from R10 SE corner
E	14/5/24	Revise as per COB comments
D	7/5/24	Revise as per most recent concept
C	15/12/22	Revise as per most recent concept

LEGEND

	STRUCTURE PLAN BOUNDARY		RECREATION RESERVE		PERIMETER ROAD
	RESIDENTIAL R2.5		LOCAL CENTRE (R80)		ACCESS STREET B
	RESIDENTIAL R10		FLOODWAY		HIGHER ORDER CYCLE PATH
	RESIDENTIAL R20				ACCESS STREET D (INDICATIVE ONLY)
	RESIDENTIAL R20 - R40				EMERGENCY SECONDARY EGRESS
	RESIDENTIAL R60				PEDESTRIAN LINK

	FUTURE PEDESTRIAN / CYCLE CONNECTION TO BUAYANYUP DRAIN CYCLE PATH
	POS NUMBER
	CUL DE SAC
	ROUNDABOUT
	2 STAGE "T" INTERSECTION
	LEFT IN / LEFT OUT INTERSECTION

-	: CLIENT
A3@1:2,500	: SCALE
26 July 2024	: DATE
IA Abbey-2-001	: PLAN No
F	: REVISION
C.L.	: PLANNER
B.L.	: DRAWN



ABBEY SOUTH LOCAL STRUCTURE PLAN

CONCEPT MASTER PLAN

1 MAY 2024



Rise Urban

Abbey South Open Space Investigation Area
Assessment and Investigation Report



Abbey South Open Space Investigation Area

Assessment and Investigation Report



Prepared for: The Abbey Landowner Group

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Job Code: 0152020

Doc Reference: Rep23A-0152020

Issue No: 2 – Final for Lodgement

Date: 25 November 2022

Table of Contents

1. Introduction	3
2. Background	4
3. Description of the Open Space Investigation Area	6
3.1 Broadwater Nature Reserve Swamp Floodplain	8
3.2 Wetlands	11
3.3 Trees and Vegetation	12
3.4 Topography	13
4. Specific Matters to be Addressed	14
4.1 Water Management	14
4.2 Coastal Inundation	15
4.3 Open Space Requirements	16
5. Conclusion	19

Appendices:

Appendix 1 - Site Plan of Open Space Investigation Area	
Appendix 2 - Site photos of Abbey OSI Area	
Appendix 3 - DWER Floodway Mapping (DWER, 2021)	
Appendix 4 - DWER Floodplain Factsheet (DWER, 2000)	
Appendix 5 - Topographical map and cross sections (Rise Urban & Emerge Assoc, 2022)	

1. Introduction

The purpose of this report is to address all of the key planning and environmental considerations associated with the area identified as ‘Open Space Investigation’ (“OSI”) between the Abbey South Urban Area and Vasse North Urban Area as identified in the *Leeuwin - Naturaliste Sub-regional Strategy*.

The report summarises the key technical findings (environmental and hydrological) that have been resolved through the preparation of the Abbey South Structure Plan, and also uses information that is publicly available to assess the attributes of the southern portion of the OSI area that is located to the south of the Abbey South Structure Plan area (Vasse North OSI - lots 19 and 20).

It is intended that this report be read as a supporting addendum to the Abbey South Structure Plan, and should be read in conjunction with the Environmental Assessment Report, Local Water Management Strategy, and Landscape Strategy that form part of the Structure Plan.

This report considers the hydrological and environmental attributes of the entire OSI area, and identifies the common and differing characteristics between the Abbey South and Vasse North portions.

The investigations conclude that:

- a) The Abbey South portion of the OSI area is noticeably different to Vasse North with respect to its topography / elevation, vegetation and surface water hydrology;
- b) The key feature of the OSI area is the portion of the *Broadwater Nature Reserve Swamp Floodplain* that traverses the OSI area on an east-west axis. The large majority of the Floodplain is located to the south of the Abbey South OSI area.
- c) There are no other significant environmental features or attributes within the Abbey South OSI.
- d) The Local Water Management Strategy that supports the Abbey South Structure Plan considers water management for both the Abbey South OSI area, and the broader floodplain located to the south.
- e) Key considerations of water management, coastal inundation and open space requirements, as identified in the *Leeuwin - Naturaliste Sub-regional Strategy* have all been adequately addressed across the Abbey South portion of the OSI area via the Abbey South Structure Plan.
- f) The public open space depicted in the Abbey South Structure Plan adequately captures and fully retains the key hydrological and environmental attributes as well as allowing for broader passive recreation uses, consistent with the City’s strategic planning for the broader area.
- g) The balance of the OSI area within Abbey South that is not retained in public open space does not contain any significant environmental or hydrological features and is therefore not well suited to form part of the open space network for environmental or hydrological purposes. At between 2.3m and 3.5m AHD and almost entirely cleared of vegetation, the physical characteristics of this area are no different to the Abbey Urban area to the north. This area is therefore well suited to more intensive forms of development such as that proposed by the Abbey South Structure Plan, and its retention as public open space would be an inefficient use of developable land, resulting in a significant maintenance burden on the City of Busselton with little or no community benefit to be gained.

These findings and conclusions are discussed in further detail in the following sections of this report.

2. Background

The *Leeuwin - Naturaliste Sub-regional Strategy* (“the Strategy”) was published by the Western Australian Planning Commission in May 2019 following extensive consultation and assessment of an earlier 2017 draft.

The *Abbey Planning Investigation Area* was not identified in the 2017 draft and was included in the final version following further consideration by the Department of Planning, Lands and Heritage and WAPC.

The Strategy is an overarching strategic land use planning document outlining the WAPC’s approach to future planning and development within the City of Busselton and the Shire of Augusta-Margaret River over the next 20 years.

Section 5 of the 2019 Strategy identifies a range of universal and site-specific matters which are to be considered and addressed as part of the planning investigations for each of the Planning Investigation Areas. These matters are summarised in Table 2 below.

Table 1 – Planning Considerations for Abbey PIA as outlined in the Leeuwin Naturaliste Sub-regional Strategy (Section 5)

Universal Considerations	Site Specific Considerations
<ul style="list-style-type: none"> • Biodiversity value protection • Bushfire risk • Drainage • Landscape value protection • Protection of significant environmental values • Utility services capacity • Water source impact (groundwater and surface water) 	<ul style="list-style-type: none"> • Biodiversity values (adjacent wetlands to south) • Provision of land for employment generating activities • Transition/interface with adjacent tourist uses (caravan park to west, boutique uses to east)

In April 2021 the Abbey landowner group submitted to the WAPC a suite of technical reports and studies that addressed all of the universal and site-specific considerations listed above.

All five of the PIAs identified in the Strategy were assessed and considered by the WAPC in October 2021, where in relation to the Abbey PIA, the WAPC resolved to (emphasis added):

1. *Designate the following lots as ‘Urban’:*
 - Lot 12 on Diagram 43998
 - Lot 14 on Diagram 96590
 - Lot 15 on Diagram 96590
 - Lot 402 on Deposited Plan 252489
 - Northern portion of Lot 4 on Diagram 46285
2. *Designate the following lots as ‘Open Space Investigation’:*
 - Southern portion of Lot 4 on Diagram 46285.
3. *Remove the Abbey Planning Investigation Area from the Strategy Plan.*
4. *Require the preparation of a single structure plan over the entirety of the land identified in (1) and (2) above. In addition to the information to be included in a structure plan outlined in Clause 16 of the Deemed Provisions, the structure plan is to set out the following:*

- **a water management report** that takes into consideration the land to the south and addresses all water-related matters relevant to the proposal.
- *measures to manage risk from coastal inundation.*
- **open space requirements.**

The WAPC also determined to include a description of the Open Space Investigation category in the Strategy to further clarify its intent. The definition, located on page 18 of the strategy states:

Open Space Investigation

Further investigation is to consider factors that may be relevant to the intended open space purpose, such as wetland buffer and flood management requirements. The final extent of land required for open space purposes is to be determined through the investigation process and informed by appropriate studies, and may be larger, smaller or the same size as the area designated as ‘Open Space Investigation’.

Following the WAPC’s October 2021 decision, the landowners and Rise Urban met with the WAPC Chair and Senior Department of Planning, Lands and Heritage officers to further clarify the purpose and intent of the Open Space Investigation (OSI) area, and to ensure that the future Structure Plan would align with the Commission’s intent for the Investigation Area. At this meeting, it was agreed that a Structure Plan is the appropriate vehicle to determine the full extent of the open space area in the southern half of Lot 4. Further, it was acknowledged that the OSI designation:

- a) Is “more of a question mark than a fixed line” and is intended to be refined through the structure plan process to determine which portions are suitable for open space and / or urban development.
- b) Does not necessarily dictate that the land should be set aside for conservation or recreation purposes. Rather, it is intended that the Structure Plan should determine the extent of land needed for flooding / drainage / conservation and recreation purposes and ensure that this land is integrated into the broader urban area as part of an integrated and functional open space area.
- c) The floodway and the hydrology of the area is the key site consideration for the investigation area.
- d) Requires that water management, coastal inundation, and open space requirements are addressed in the structure plan.

These specific considerations are addressed in subsequent sections and appendices of this report.

3. Description of the Open Space Investigation Area

The OSI area extends beyond the southern boundary of the Abbey South area and includes a significant portion of what was previously identified as the Vasse North PIA in the 2019 Strategy. Similarly to Abbey South, the Commission resolved to designate the northern portion of the Vasse North area as OSI, and the southern portion as Urban. An extract from the 2021 Strategy Map that depicts the OSI area in the green hatched area is Figure 1 below.



Figure 1 – extract from Leeuwin – Naturaliste Sub-regional Strategy (WAPC, 2021)

The combined extent of the OSI area aligns with the northern and southern boundaries of the current 'Conservation' zone of Local Planning Scheme 21. It should be noted the Conservation designation is a zone and not a reserve, and does not preclude all forms of development. Rather, it is intended to recognise land containing *special aesthetic, ecological or conservation values*.

The land was designated OSI as recognition of the requirement for further studies to determine the extent of these values and how these relate to the open space requirements of the surrounding urban area. This report, along with the Abbey South Structure Plan demonstrates how those aesthetic, ecological and / or conservation values have been recognised and retained.

A site plan and aerial photo depicting the full extent of the OSI area for both Abbey South and Vasse North is Figure 2 and is also included as Appendix 1 to this report, while some images / photographs of the Abbey portion of the OSI taken between 2020 and 2022 are included as Appendix 2.

The combined OSI area is approximately 550m in width (north – south) and approximately 35ha in area. Of the 35ha, approximately 10ha is located within Lot 4 Caves Road (Abbey South OSI), and the balance 25ha within lots 19 and 20 (Vasse North OSI). A 10m wide unmade road reserve (Fox Road) separates Abbey South area from Vasse North. Fox Road contains good quality vegetation (predominantly peppermint trees) and due to its elevated topography of around 2.5m - 3m AHD, forms a physical bund between the Abbey South and the lower-lying Vasse North areas.



Figure 2 – Abbey South and Vasse North Open Space Investigation Areas

3.1 Broadwater Nature Reserve Swamp Floodplain

As noted by the earlier planning investigations undertaken by the WAPC in 2021, the key significant natural feature of the OSI area is the Broadwater Nature Reserve Swamp (BNRS) floodplain, which comprises of both the 1% AEP event floodway, and the broader flood fringe.

DWER's mapping of the floodway area is shown at Figures 3 & 4 and Appendix 3. As demonstrated by the DWER mapping, the floodway is largely confined to Vasse North OSI, with the exception of a smaller offshoot to the north of the main channel, which is located within Abbey South OSI.



Figure 3 – DWER Floodway Mapping (source: DWER, 2021)

DWER, in its factsheet on Floodplain Management (DWER, 2000) defines the two components of the floodplain as follows:

Floodway

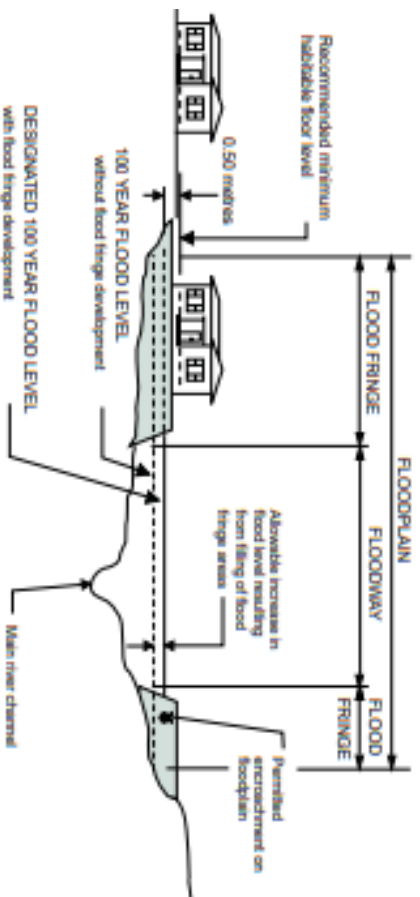
The river channel and a portion of the floodplain which forms the main flow path for floodwaters once the main channel has overflowed. If the floodway is even partially blocked then upstream flood levels may be raised and thereby affect areas which may not have been previously affected. Development in floodways is to be avoided wherever possible.

Flood fringe

The area of the floodplain, outside of the floodway, which is affected by flooding but where development could be permitted provided appropriate measures are taken. These areas are generally covered by still or very slow moving waters during a 100 year ARI flood.

- *Development (i.e. filling, building, etc) that is located within the flood fringe is considered acceptable with respect to major river flooding. However, a minimum habitable floor level of 0.50 metre above the adjacent 100 year flood level is recommended to ensure adequate flood protection.*

- Development (i.e. filling, building, etc) that is located within the floodway and is considered obstructive to major river flows is not acceptable as it will increase flood levels upstream.



Typical recommended floodplain management strategy.

Source: DWER Factsheet – Floodplain Management, 2000

Figure 4 depicts the extent of floodway and flood fringe within the Abbey South OSI area.



Figure 4 – Abbey PIA - DWER Floodway and Flood Fringe (source: Emerge Associates, 2022)

A full copy of DWER’s factsheet is Appendix 4. Consistent with the Factsheet, DWER has advised that development within the flood fringe area of Abbey South is permissible subject to achieving a habitable floor level of 2.3m AHD or greater. This can be achieved either through the filling of the flood fringe area, or via a built-form response.

The gross area of the mapped floodway (DWER, 2021) within the combined Open Space Investigation area is 8.5ha, of which 1.3ha or 15% is located within Abbey South, while the

balance 7.2ha or 85% is within Vasse North. Similarly, the majority of the flood fringe is also within the Vasse North portion of the site, with only 0.85ha of the flood fringe being located within the Abbey South OSI area.

This is demonstrated further in Table 2 below.

Table 2 – Floodplain Summary

	Abbey South	Vasse North	Fox Road	Total
Total OSI Area (ha)	10.4	24.5	0.53	35.4ha
DWER Floodway within OSI (ha)	1.33	7.22	0	8.55ha
Breakdown of combined OSI				
Area comprising Abbey South, Vasse North and Fox Road				
DWER Flood Fringe within OSI* (ha)	0.85	16.51	0	17.36ha
Portion of Flood Fringe Area within OSI	5%	95%	0%	100%
Floodway as % of individual OSI area	13%	29%	-	-
Flood Fringe as % of individual OSI area	8%	67%	-	-
Comparison of areas: (Vasse North vs Abbey South)				
Total area of individual OSI containing either floodway or flood fringe	2.18ha	23.73	-	-
Floodway / fringe as % of individual OSI area	21%	96%	-	-

**DWER mapping also includes the majority of the Vasse North Urban Area (lot 9001) within the flood fringe – generally coinciding with the land that is 2m AHD or below.*

Table 2 demonstrates the considerable differences between the two OSI areas with respect to the recognised hydrological features. The key findings that can be drawn from Table 2 are:

- Approximately 96% of the Vasse North OSI area is encumbered by the floodplain (floodway + flood fringe), while only 21% of the Abbey South OSI area is similarly encumbered.
- The large majority (85%) of the mapped floodway area lies within the Vasse North portion of the OSI.

- Only 13% of the total Abbey South OSI is mapped as floodway. The rest of the OSI area is unencumbered.

As noted in the DWER's fact sheet and the advice provided to the Abbey South project team, the DWER's expectation is that the floodway itself is retained in full and is not filled, altered or developed such that there may be upstream or downstream implications.

The landowner's intentions for the Vasse North OSI area and the floodway in particular are unknown, and there is no formal structure plan or rezoning proposal at present. It is reasonable to expect that the DWER will require the full retention of the mapped floodway area within the Vasse North OSI as part of any future development within the Vasse North area, while development over the remaining area will be subject to the viability of filling the land to achieve adequate clearance for flood protection and coastal inundation.

Consistent with the DWER's advice, the Abbey South Structure Plan retains the full 1.33ha (or 13%) portion of the floodway within Abbey South OSI area as part of a broader contiguous open space area comprising more than 2.7ha (2.3ha of which is located within the designated Abbey South OSI area). It also retains the connection to the main floodway channel in the south western corner of the OSI area, ensuring that the pre-development site hydrology and the overall function of the floodway is retained.



Figure 5 – Image of Abbey South floodway. Photo taken from the western end of the site and facing east (source: Rise Urban, November 2021)

3.2 Wetlands

The OSI area does not contain any Conservation Category or Resource Enhancement wetlands. A small portion of Abbey South, and the entirety of Vasse North is mapped as Multiple Use (MU) wetland. MU wetlands are indicative of groundwater being close to the surface, but where no ecological values are present. The DWER does not generally require retention of MU wetlands unless other attributes (such as a floodway) are also present, and there are numerous examples of other MU wetlands being filled and developed throughout the Geographie region and beyond.

When MU wetlands are retained, the DWER and DBCA do not typically require any buffers for conservation purposes.

3.3 Trees and Vegetation

The OSI area is largely cleared of intact native vegetation and has been used for livestock grazing for the past 50 years. Remnant paddock trees are scattered throughout the area, with predominantly *Agonis flexuosa* (peppermint trees) within Abbey South, and *Melaleuca* (paperbark) species within Vasse North. Ground cover vegetation comprises solely of non-native paddock grasses.

Environmental consultants Emerge Associates have advised that the differing species of trees within the area are indicative of the topography and soil types, with peppermints preferring drier sandy soils, and melaleuca typically being found in lower-lying and wetter areas.

The Abbey South Structure Plan proposes to retain the majority of the mature trees within the central and western portions of the OSI area. The south eastern portion of Abbey South is almost entirely cleared with the exception of a scattering of small to medium size peppermint trees adjacent to the eastern boundary. These trees were observed by Emerge Associates to be:

- a) in poor health due to historical land uses and damage from cattle;
- b) likely to be deemed to be unsuitable from a safety perspective for retention in POS; and
- c) unlikely to provide suitable habitat for black cockatoos or western ringtail possums due to low foraging value (in the case of cockatoos) and lack of canopy connectivity for possums.

Overall the ecological value of these trees is found to be very low, and their retention is not warranted on environmental grounds.



Figure 5 – Remnant peppermint trees in SE corner of Abbey South OSI area – facing north with eastern boundary on the RHS of image (source: Emerge Associates, 2022)

The condition and / or significance of vegetation within lots 19 and 20 has not been assessed as part of this review.

3.4 Topography

Topography within the OSI area varies considerably. In general terms the area slopes north to south. The highest point is in the north eastern portion of the OSI area, which sits at between 2.2m and 3.2m AHD. The eastern portion of Fox Road is higher again, at around 3.5m AHD. The land then drops away steeply on the southern side of Fox Road to around 1m AHD (coinciding with the main channel of the floodway) and then remains low at between 1m and 2m AHD throughout the Vasse North area.

The south western end of Abbey South drops from around 3.4m AHD at the northern end of the OSI area down to 1m AHD (corresponding to the floodway area) before climbing back up to between 2 and 3m AHD at Fox Road. From Fox Road the levels drop back down to between 1m – 1.6m AHD, and remain at this level for the remainder of the OSI area and beyond into the Vasse North urban area.

In order to further demonstrate the changes in levels across the site, a topographic map and longitudinal cross sections are included at Figure 6 and Appendix 5.

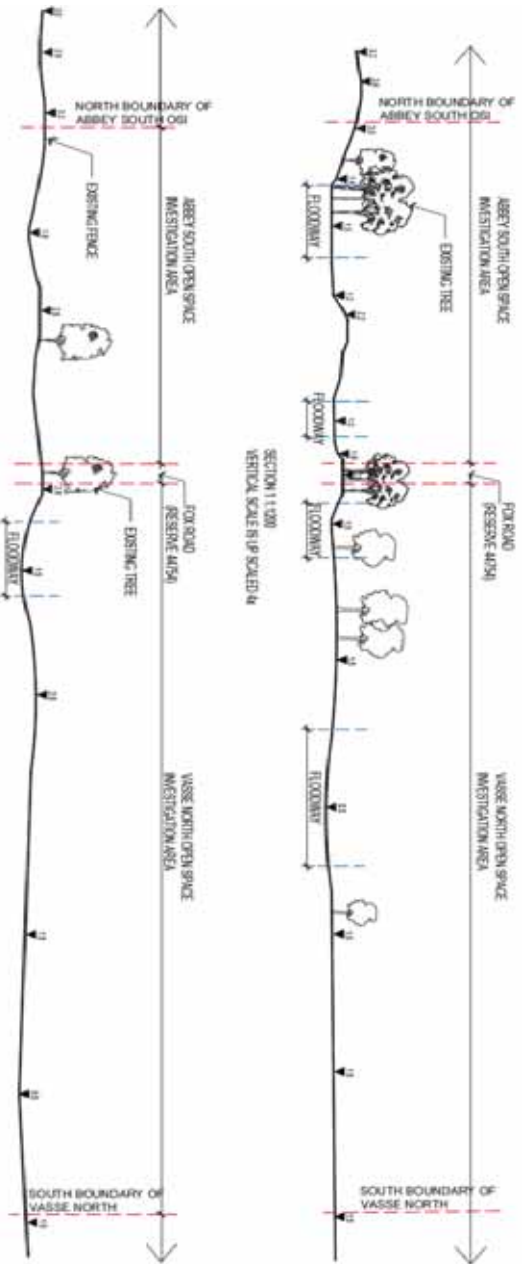


Figure 6 – Open Space Investigation Area Cross Sections (source: Emerge Associates) – upper cross-section western portion of site (N/S); lower cross-section eastern portion of site (N/S). Refer Appendix 5 for full versions.

4. Specific Matters to be Addressed

The following sections specifically reference and address the three key matters identified in the Leeuwin-Naturaliste Sub-regional Strategy that are to be considered as part of the further investigations into the suitability of the Abbey South OSI area for open space and / or urbanisation. These three key matters are:

1. Water management
2. Coastal inundation; and
3. Open space requirements.

Further discussion in relation to each matter is set out in the following sections.

4.1 Water Management

Consistent with the requirements of the Strategy, Emerge Associates has prepared a water management report in the form of a *Local Water Management Strategy* (“LWMS”) which addresses the key hydrological considerations of the Abbey South Structure Plan area including the Abbey South OSI in both the pre-development and post-development stages.

Emerge engaged with DWER early in the formulation process of the LWMS, and were advised via email dated 23 February 2021 of the following considerations for the LWMS:

- The DWER mapping tool (online) is incorrect, and the flood fringe within the Abbey South area is in fact smaller than what is shown on the mapping tool. (Copy of the updated mapping was provided and is reflected in all structure plan documents).
- It is critical that the connectivity between the Vasse North and Abbey South portions of the mapped floodway is maintained.
- DWER has no objection to filling within the flood fringe area provided that a minimum habitable floor level of 2.3m AHD is achieved.

The LWMS is included in full as Appendix 2 to the Abbey South Structure Plan.

The key findings of the LWMS relevant to the Abbey OSI area are summarised below:

- As per DWER’s advice, the floodway is fully retained within the proposed public open space area, and its connection to the broader (and main) floodway to the south has been fully retained within the site (south western corner) and is not proposed to be modified. The impact of flooding (and height) has been considered as part of the modelling undertaken to determine drainage areas and required public open space.
- Pre-development hydrological conditions are maintained based on the detention and retention of water within the site, accommodated through the proposed public open space network.
- No conservation category or resource enhancement wetlands are identified within the site, nor within 50 m of the site. Therefore no wetland features require specific protection, and no buffers for identified nearby values need to be accommodated within the site.
- The change in land use from rural / agricultural to residential will reduce the total nutrient loads infiltrating into the underlying groundwater.
- Infiltration via bio retention areas and vegetated swales will also provide treatment via filtration and adsorption of pollutants/nutrients and will improve water quality that is discharged into the floodway from its present state.
- Acid sulfate soils (ASS) can be managed through the standard development process, and is only an issue if the permanent groundwater is intersected. Based on the existing separation to groundwater and fill required within the site, deep excavation within the southern portion of the site is unlikely, and therefore disturbance of ASS will be low.

At the time of writing, the LWMS is still under assessment by both DWER and the City of Busselton. DWER provided some initial comments to the consultant team in September 2022, as is typical during the assessment of the LWMS. DWER has not raised any specific concerns pertaining to the proposed treatment of the floodway and flood fringe within the Abbey South OSI area.

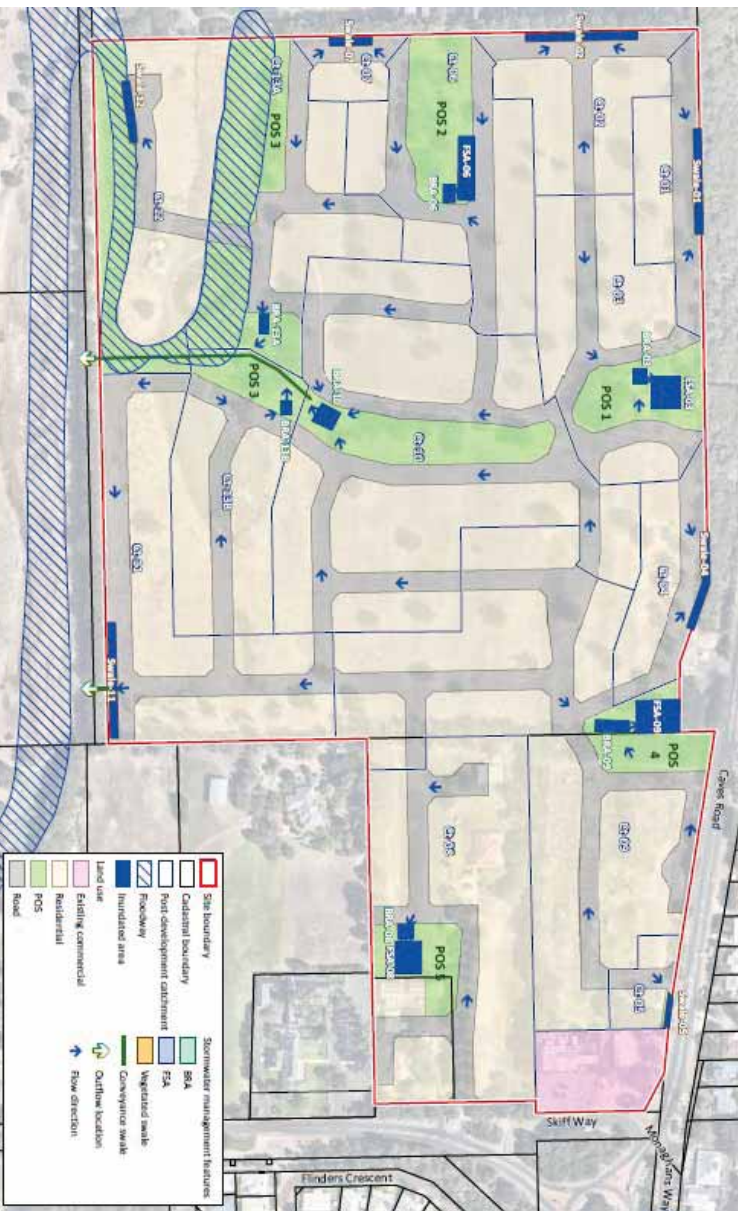


Figure 7 – Abbey South Inundation Plan – 1% AEP Event – extract from LWMS (source: Emerge Associates, 2022)

4.2 Coastal Inundation

The Strategy requires, as part of the Structure Plan for Abbey South, to consider *measures to manage risk of coastal inundation*.

The City of Busselton formally adopted its ‘Coastal Hazard Risk Management and Adaptation Plan’ in October 2022 (post-lodgement of the Abbey South Structure Plan).

The Coastal Hazard Risk Management and Adaptation Plan (CHRMAP) provides a long-term view of coastal hazards for the City and recommends pathways to adapt to future oceanic and coastal conditions, including coastal inundation. The CHRMAP aims to ensure that the City is strategically well-placed to contend with those hazards as and when they arise.

The Department of Transport had previously confirmed a flood level of 3.8m AHD is the forecast maximum flood level in the 100th year in a major storm event.

Instead of mandating 3.8m as a minimum finished floor level, which would have significant economic implications for all of Busselton, the CHRMAP recommends a medium - to long-term ‘protect’ strategy for inundation risk for the City’s main urban/developed areas, including Abbey. That would entail the construction of a continuous seawall/bund or similar in the foreshore reserve for much of the coast. It would also entail works to prevent seawater entering urban areas via the various ‘gaps’ along the coast – such as drain and inlet entry channels.

The protect approach enables a reduced FFL requirement. The advertised version of the CHRMAP recommended a minimum FFL of 3.0m AHD across the entire Busselton coastal region. 3.0m AHD was chosen in recognition of the fact that it may take several decades to

implement the medium- to long-term protect strategy for inundation risk for the City's main urban/developed areas, and there is still a significant coastal inundation risk in the interim period.

Following advertising of the CHRMAP in early 2022, the Council resolved to reduce this minimum FFL requirement from 3.0m down to 2.7m AHD in areas where protection is proposed. The reduced level came about as a result of some detailed flood and storm modelling in the Port Geographie area. Page 60 of the CHRMAP explains further:

That modelling indicates that the level of a 1 in 500 year coastal storm surge with present day mean sea levels is 2.5m AHD (i.e. 2.5 metres above mean sea level), or 3.4m AHD with mean sea level 0.9 metres higher, rather than 2.9m AHD or 3.8m AHD respectively. That modelling, prepared by Baird Consultants for the developers (Aigle Royal) has been accepted by DoT, and there is not seen to be any reason why the figure would be higher for other parts of the City's coast. On the basis of that, it is considered that minimum FFLs for new development in areas where a medium- to long-term protect strategy for inundation risk is being proposed could be reduced from the originally proposed 3.0m AHD to 2.7m AHD. The reason that 2.5m AHD is not proposed is because some of the projected 0.9m sea level rise over the next 100 years will occur in the period between now and when the medium- to long-term protect strategy for inundation risk can actually be implemented.

As a direct response to the risks associated with coastal inundation, the Abbey South Structure Plan includes a requirement for a minimum FFL of 3.0m in keeping with the advertised draft CHRMAP. Given that the final version, including the revised FFL of 2.7m AHD has now been formally adopted, it is expected that the Structure Plan will be amended to reduce the minimum required FFL accordingly. This will be pursued at an appropriate juncture in the assessment of the structure plan.

4.3 Open Space Requirements

The third consideration of the *Leeuwin Naturaliste Sub-regional Strategy* is "open space requirements". The Strategy does not go into any further detail as to what the open space requirements are, or whether there are additional open space requirements over and above the typical requirements that are set out in Liveable Neighbourhoods and form part of any urban development.

The open space requirements and provision for Abbey South, including detailed description and landscape concept plans for each area, is addressed in considerable detail in section 4.5 of the Structure Plan explanatory report, and section 4.5.2 deals specifically with the OSI area.

Overall, the Abbey South Structure Plan provides 4.7ha of public open space. This equates to more than 15% of the gross structure plan.5 area.

Even with the 1.3ha floodway and all of the other high frequency drainage areas deducted from the POS contribution, the Structure Plan still delivers more than 11.5% useable and creditable public open space (as defined by Liveable Neighbourhoods). This is around 13% or 3,700m² more creditable open space than the minimum requirement.

As per the advice provided to the landowners by the WAPC Chair and senior officers in November 2021, the Structure Plan integrates the floodway feature into the broader POS network, such that it provides a high amenity, functional area of open space, as opposed to an isolated and unusable area. This has resulted in the 1.3ha floodway area being incorporated into a larger 2.7ha area of contiguous open space that provides for a range of passive recreation and amenity functions, as well as retaining between 30 and 40 mature paddock trees.

In considering the suitability of the remainder of the Abbey South OSI area for open space, it should be noted that the remainder of the OSI area is largely cleared of trees, and does not contain any wetlands, waterways, floodways, or other natural features of note. As such, any

additional open space in this location would be purely for recreation purposes (passive or active), as opposed to providing any form of conservation.



Figure 8 – SE Corner of Abbey South OSI facing west. Fox Road on the LHS of picture (source: Rise Urban, 2021)

The City of Busselton has confirmed via its *Sport and Recreation Facilities Strategy 2020 – 2030* that it does not require any active open space (playing fields or sporting facilities) in this area, and prefers that active open space is located centrally within the Vasse urban area where there is a larger residential catchment and better accessibility. The *Sport and Recreation Facilities Strategy* has a clear preference for larger multi-purpose sporting facilities at the district and regional level of the hierarchy, as opposed to smaller neighbourhood level playing fields which are inefficient and difficult / costly to maintain.

The Abbey South OSI is not well suited for playing fields or other forms of active open space at either the neighbourhood or district scale given the separation from the bulk of the residential catchment, the lack of suitable land area to provide facilities of an appropriate scale (district open space is typically >10ha in area), and the potential conflict with the existing floodway, which is required to be retained even if the balance of the site was identified for active open space. Furthermore, groundwater in this area is fully allocated, meaning that there is no water available for irrigation purposes. As such, any open space in this area would have to be unirrigated unless the City could source a suitable water supply (i.e. by purchasing a groundwater licence or using scheme water) to maintain the open space in the longer term.

Having ruled out the suitability of the OSI for active open space, the only other possible open space use in this location is for passive recreation. In this regard, it should be noted that the Abbey South Structure Plan provides substantial areas for passive recreation (4.7ha in total). These areas incorporate paths, shelters, picnic / barbecue areas and playgrounds, as well as

retaining the best trees across the site and providing an integrated drainage and water management response consistent with best practice. The absence of any trees in the eastern half of the OSI area means that any passive open space in this location would lack shade and interest unless it was to be artificially created via shade structures, public art, play equipment, and other structures. The lack of irrigation water would once again be a significant constraint for POS in this area. Whilst this area could theoretically be adapted to be used as passive open space, there are more appropriate areas elsewhere which retain natural features and provide connectivity and recreation opportunities to residents. Passive open space in this location would not serve any planning, environmental or community benefit, and would result in an inefficient and inappropriate use of land that would be better utilised for more intensive forms of development.

In the Council report dated 16 November 2022 concerning the initiation of the Scheme Amendment for the Abbey South area, City of Busselton officers noted that:

The City has not independently identified any strategic basis for additional open space in this location. Further, there is general acceptance by officers that a portion of the 'Open Space Investigation' area is suitable for urban development.

This view aligns with the City's Local Planning Strategy 2019, as well as the *Sport and Recreation Facilities Strategy 2020 – 2030*, and *Strategic Community Plan 2021-2031 – none of which identify the need for any specific open space infrastructure in the Abbey South area.*

On this basis, and in considering the 'open space requirements' for Abbey South, the following key points are apparent:

- The Abbey South Structure Plan recognises and retains all of the significant environmental and hydrological features within the OSI area and incorporates them into larger areas of useable public open space.
- The balance of the OSI has little or no conservation value and is not constrained by any wetlands, floodplains or habitat.
- The Abbey South OSI is not well suited as active open space, and the City does not support active open space in this location.
- The Abbey South Structure Plan provides considerably more open space than the minimum requirement under WAPC Policy, and in a manner that is consistent with the objectives and requirements of *Liveable Neighbourhoods*.
- The City has no strategic plan or requirement for additional open space in this location; and does not wish for the Abbey South OSI to be designated as public open space in full due to the significant and ongoing maintenance burden that it would create, and with little or no community benefit in return.

From this, it can be concluded that the 'open space requirements' are adequately and appropriately addressed via the Abbey South Structure Plan, and that the remaining portions of the Abbey South OSI are not suitable for open space.

5. Conclusion

This report summarises the findings of the technical studies prepared over the OSI area, and addresses the specific matters identified in the Leeuwin-Naturalise Sub-regional Strategy.

The studies have determined that the Abbey South and Vasse North portions of the OSI area are physically very different. The entirety of the Vasse North portion is significantly constrained due to the presence of the main floodway channel and the low-lying nature of the land around it. This is in stark contrast to the Abbey South portion which, except for the areas that are proposed to be retained in open space, has few constraints and is on average more than a metre higher than the area to the south. Whilst a portion of the floodway is located within the Abbey South area, this is an offshoot rather than the main channel, and it does not ‘flow’ even in the most severe weather events. Notwithstanding, this floodway is proposed to be retained in full, as required by DWER, and will be integrated into the broader open space network, as required by the WAPC.

This report addresses the three key areas that are identified in the Leeuwin-Naturaliste Sub-regional Strategy, being water management, coastal inundation, and open space requirements, and demonstrates that the current structure plan is an adequate and appropriate response to these key matters.

As noted in the definition of Open Space Investigation on page 18 of the Strategy:

The final extent of land required for open space purposes is to be determined through the investigation process and informed by appropriate studies, and may be larger, smaller or the same size as the area designated as ‘Open Space Investigation’.

Retaining the entire OSI area as public open space would be a poor planning outcome as:

- a) It is contrary to the City’s strategic plan for open space in the area;
- b) It does not contain any environmental or natural attributes that are worthy of retention, apart from those proposed to be retained and which are clearly identified on the Structure Plan;
- c) It is not well suited for active open space / playing fields due to size and location constraints; and
- d) Any passive recreation function in this area would require artificial shade and amenity if it is to be well utilised.

Overall, setting aside the entirety of the Abbey OSI area for open space is unnecessary, serves no planning purpose, and is an inefficient use of unconstrained land that is better suited for urban development.

Element 1 (page 2) of the WAPC’s operational policy *Liveable Neighbourhoods 2009* actively discourages the unnecessary sterilisation of land that is suitable for urbanisation, and states (emphasis added):

Another aspect of urban development requiring critical review under Liveable Neighbourhoods is the amount of land set aside for various agency requirements, based on the conventional view that more is better.

This applies, for example, to land allocation for environmental buffers, easements, foreshores, setbacks, acoustic barriers, street reserves and community facilities (eg schools). This excessive approach to land use decreases urban efficiency, wastes land, decreases density, increases overall cost of urban development and contributes to urban sprawl. Many of the issues or concerns can be dealt with by using appropriate urban design or built form solutions.

When producing a structure plan, these various land requirement matters should be critically reviewed, to ensure that land is being used efficiently.

The Abbey South Structure Plan undertakes a critical review of the OSI area as required by both the *Leeuwin-Naturaliste Sub-regional Strategy* and *Liveable Neighbourhoods* and delivers an outcome that makes efficient use of the land, whilst still comfortably exceeding the minimum environmental and amenity expectations to deliver a high-quality and site responsive land use plan.

This land use efficiency will not only go some way towards addressing the critical housing shortage in the City of Busselton, but will also relieve some of the pressure to develop other less-suitable areas such as Vasse North and Ambergate, which are low-lying, flood prone areas that require a considerable amount of fill and / or have a number of natural constraints that are not found in the Abbey South OSI area.



Figure 9 – Eastern end of Abbey South OSI facing south west. Fox Road trees in the background (source: Rise Urban, 2021)



Appendix 1

Site Plan
Open Space Investigation Area



ABBHEY SOUTH AND VASSE NORTH OPEN SPACE INVESTIGATION AREAS

SITE PLAN

NOTE:
 Base Data supplied by Landgate.
 Aerial image supplied by Landgate (January 2021)
 Survey data supplied by Landgate on the subject
 to final survey calculations.

Revision	Date	From
A	1/11/22	Work Issue

LEGEND



ABBHEY SOUTH PROJECT AREA



VASSE NORTH PROJECT AREA

CLIENT	SCALE
A3@1:5,000	9 November 2022
IA Abbey-5-010	PLAN No
A	REVISION
C.L.	PLANNER
BL	DRAWN



Appendix 2

Abbey South OSI Area
Site Photos

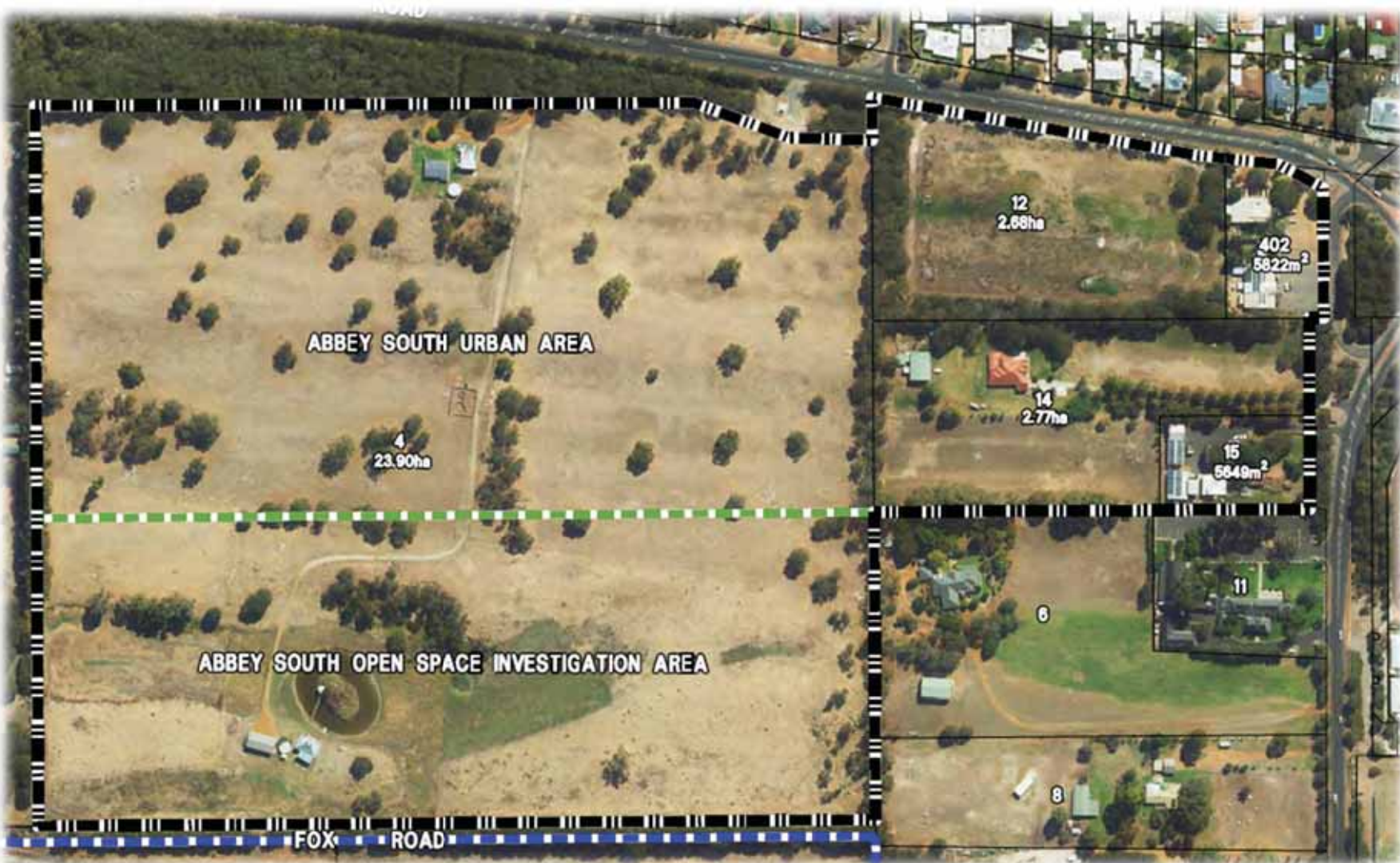
Rise Urban.

AGILE PLANNING FOR THE NEW NORMAL

Abbey South Open Space Investigation Area

Site photos (Nov 2020, Nov 2021 and Dec 2021)

Abbey South Open Space Investigation Area



Site Plan
Abbey South OSI
Area

Abbey South Open Space Investigation Area



Site Plan
Combined OSI Area

Abbey South Open Space Investigation Area



Image 1

*South east corner of OSI area –
facing north with boundary fence to
lot 8 Bussell Highway on right*

(Nov 2021)

Abbey South Open Space Investigation Area



Image 2

*SE Corner of OSI area – facing west
with boundary fence to Fox Road on
left*

(Nov 2021)

Abbey South Open Space Investigation Area



Image 3

Central eastern portion of the Abbey South OSI area – facing west / south west. Fox Road trees on left.

(Dec 2021)

Abbey South Open Space Investigation Area



Image 4

Southern boundary of Abbey South OSI area facing south into Fox Road (immediate foreground) and Vasse North OSI area beyond. Note the elevated 'bund' in Fox Road (Nov 2021)

Abbey South Open Space Investigation Area



Image 5

South eastern boundary of Abbey South OSI area facing south into Fox Road (immediate foreground) and Vasse North OSI area and floodway beyond. Note the elevated 'bund' in Fox Road (Nov 2022)

Abbey South Open Space Investigation Area



Image 6

*Eastern end of Abbey OSI facing west
with Fox Road on left*

(Nov 2022)

Abbey South Open Space Investigation Area



Image 7

*Eastern end of Fox Road and Abbey
OSI, facing west*

(March 2021)

Abbey South Open Space Investigation Area



Image 8

Central portion of OSI area – facing north west. Trees in background to be retained in POS.

(Dec 2021)

Abbey South Open Space Investigation Area



Image 9

north western corner of OSI – facing south with floodway in mid-ground and Fox Road in the distance

(Nov 2021)

Abbey South Open Space Investigation Area



Image 10

Floodway at western end of the OSI area – facing south east (Nov 2021). Photo taken from the north bank. Trees on LHS to be retained in POS. (Nov 2020)

Abbey South Open Space Investigation Area



Image 11

Floodway at western end of the OSI area – facing south east (Nov 2021). Photo taken from the north bank. Trees on LHS to be retained in POS. (Nov 2021)

Abbey South Open Space Investigation Area



Image 12

*Floodway at western end of the OSI area from south bank (standing on the future 'peninsula') – facing west
Trees in background to be retained in POS.*

(Dec 2021)

Abbey South Open Space Investigation Area



Image 13

*Causeway track across floodway –
facing south.*

(Nov 2022)

Abbey South Open Space Investigation Area



Image 14

*Central portion of retained floodway
– facing west. Trees to be retained in
POS on right.*

(Nov 2022)

Abbey South Open Space Investigation Area



Image 15

Eastern portion of retained floodway – facing east. Trees on left to be retained in POS. Man made dam is to be removed and floodway reinstated

(Nov 2022)



Appendix 3

DWER Floodway Mapping
(DWER, 2021)



ABBHEY SOUTH AND VASSE NORTH OPEN SPACE INVESTIGATION AREAS

SITE PLAN



NOTE:
 Base Data supplied by Landgate.
 Aerial image supplied by Landgate (January 2021)
 All measurements are in metres unless otherwise stated.
 All measurements are to the centre of the subject
 to final survey calculations.

Revision	Date	From
A	1/11/22	Work Issue

LEGEND

- ABBHEY SOUTH PROJECT AREA
- VASSE NORTH PROJECT AREA
- FLOODWAY

CLIENT	SCALE
A3@1:5,000	9 November 2022
DATE	PLAN NO
IA Abbey-5-010	A
REVISION	PLANNER
C.L.	BL
PLANNER	DRAWN





Appendix 4

Floodplain Factsheet
DWER, 2000



Water facts 14

Floodplain management

Floodplains continue to be under pressure for more intensive uses despite the significant flood risk. This pressure is increasing as desirable undeveloped land becomes scarce. This Water Facts describes the principles for good floodplain management and explains the roles of government agencies.

Severe floods do not occur frequently in this State so the extent of flooding and its consequences are usually soon forgotten. However, when flooding does occur, the resulting damage to property can be quite considerable (see Water Facts 13, Flooding in Western Australia).

In recognising the need to contain and lessen potential flood damage, the former Public Works Department in 1975 commenced floodplain mapping of major rivers throughout the State to provide planning bodies and local government with strategies for ensuring sound development on floodplains. This advisory service was continued by the former Water Authority between 1985 and 1996. Since then the service has been provided by the Water and Rivers Commission.

The floodplain management program has been providing a non-structural means of protecting future development from major flooding. Floodplain management strategies are an essential part of an integrated catchment management approach to development on floodplains and provide a high degree of flood protection.

Effective floodplain management requires co-operation and co-ordination between all three levels of government.

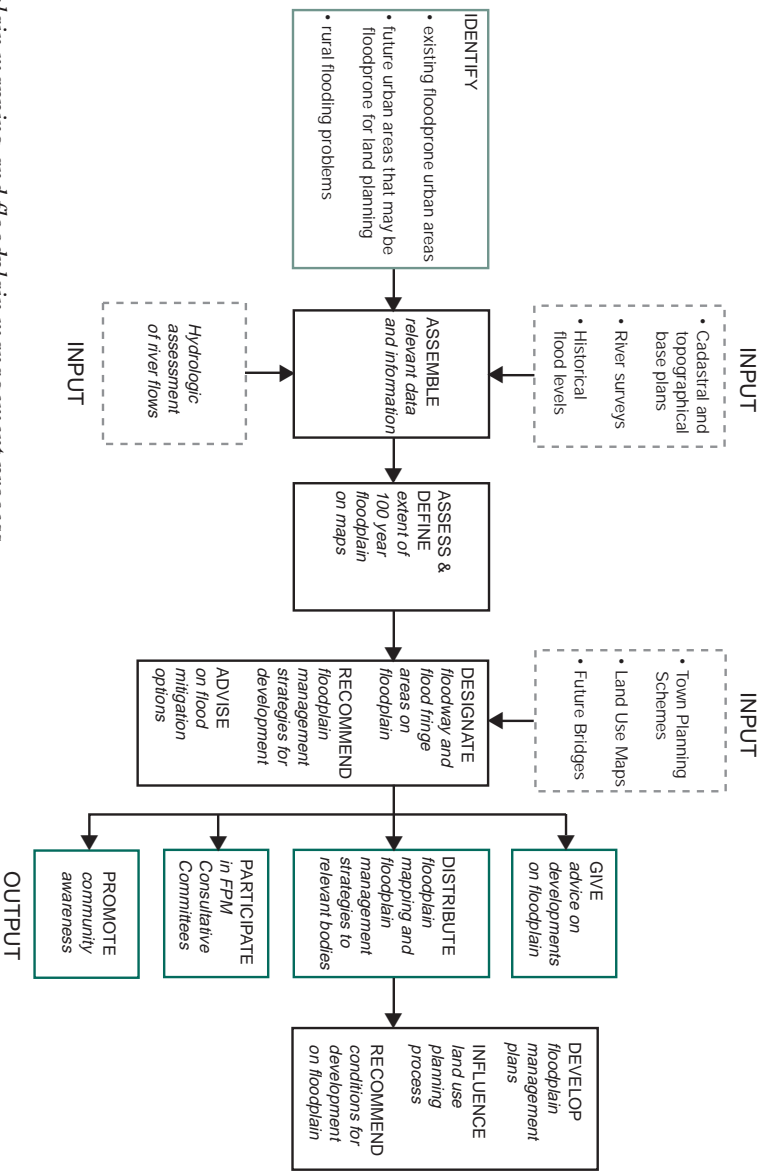
Principles of floodplain management

Floodplains should be managed for the benefit of the whole community so that the risk and damages are minimised and environmental values are protected.

Sound floodplain management should:

- ensure land use minimises flood risk and damage costs;
 - ensure all three levels of government and the local community accept their responsibilities in floodplain management;
 - ensure appropriate floodplain mitigation measures minimise damage and are acceptable to the local community;
 - promote the use of **non-structural*** rather than **structural**** mitigation measures where possible;
 - ensure floodplain management measures have beneficial economic, social and environmental outcomes; and
 - provide flood forecasting and warning systems and emergency management arrangements to help minimise the impact of flooding.
- * **Non-structural measures** aim at reducing or avoiding the susceptibility of new developments to flood damage as well as reducing the impact of flooding on existing developments. They include land use and building controls, acquisition of land and relocation, effective flood forecasting and flood warning, creating public awareness and flood insurance.
- ** **Structural measures** physically modify the natural behaviour of flooding and are designed to reduce the frequency or impact of flooding on existing developments. They include levee banks, channel improvements, river diversions, retarding basins and flood mitigation dams.





Floodplain mapping and floodplain management process.

Terms commonly used in floodplain management

Average recurrence interval (ARI)

A statistical estimate of the average period in years between the occurrence of a flood of a given size or larger. The ARI of a flood event gives no indication of when a flood of that size will occur again.

100 year ARI flood

A flood having an average recurrence interval (ARI) of 100 years. This flood has a 1% chance of occurring in any one year and has a 50% chance of being experienced at least once in a person's life time. The 100 year ARI flood has been generally adopted in Australia and overseas as the basis for floodplain management planning.

Floodplain

The portion of a river valley next to the river channel which is covered with water when the river overflows its banks during major river flows. The term also applies to land adjacent to estuaries which is subject to inundation during flooding.

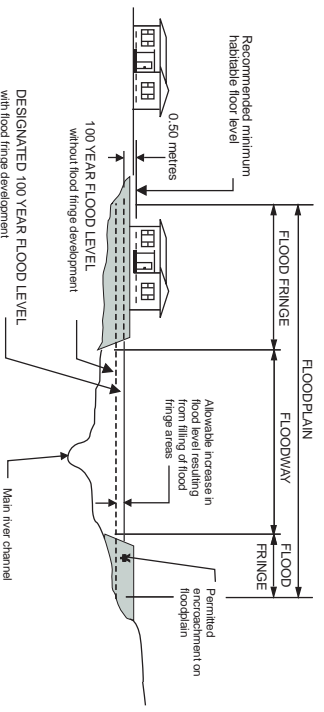
Floodway

The river channel and a portion of the floodplain which forms the main flow path for floodwaters once the main channel has overflowed. If the floodway is even partially blocked then upstream flood levels may be raised and thereby affect areas which may not have been previously

affected. Development in floodways is to be avoided wherever possible.

Flood fringe

The area of the floodplain, outside of the floodway, which is affected by flooding but where development could be permitted provided appropriate measures are taken. These areas are generally covered by still or very slow moving waters during a 100 year ARI flood.



Typical recommended floodplain management strategy:

- Development (i.e. filling, building, etc) that is located within the flood fringe is considered acceptable with respect to major river flooding. However, a minimum habitable floor level of 0.50 metre above the adjacent 100 year flood level is recommended to ensure adequate flood protection.

- Development (i.e. filling, building, etc) that is located within the floodway and is considered obstructive to major river flows is not acceptable as it will increase flood levels upstream.



State Government

The primary role of State Government is to develop appropriate standards and strategic approaches for floodplain management and to ensure that they are applied in a co-ordinated and integrated fashion across the State.

This role involves the provision of expert technical support by the Water and Rivers Commission, land planning through the Ministry for Planning and provision of effective flood emergency management and planning through the State Emergency Service.

- **Water and Rivers Commission**

The Water and Rivers Commission is the State Government's lead agency in floodplain mapping and providing floodplain management advice. In accordance with the *Water and Rivers Commission Act 1995* the Commission's function is to "develop plans for and provide advice on flood management".

The Commission provides advice on development of floodplains with the object of promoting the wise use of floodplains while minimising flood risk and damage. In particular, its role is to:

- collect and analyse flood data;
- prepare floodplain maps of existing and future urban areas which are floodprone;
- provide advice to the Ministry for Planning, Local Government and other agencies on flooding and recommend guidelines for sound development on floodplains; and

- assist in flood forecasting in association with the Bureau of Meteorology for the issuing of flood warnings.

The Commission, as a central advisory service for floodplain management, provides consistent minimum standards of flood protection throughout the State and provides impartial advice with regard to proposed development.

- **Ministry for Planning**

The Ministry for Planning and the Western Australian Planning Commission are responsible for developing, reviewing, and implementing the land use planning system. The Ministry for Planning is responsible for advising the Western Australian Planning Commission on land use planning and policy matters. This is achieved through the preparation and review of Region Schemes, Corridor Plans, Town Planning Schemes and Scheme amendments and the development of planning policies.

- **State Emergency Service**

The State Emergency Service (SES) is the Lead Combat Authority in emergency management and planning for floods. It is responsible for the preparation of the State Flood Strategy, Regional and Local Flood Emergency Plans. Effective local flood emergency planning requires close co-operation between SES, Local Government and Water and Rivers Commission.

Local Government

The principal role of Local Government in floodplain management is the implementation of floodplain management strategies. This is achieved by land and development controls through statutory planning and by various building regulations.

Councils are encouraged to incorporate floodplain management strategies and guidelines into their Town Planning Schemes or into a Council Policy Statement. Local Government should also actively promote and sustain flood awareness at the community level and make a significant contribution to flood emergency management and planning.

For more information contact



WATER AND RIVERS COMMISSION

Level 2, Hyatt Centre

3 Plain Street

East Perth Western Australia 6004

Telephone: (08) 9278 0300

Facsimile: (08) 9278 0301

or your regional office

Website: <http://www.wrc.wa.gov.au>



This Water Facts sheet is one in a series providing information on water issues of interest to the community.

It was produced as part of the Waterways WA Program. Managing and enhancing our waterways for the future.

Text by Rick Brethall. Water Facts sheet project coordination by Heidi Oswald.

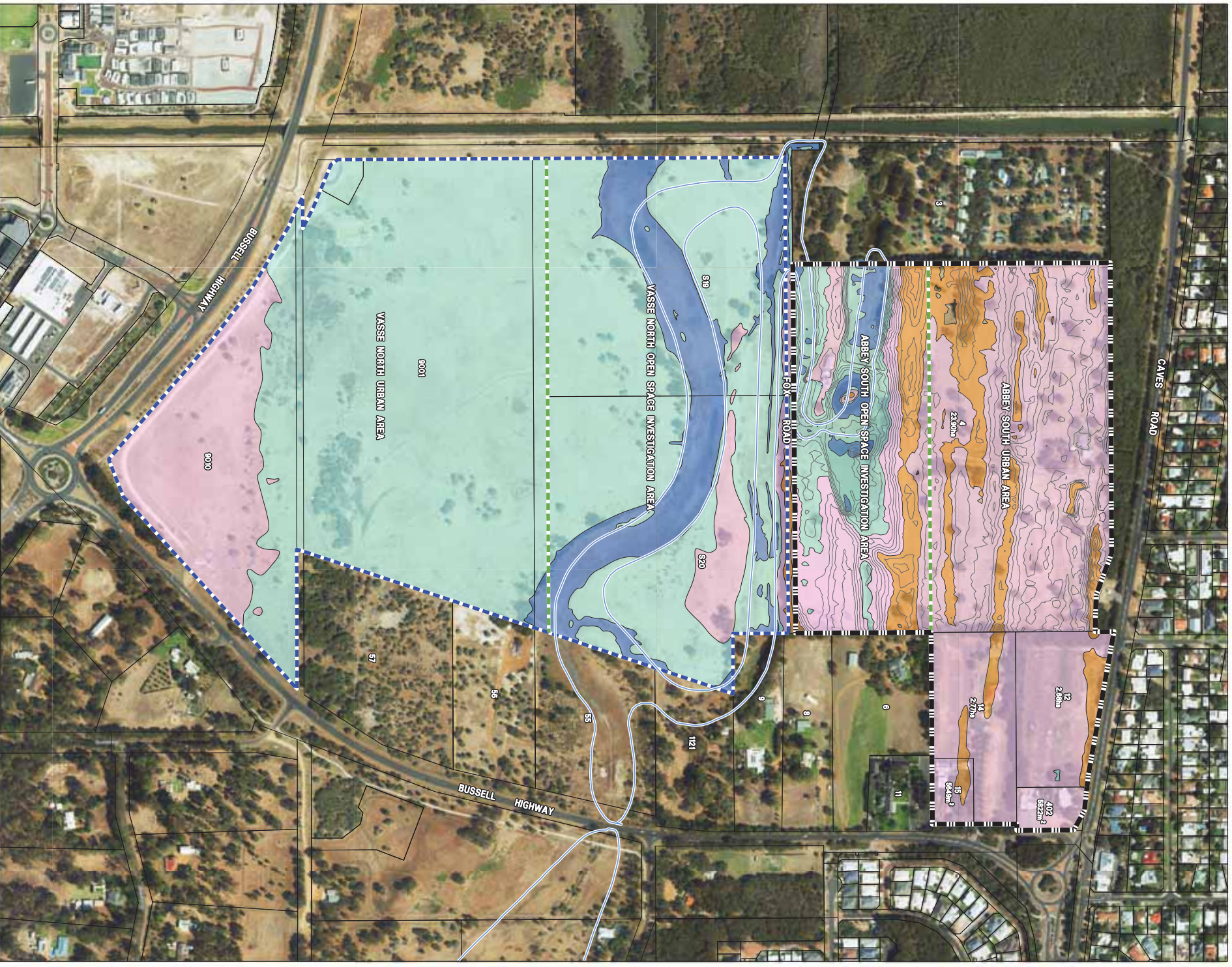
Printed on recycled paper July 2000

ISSN 1328-2042 ISBN 0-7309-7459-6

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Appendix 5


Open Space Investigation Area
Topo Map and Cross Sections



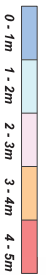
ABBHEY SOUTH AND VASSE NORTH OPEN SPACE INVESTIGATION AREAS

TOPOGRAPHY MAP

LEGEND

-  SUBJECT LOT BOUNDARY
-  OPEN SPACE / URBAN AREA BOUNDARY
-  FLOODWAY

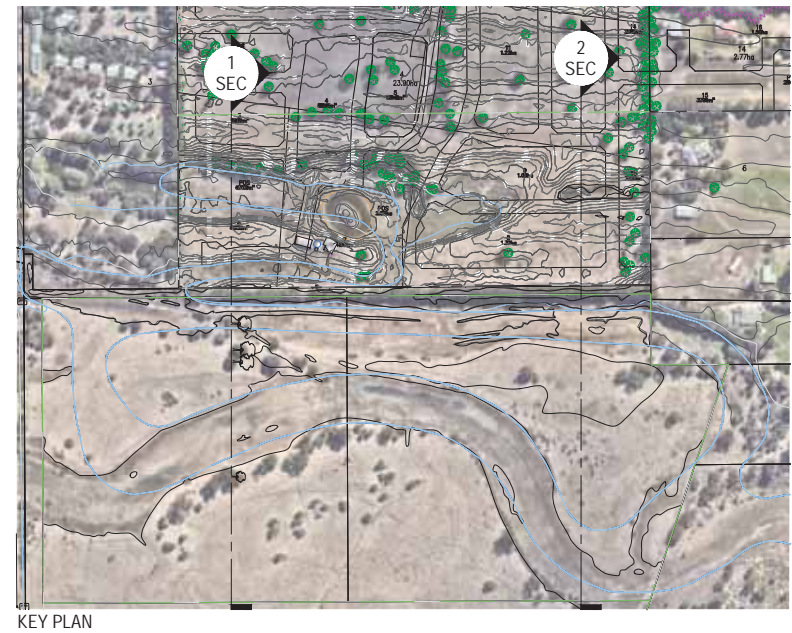
HEIGHT CONTOURS (AHD)



CLIENT	A3@1:5,000	SCALE
DATE	4 November 2022	DATE
PLAN NO	1A Abbey-5-010	PLAN NO
REVISION	A	REVISION
PLANNER	C.L.	PLANNER
DRAWN	B.L.	DRAWN

NOTE:
 Base Data supplied by Landgate.
 Aerial image supplied by Landgate (January 2021).
 All elevations are in metres above sea level and are subject to final survey calculations.

Revision	Date	By
A	1/11/22	Wickham



KEY PLAN

