



Harley Dykstra

PLANNING & SURVEY SOLUTIONS

Amendment No. 15

Lot 422 (No.16) Affleck Road, Kalgan

City of Albany Local Planning Scheme No.1

Prepared by Harley Dykstra Pty Ltd

ALBANY

116 Serpentine Road, Albany WA 6332
PO Box 5207, Albany WA 6332

T: 08 9841 7333
F: 08 9841 3643

E: albany@harleydykstra.com.au
www.harleydykstra.com.au

Albany Bunbury Busselton Kelmscott Perth

ACN 009 101 786 ABN 77 503 764 248



PLANNING AND DEVELOPMENT ACT 2005

RESOLUTION DECIDING TO AMEND A LOCAL PLANNING SCHEME

CITY OF ALBANY

LOCAL PLANNING SCHEME NO.1

AMENDMENT NO. 15

RESOLVED that the Council, in pursuance of Section 75 of the Planning and Development Act 2005, amend the above local planning scheme by:

1. Rezoning Lot 422 (No.16) Affleck Road, Kalgan from 'General Agriculture' zone to 'Rural Residential' zone, and amending the Scheme Maps accordingly;
2. Inserting provisions relating to the subdivision, development and use of Rural Residential Area No.45 into Schedule 14 of the Scheme Text.

The Amendment is standard under the provisions of the Planning and Development (Local Planning Schemes) Regulations 2015 for the following reason(s):

- The amendment is consistent with the *Albany Local Planning Strategy*, which identifies the site as "*Special Residential*" and "*Rural Residential*" and sets strategic objectives to encourage the efficient use of existing rural living areas, based on land capability to maximise their development potential, and ensure that rural living areas are planned and developed in an efficient and co-ordinated manner.
- The amendment would have minimal impact on land in the scheme area that is not the subject of the amendment; and
- The amendment does not result in any significant environmental, social, economic or governance impacts on land in the scheme area.

Dated this _____ day of _____ 20____ .

CHIEF EXECUTIVE OFFICER

DOCUMENT CONTROL

Control Version	DATE	Status	Distribution	Comment
A	01.04.15	Draft	Client	Draft for Comment and Approval
B	03.06.15	Draft	City of Albany	Draft for Comment and Approval
C	19.08.15	Draft	HD	Draft for Comment and Approval
D	18.04.16	Draft	City of Albany	Inclusion of revised FMP, SGP, amendment number and RR area.

Prepared by: DC

Reviewed by: HD

Date: 18.04.2016

Job No & Name: 20308 Lot 422 Affleck Road, Kalgan

Version: D

DISCLAIMER

This document has been prepared by HARLEY DYKSTRA PTY LTD (the Consultant) on behalf of the Client. All contents of the document remain the property of the Consultant and the Client except where otherwise noted and is subject to Copyright. The document may only be used for the purpose for which it was commissioned and in accordance with the terms of engagement for the commission.

This document has been exclusively drafted. No express or implied warranties are made by the Consultant regarding the research findings and data contained in this report. All of the information details included in this report are based upon the existent land area conditions and research provided and obtained at the time the Consultant conducted its analysis.

Please note that the information in this report may not be directly applicable towards another client. The Consultant warns against adapting this report's strategies/contents to another land area which has not been researched and analysed by the Consultant. Otherwise, the Consultant accepts no liability whatsoever for a third party's use of, or reliance upon, this specific document.

CONTENTS

DOCUMENT CONTROL.....	i
DISCLAIMER.....	i
CONTENTS	ii
1 INTRODUCTION & PROPOSAL	1
1.1 Objectives of Amendment	2
1.2 Strategic Considerations	2
1.2.1 Albany Local Planning Strategy (ALPS) and City of Albany Local Planning Scheme No.1	2
2 CONTEXT ANALYSIS.....	4
2.1 Site Description	4
2.1.1 Location and Description	4
2.2 Land Use.....	4
2.2.1 Existing Land Use	4
2.2.2 Surrounding Land Use and Zonings	9
2.3 Community Consultation	9
2.4 Environmental.....	9
2.4.1 Topography.....	9
2.4.2 Environmental Considerations	11
2.4.3 Visual Landscape.....	14
2.5 Bush Fire Hazard Management	15
2.6 Infrastructure	15
2.6.1 Access.....	15
2.6.2 Services	16
3 PLANNING CONTEXT	19
3.1 State and Regional Planning	19
3.1.1 State Planning Policy No.1 – State Planning Framework Policy	19
3.1.2 State Planning Policy No.2.5 – Land Use Planning in Rural Areas	19
3.1.3 State Planning Policy No.3 – Urban Growth and Settlement.....	22
3.1.4 Development Control Policy No.3.4 Subdivision of Rural Land.....	23
3.1.5 Draft Country Sewerage Policy	24
3.2 Local Planning.....	24
3.2.1 City of Albany Local Planning Scheme No.1.....	24
3.2.2 Albany Local Planning Strategy	27
4 SUBDIVISION GUIDE PLAN AND SCHEME PROVISIONS	29

4.1	Introduction	29
4.2	Subdivision Guide Plan and Scheme Provisions	29
4.2.1	Design Philosophy.....	29
4.2.2	Constraints to Development	29
4.2.3	Opportunities Presented by the Amendment	31
4.3	Conclusion.....	32
5	JUSTIFICATION AND CONCLUSION	33
	APPENDIX A – CERTIFICATES OF TITLE	1
	APPENDIX B – SITE PLAN.....	1
	APPENDIX C – LAND CAPABILITY – GEOTECHNICAL ASSESSMENT AND LOCAL WATER MANAGEMNT STRATEGY – LANDFORM RESEARCH.....	2
	APPENDIX D – FIRE MANAGEMENT PLAN	3
	APPENDIX E – SUBDIVISION GUIDE PLAN	4
	APPENDIX F – ADDITIONAL INFORMATION SUPPORTING SCHEME AMENDMENT TO REZONE LOT 422 AFFLECK ROAD	5

MINISTER FOR PLANNING

PROPOSAL TO AMEND A LOCAL PLANNING SCHEME

LOCAL AUTHORITY:	CITY OF ALBANY
DESCRIPTION OF TOWN	
PLANNING SCHEME:	LOCAL PLANNING SCHEME NO.1
TYPE OF SCHEME:	DISTRICT PLANNING SCHEME
NO. OF AMENDMENT:	AMENDMENT NO. 15
REZONING LOT 422 (NO.16) AFFLECK ROAD, KALGAN TO 'RURAL RESIDENTIAL ZONE NO. 45' AND INCLUDING PROVISIONS RELATING TO RURAL RESIDENTIAL ZONE NO. 45 IN SCHEDULE 14 OF THE SCHEME TEXT.	

1 INTRODUCTION & PROPOSAL

The purpose of this Amendment to the City of Albany Local Planning Scheme No.1 (LPS 1) is to rezone Lot 422 (No.16) Affleck Road, Kalgan to *Rural Residential* (herein referred to as the 'subject site'). The Amendment also incorporates provisions within Schedule 14 – Rural Residential Zones, to appropriately control subdivision, development and use in the new zone.

This proposal has sound planning grounds, as justified by the following:

- The rezoning of the subject site to *Rural Residential* would complete the *Rural Residential* zoning in this locality. All of the surrounding properties are zoned similarly;
- The subject site is identified for *Rural Residential* and *Special Residential* land uses by the Albany Local Planning Strategy (ALPS);
- The proposal will improve the fire management of the property, as well as ensuring that vegetation protection is instilled over the land; and
- The subject site would have better environmental controls as a result of the proposal.

The subject site is identified as *Special Residential* and *Rural Residential* by the ALPS. At this time, it is not proposed to rezone the land to *Special Residential* in accordance with the ALPS, given a reticulated water supply is not readily available for connection to the subject site (which is required for land uses such as special residential with a lot size below 1ha). However, a number of lots within the Subdivision Guide Plan will be capable of further rationalisation under the *Special Residential* zone, should this zone be applied in the future and reticulated water becomes readily available.

1.1 Objectives of Amendment

The following key objectives are applicable to the Amendment:

- Providing well located lifestyle lots appropriately located in the Albany hinterland;
- Finalising the rural residential precinct in this locality; and
- Respecting the landform and providing future subdivision and development opportunities that consider the site's opportunities and constraints.

1.2 Strategic Considerations

1.2.1 Albany Local Planning Strategy (ALPS) and City of Albany Local Planning Scheme No.1

As outlined above, the subject site is identified within the ALPS as *Rural Residential* and *Special Residential*.

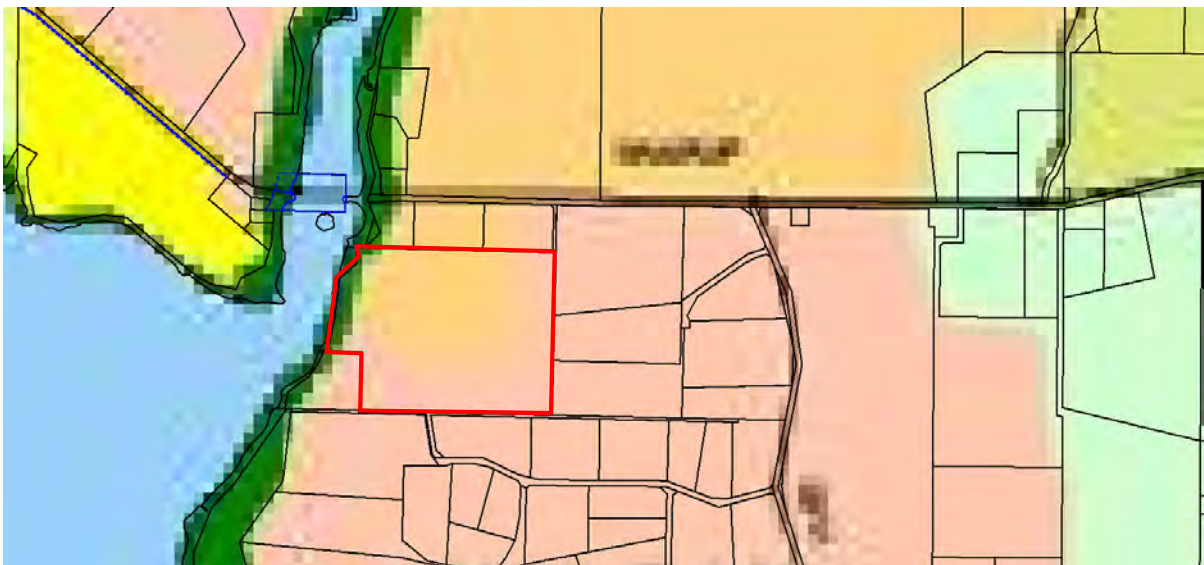


Figure 1: Excerpts from Map 9B of ALPS, showing the current classification of the subject site (outlined in red), which contains a core of *Special Residential* and fringe of *Rural Residential* identified land.

When considering the strategic relevance of the proposal, it will provide for well-located rural residential land in an already existing rural residential area. The subject site is surrounded on all-sides by land zoned *Rural Residential* (with the exception of Oyster Harbour to the west).

Special Residential Land Use

As explained above, it is not proposed at this time to incorporate *Special Residential* within the rezoning of the land, but to zone and have it developed for *Rural Residential* land uses. This is due to the following issues that would eventuate from *Special Residential* rezoning:

- A reticulated potable water supply would have to be connected to the land. A non-standard connection already exists for the current house. However, advice from the Water

Corporation is that further connections cannot be obtained from the current supply and a new mains supply would have to be extended from the opposite side of the Kalgan River;

- The lack of *Special Residential* zoned land uses in this locality. At this time, *Special Residential* land uses have not eventuated in this part of the Kalgan locality, primarily due to the lack of reticulated water; and
- The City of Albany has advised that there is some community opposition to *Special Residential* being developed in this portion of the Kalgan locality, primarily as it represents a more urban form of development. The use of this portion of the Kalgan locality for *Special Residential* will likely be reviewed in the upcoming ALPS review.

The proponent would not like to rule out the possibility of *Special Residential* rezoning occurring on the land, but realizes that it is subject to the limitation of reticulated water supply at present. As such, a number of the lots proposed by the Subdivision Guide Plan will be able to be rationalized to *Special Residential* size should this option become available.

2 CONTEXT ANALYSIS

2.1 Site Description

2.1.1 Location and Description

The subject site comprises of Lot 422 (No.16) Affleck Road, Kalgan, which has an area of 40.667ha.

The subject site is 15km from the Albany CBD, via Nanarup, Lower King and Ulster Roads and Lockyer Avenue.

For a location plan, refer to **Figure 2**.



Figure 2: Location Plan (subject site shaded in red)

[Source: Harley Dykstra]

2.2 Land Use

2.2.1 Existing Land Use

The subject site is currently used as a lifestyle property with some grazing by stock. The Site Plan at **Appendix B** provides an aerial photograph of the subject site.

2.2.2 Surrounding Land Use and Zonings

The subject site is surrounded by a variety of zones and reserves (refer to **Figure 3**). Adjoining the subject site on the north, south and east is land zoned *Rural Residential* and included within Rural Residential Area's No.6 and No.9.

To the west of the subject site is Oyster Harbour. A foreshore reserve for Oyster Harbour is reserved as *Parks and Recreation* by LPS 1. Adjoining the southwest corner of the subject site is land also zoned *General Agriculture*.

The proposal will complete the *Rural Residential* zoning in the locality.

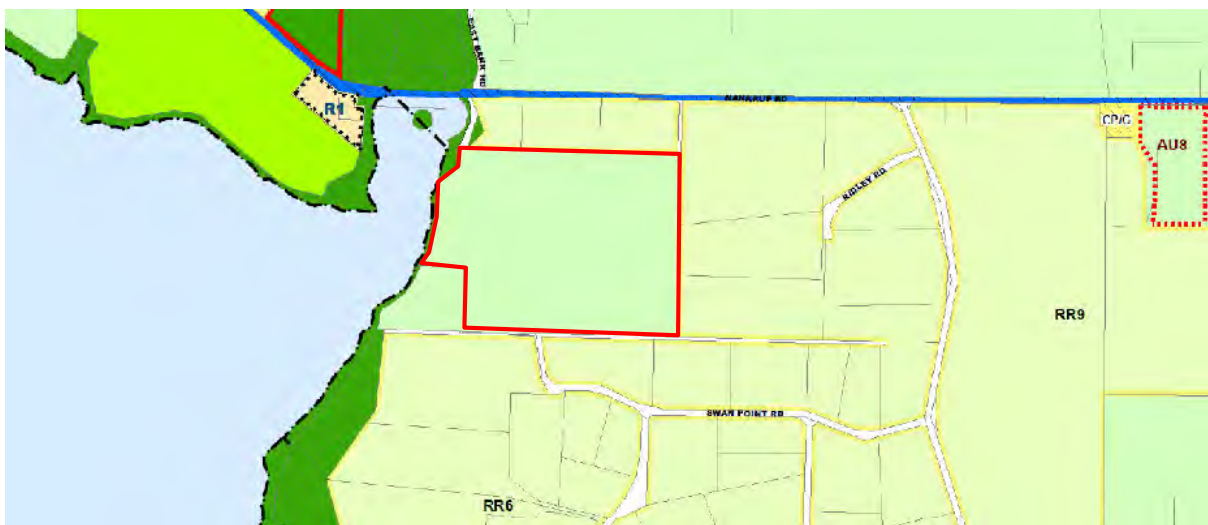


Figure 3: Land Zoning (subject site highlighted in red)

[Source: City of Albany]

2.3 Community Consultation

In accordance with the requirements of the *Planning and Development Act 2005*, the Amendment is required to be advertised for 42 days for public submissions. These submissions are then presented to Council at its final consideration of the Amendment.

2.4 Environmental

2.4.1 Topography

The subject site consists of undulating farmland. The dominant features of the subject site are:

- A central ridgeline running from southeast to northwest with relatively gentle gradients;
- A steep west facing slope overlooking Oyster Harbour; and
- Low lying western portions adjoining Oyster Harbour.

2.4.2 Environmental Considerations

During 2009, Landform Research prepared a Land Capability – Geotechnical Assessment and Water Management Strategy for the subject site, the premise of which was the proposal to develop the site for a combination of *Rural Residential* and *Special Residential* zoned land uses. This assessment is attached in **Appendix C** of the Amendment.

The purpose of this section of the Amendment is to summarise and review the findings of the assessment undertaken by Landform Research and its implications on the current proposal for consideration. Of note is that the current proposal is for significantly less development than that proposed in 2009, hence land uses impacts are anticipated to be reduced overall.

Site Foundation – Geotechnical Assessment

The soils of the subject site were found to be generally suitable for dwelling and road development, demonstrating a fair to very high capability for development across the majority of the subject site.

Soils types depicted in Figure 1 of the assessment consisted of:

- Sand over Laterite and Silt (majority of site);
- Sand over Silt (associated with west slopes of the subject site);
- Laterite Duricrust over Silt (associated with crest of ridgeline and comparable to Sand over Laterite and Silt);
- Sand over Granite Saprolite (small portion of site near existing dam in northwest corner);
- Estuarine Silts (adjacent to Oyster Harbour)
- Deep Leached Sands (associated with northeast corner);

Figure 2 of the assessment depicts the land capability ratings across the subject site for the proposed land uses. Areas that were subject to limitations were the Estuarine Silts located adjacent to Oyster Harbour, low lying land in the north-east corner and low lying land adjacent to the southern boundary. These areas have been avoided and are not proposed for development within the Subdivision Guide Plan and overall, the capability rating for subdivision and development of the subject site should be considered high.

Waste Water Capability and Nutrient Management

A summary of the current conditions of the subject site as noted by the assessment are:

- Soils types are generally sandy soils and sandy over silty clay with a layer of laterite in many locations in the centre of the site, which is similar to many locations around the Albany area;
- The majority of the site is well-drained and has no waterlogging. Test holes were undertaken across the site, with the assessment deeming that all lots had a location suitable for on-site effluent disposal where there was clearance to groundwater of 500mm or more;
- Sandy soils and laterite present across the majority of the subject site have suitable infiltration. Some sites may need limited modification (modification of soils) to achieve

necessary compliance, but this would be a normal requirement of many sites across Albany and is not seen as a significant limitation; and

- The type of wastewater system utilised can ameliorate any concerns regarding nutrient loading, phosphorous retention and nitrogen loss.

The soils of the subject site were found to be suitable for waste water capability and nutrient management. As noted in the assessment, all of the proposed lots exceed the minimum of 2000m² required for on-site effluent disposal. Figure 2 of the assessment depicts the land on which all building envelopes are proposed has a fair to very high capability for dwellings and development. Furthermore, in these areas, suitable clearance to groundwater in excess of 500mm was achieved.

In regards to recommendations for waste water capability and nutrient management, the assessment recommends the use of Alternative Treatment Units (ATU's) as well as compliance with the requirements of the Health (Treatment of Sewage and Disposal of Effluent and Liquid Waste) Regulations 1974. These requirements will be applied to the proposed development through the Scheme Provisions.

Hydrological Assessment and Water Management

A summary of the current conditions of the subject site as noted by the assessment are:

- Soil moisture is rapidly infiltrated through the majority of the site through sandy top soils. However, a perched water table may sometimes form where these sandy soils change to less permeable soil types such as clay. The construction of road across the subject site is likely to interrupt sub-surface perched water table migration, making soil conditions drier in some portions of the subject site;
- The site is generally well drained, however there is some temporary winter water logging associated with the lower slopes and central swale. It is likely that the increased soil moisture levels on the subject site resulting from clearing will be returned to pre-clearing conditions through the construction of roads and interruption of sub-surface water flow;
- The subject site has no flooding risk;
- There are no identified wetlands on the subject site except those lower/wetter soils located adjacent to Oyster Harbour, which have been excluded from development;
- There is no evidence of salinity; and
- There is no evidence of deep regional groundwater on the subject site. Groundwater is likely to be localized and interpreted that it is variable across the subject site, dependent on the soil profile, location of impermeable profile and soil moisture.

The assessment notes that the subject site does not contain any water courses, with only two (2) dams/soaks being located across the site. The assessment notes there is no risk or limitations to ground water from future subdivision and development.

Of note, the assessment raises that:

- There are no limitations on surface water;

- Soil calculations indicate that soils will be able to accept the infiltration of a ARI 1yr event; and
- Water management actions are able to be incorporated into the development at the design stage;

Calculations regarding storm water management, net water increase/decrease and the like are also included within the assessment, the assumptions of which were based upon a design which had a reticulated water connection and an increased road network. Of note, the subject site will not be connected to a reticulated water supply, which the assessment deems has no net increase in water exports.

When considering the proposal, it does note that there may be a slight increase in infiltration from the road network due to less evapotranspiration, however, given the relatively low density of the proposal, this is likely to be negligible. In accordance with requirements, an Urban Water Management Plan will be prepared as part of the subdivision of the land, complying with the relevant requirements of the City of Albany and the Department of Water.

Biodiversity and Management

The subject site contains approximately 40 percent remnant vegetation, in varying scales of condition. Remnant vegetation communities include:

- Jarrah-Marri Low Forest is the predominant vegetation type on the subject site, with a larger area in good condition adjoining the southern property boundary and a small portion adjoining the northern boundary. Other portions of the complex extending into the site are completely degraded, due to grazing by livestock;
- Peppermint Forest is found in small pockets around the subject site, all of which are proposed to be retained;
- Melaleuca Thicket is found in small communities adjoining Oyster Harbour, all of which are proposed to be retained;
- Estuarine Low Heath is located adjacent to the Oyster Harbour and will be retained;
- Eucalyptus-Taxandria Low Woodland is located in the northeast corner of the subject site; and
- Taxadria Thicket is located in the northeast corner of the property and adjoining the southern boundary.

The assessment notes the condition of remnant vegetation in Figure 4, with condition ranging from Degraded to Very Good, and it is noted that portions of the site are highly disturbed and fully cleared. The subject site also contains some wetlands associated with Oyster Harbour.

The assessment notes that the vegetation listed above can form habitat for fauna, with the general premise that the more remnant vegetation retained, the better fauna values are maintained. It notes that the vegetation on the subject site may be habitat for the Black Cockatoo (*Calyptorhynchus baudinii*) and Western Ringtail Possum (*Pseudocheirus peregrinus occidentalis*). Overall, the majority of remnant vegetation will be protected through subdivision and development.

The proposal seeks to limit the impacts on remnant vegetation as a result of development. Where good condition vegetation is present, this is included within the 'Vegetation Protection Zone', with relevant management requirements included within the Scheme Provisions to ensure that these habitats are not compromised as a result of development.

Foreshore Management

The land lies adjacent to the Oyster Harbour, with almost the entire western property boundary directly fronting the foreshore of the harbour. The north portion of this frontage has foreshore vegetation of approximately 50m and over in width, portions of which are reserved and portions of which are within the subject site.

To the south of this area, the foreshore reserve narrows considerably, containing approximately 5-10m width of remnant vegetation. Discussions regarding this have been held with the City of Albany, who advised that widening the vegetated area would be extremely difficult, given the neighboring land contained in the subject site is pastured. Removing this pasture is an intensive process.

As shown on the Subdivision Guide Plan, it is proposed to give up foreshore reserve adjoining the northern portion of the foreshore, which contains existing remnant vegetation. This will ensure that this important foreshore vegetation is in public ownership. The southern portion of the foreshore is not proposed to be widened on the Subdivision Guide Plan, given the intensive and costly process, which would likely have to occur after the three year bonding period by the City of Albany. This land will be maintained in the private ownership of Lot 7 and continue to be pastured.

With the exception of the existing dwelling and building envelope for Lot 7, all building envelopes are located more than 100m setback from Oyster Harbour.

2.4.3 Visual Landscape

The subject site can be described as an 'Undulating Rural Landscape' by *Visual Landscape Planning in Western Australia*. It contains natural features such as hilly terrain and remnant vegetation. Future subdivision and development of the subject site seeks to protect the visual elements of the site by:

- Retaining remnant vegetation on the ridgeline of the subject site;
- Providing building and design elements enforceable through the Scheme Provisions that will ensure that development is well suited to the rural landscape; and
- Development, where located on the main ridgeline, will be located at lower elevations to remnant vegetation, a key design aspect of the development.

The subject site does not front any major road and is well screened. Because of this and the proposed design and controls, it is considered that the Amendment and future development will be sensitive to the landscape and respond with appropriate visual form.

2.5 Bush Fire Hazard Management

A Bushfire Management Plan has been prepared by Bio Diverse Solutions to accompany this Amendment and is included in **Appendix D**. Measures implemented by the Bushfire Management Plan on the subject site include:

- Establishing Bushfire Attack Level (BAL) ratings for building envelopes, which will correspond with construction requirements listed in AS 3959 – 2009;
- Creating Emergency Access Ways which will result in an access network with no dead-ends and three points of access/egress to the subject site;
- Ensuring suitable Building Protection Zones can be established to building envelopes; and
- Providing sufficient water supplies to fight bushfire.

The Amendment will improve the bushfire management of the subject site and ensure that future lives and property are protected with the intensified development of the subject site.

2.6 Infrastructure

2.6.1 Access

External Access

Access to the subject site will be from Nanarup Road, with the proposed access to be secured through Lot 184 (No.334) Nanarup Road, Kalgan. The purpose of securing access through this property is that the two current road reserve accesses that enter the property are subject to limitations, as listed below:

- Affleck Road: This road reserve is low lying and directly adjacent the Oyster Harbour foreshore. Works to upgrade this road beyond the current standard would be expensive and result in environmental implications; and
- Unconstructed road reserve. Lot 66 Nanarup Road, Kalgan is located adjacent to the eastern boundary of Lot 183 Nanarup Road. However, to achieve access through this road reserve will require clearing and widening (currently 10m in width) to create a road reserve link. This road reserve also traverses a small valley, which will have associated drainage issues.

Therefore, due to the above limitations on access, an alternative access through Lot 184 will be required. This will be 20m wide and developed in accordance with the City of Albany requirements for *Rural Residential* roads.

Internal Access

Internal access throughout the proposed future subdivision will be via 20m and 15m wide road reserves. In addition, four (4) of the proposed lots will be serviced by battleaxes driveways. Roadways and battleaxe driveways will be built to the specifications of the City of Albany.

2.6.2 Services

Water

A key sustainability initiative of the proposed development is that each property will be serviced by its own on-site water supply through rainwater capture and storage. When comparing rainwater capture and storage to the alternative of providing reticulated water, it is asserted that the following justifications be taken into consideration:

- Clause 5.6.9.2 requires that each dwelling not connected to a reticulated potable water supply be provided with a 92,000L sustainable potable water supply;
- Albany has an annual average rainfall of 929mm, which is reliable and has been proven adequate to supply on-site rainwater use by the numerous other rural residential developments which rely on on-site rainwater supply.
- It is the size of the roof area and not the lot size that have bearing on the catchment amount of a rainwater system of potable water supply. In residential land of 1 ha and above, it can clearly be argued that the roof catchment area does not grow in relation to the size of the lot. Whilst it may be argued that on-site capture of surface runoff would reduce, the same is not so for rainwater captured from roof surfaces.
- Each of the proposed lots has been allocated a building envelope, varying from 1000m² to in excess of 3000m², dependent on site constraints. The normal use of the building envelope on a rural residential property includes:
 - The single house;
 - The associated outbuilding;
 - The on-site effluent disposal system;
 - The rainwater tank.

These uses are easily accommodated within the designated building envelope, which can be demonstrated by the numerous examples of larger lots around Albany with no water supply. Therefore, it is the size of the roof catchment and not lot size that dictate the need for a reticulated water supply;

- An example of where on-site water supply can be reliably provided on smaller lots has occurred in Western Australia in the town of Muchea. Recent residential development in this town has provided lots with a minimum lot size of 4000m², which have a building envelope of a minimum of 1000m² and are not connected to a reticulated water supply. These building envelopes accommodate the single house, on-site effluent disposal and a rainwater tank;
- The extension of the reticulated water system to service Rural Residential Area No. 45 is not economical (due to the length of pipe and bridge crossing required), or efficient and would be a waste of resources, given sufficient ability to utilise on-site supply. The layout of future subdivision, due to environmental constraints, makes the extension of some services inefficient, particularly where the road network only fronts development on one-side;
- The non-connection of a reticulated water supply is a key sustainability initiative of the proposed development. Albany has a reliable yearly rainfall which can be easily captured to provide year round reliable water supplies. This also reduces the burden on expanding a

reticulated water system, which across the State is under increased pressure to meet growing household and industrial demand;

- The use of on-site water supply as opposed to a reticulated water supply will assist with drainage of the subject site in the future. When a reticulated water supply is connected, it is less likely that households will capture and store rain water on-site, which in-turn, either becomes surface water run-off or dissipates through infiltration into groundwater. This reduction in storm water load will reduce runoff from households into Five Mile Creek, reduce erosion across lots and assist in containing high rainfall events.
- Suitable Scheme Provisions can be included to ensure that minimum supply standards are met for each lot, such as:
 - Requirement for installation and connection to a 92,000L rainwater tank for each dwelling as well as sufficient roof catchment area to supply the rainwater tank; and
 - Requirement for a portion of the tank to be assigned for fire management purposes, i.e. installation of dual tank valves with the house connection from the upper valve, ensuring a water supply is available for firefighting.

Appropriate measures are incorporated within the Scheme Provisions requiring that each dwelling have installed and be connected to a 92,000L rainwater tank, as is the standard requirement of LPS1.

Power

The subject site is currently serviced by an overhead low voltage power supply. New transformers and switch gear will be required throughout to service future subdivision and development.

On-site Effluent Disposal

The size of the proposed lots and distance from the Water Corporations Albany Sewerage Scheme requires that future development is serviced by on-site effluent disposal.

The following measures have been incorporated within Rural Residential Area No. 45 to ensure that on-site effluent disposal can occur within the parameters of the City of Albany and the Department of Health:

- All effluent disposal on the subject site will occur through the use of alternative treatment units;
- No effluent disposal to occur within 30m of a water course or body or on land identified as waterlogged (Effluent Disposal/Development Exclusion Zone shown on the Subdivision Guide Plan).

The above measures will ensure that on-site effluent disposal will occur in a suitable manner respecting the constraints of the subject site. Earlier sections of this report have outlined the land capability for on-site effluent disposal and constraints on the land affecting placement/type of effluent disposal units.

Telecommunications

The subject site is currently connected to telecommunications and will retain this connection as a result of future subdivision and development.

3 PLANNING CONTEXT

3.1 State and Regional Planning

Applicable State Planning Policies are SPP1 – “State Planning Framework Policy (variation No.2), SPP2.5 “Land Use Planning in Rural Areas” and SPP3 “Urban Growth and Settlement”. The applicable Development Control Policy (DCP) is DCP3.4 “Subdivision of Rural Land”.

3.1.1 State Planning Policy No.1 – State Planning Framework Policy

The purpose of SPP1 is to bring together the State and regional policies that apply to land use and development in Western Australia and to establish the general principles for land use planning and development in WA. SPP1 states *“the primary aim of planning is to provide for the sustainable use and development of land”*. It goes on to quantify this through identifying and expanding upon the five key principles that further define this statement, environment, community, economy, infrastructure and regional development.

The Amendment meets the objectives of SPP1, as evidenced by the following:

- The Amendment complies with ALPS;
- The Amendment seeks to promote the environmental values of the subject site, by ensuring that riparian vegetation is protected and foreshore enhanced;
- It will provide an alternative source of land for settlement in the Albany urban hinterland and remove pressure to expand into new areas for this type of development. The proposal will not inhibit the future urban expansion of Albany and is a completion of rural residential subdivision pattern in the locality;
- It will support the local economy by allowing the growth of Albany and providing an additional housing/lifestyle choice;
- The proposal will have minimal ability to generate land use conflicts, given the majority of adjoining land uses are rural residential in nature; and
- It will utilize existing infrastructure for servicing, as well as completing the local road network and strategic Emergency Access Routes in the locality.

3.1.2 State Planning Policy No.2.5 – Land Use Planning in Rural Areas

SPP 2.5 provides the overarching objectives and policy statements for land use planning for rural and rural settlement development. SPP 2.5 lists the following policy measures that shall be applicable to decision making regarding rural living proposals:

- a) *“The rural living precinct is part of a settlement hierarchy established in a WAPC endorsed planning strategy.*
- b) *The WAPC will consider identifying rural living precincts or supporting proposals for rural living when:*
 - i) *the precinct is adjacent to existing urban areas and has appropriate access to services, facilities and amenities;*

- ii) *the precinct will not conflict with rural land use activity or reduce the primary production potential of adjoining or nearby land;*
- iii) *areas required for priority agricultural land are avoided;*
- iv) *the extent of proposed rural living settlement is guided by existing land supply and take-up and population projections;*
- v) *areas required for urban expansion are avoided;*
- vi) *where lots with an individual area of 4 hectares or less are proposed and a reticulated water supply of sufficient capacity is available in the locality, the precinct will be required to be serviced with reticulated domestic water provided by a/the licensed service provider, including water for firefighting. Should an alternative to a reticulated water supply be proposed, it must be demonstrated that a reticulated water supply is not available;*
- vii) *where a reticulated supply is demonstrated to be not available, or the individual lots are greater than 4 hectares, the WAPC may consider a fit-for-purpose domestic potable water supply, which includes water for firefighting. The supply must be demonstrated, sustainable and consistent with the appropriate standards for water and health;*
- viii) *where an acceptable supply of potable water cannot be demonstrated, the development cannot proceed;*
- ix) *it has been demonstrated the precinct can be supplied with reticulated electricity;*
- x) *the precinct can be supplied with community facilities as identified under a strategy or scheme, and in compliance with SPP 3.6 as appropriate;*
- xi) *the precinct is predominantly cleared of remnant vegetation or the loss of remnant vegetation through clearing for building envelopes, bushfire protection, access and fencing is minimised and environmental assets are not compromised;*
- xii) *it will promote good environmental and landscape outcomes and the soil and total water management cycle are addressed, and may include rehabilitation as appropriate;*
- xiii) *the land within the precinct is capable of supporting the development of a dwelling(s) and is not located in a flood prone area;*
- xiv) *the land within the precinct is not subject to a buffer from an adjoining land use or the impact(s) from the buffer can be managed;*
- xv) *the lots can be serviced by constructed road/s capable of providing access during all weather conditions, including access and egress for emergency purposes;*
- xvi) *it can be demonstrated that the precinct is not in an extreme bushfire risk area and any lesser bushfire risk can be minimised and managed without adversely affecting the natural environment; and*
- xvii) *in areas of moderate bushfire risk, dwellings will be required to be constructed to Australian Standard 3959 Construction of Buildings in Bushfire-Prone Areas (AS*

3959) and separation distances are to comply with relevant guidelines for bushfire protection.

- c) Development standards for rural living should be addressed in local planning schemes.
- d) Rural strata proposals with a residential component are considered to be rural living and will be considered in accordance with the criteria listed at 5.6 (a) and (b) of this policy."

The following points detail how the proposal complies with each of the requirements listed in clause 5.6 of SPP 2.5:

- a) The subject site is part of an endorsed *Rural Living* area in the ALPS;
- b) The response to each of the sub-clauses is outlined below:
 - (i) The subject site is located 15km from the Albany CBD and adjoins existing approved rural residential development. As previously outlined, services and amenities are provided within the Albany urban area;
 - (ii) The proposal will have minimal impact on productive agricultural land, being surrounded by *Rural Residential* zones;
 - (iii) The land is not identified for priority agriculture;
 - (iv) The land is not identified or required for urban expansion, as evidenced by the location of existing rural residential areas directly adjoining the north, south and east of the subject site;
 - (v) All of the proposed lots are to exceed a minimum size of 1ha in area, with a reticulated water connection not to be supplied due to the remoteness of the location of this supply. This is justified in Section 2.6.2 of this report;
 - (vi) As above, the lots will be serviced by a fit-for-purpose domestic water supply. This will be in the form of 92,000L rainwater tanks, serviced by roof-top rainwater capture. These rainwater tanks will be fitted with dual Camlock valves, one installed at the 10,000L mark for domestic water consumption and the other at the bottom of the tank, preserving a minimum of 10,000L for fire-fighting purposes. This has the dual purpose of reducing runoff from the subject site as a result of future development;
 - (vii) A suitable supply of potable water has been demonstrated within this document;
 - (viii) A reticulated electricity supply is currently connected to the property and able to service the future development of the subject site;
 - (ix) Community facilities are available within the Albany urban area for use of future residents. The size of the proposed development does not warrant the on-site provision of community facilities;
 - (x) As demonstrated on the Subdivision Guide Plan, clearing of remnant vegetation is minimised and confined only to those areas considered completely degraded. The environmental assets of the subject site will be protected in the long term by the proposed rezoning;

- (xi) The proposal seeks to promote good environmental and landscape outcomes, as evidenced by the following:
 - i. Retention of remnant vegetation and fencing where appropriate; and
 - ii. The use of building envelopes on less capable lots to ensure development is located on the most capable portion of the land and outside of areas considered water-logged.
- (xii) All building envelopes and lots have been designed based upon the findings of the Land Capability Assessment and Local Water Management Strategy;
- (xiii) The property is not currently subject to a buffer from an adjoining land use;
- (xiv) As shown on the Subdivision Guide Plan, all of the proposed lots are to be serviced by constructed public roads, which will be constructed to the specifications of the City of Albany and be available for access in all weather conditions;
- (xv) As evidenced by the Bushfire Management Plan undertaken by Bio Diverse Solutions, Bushfire Attack Levels (BAL) are identified across the site and dwellings will be constructed in accordance with AS 3959 – 2009 *Construction of Buildings in Bushfire Prone Areas*;
- c) Development standards for the subdivision and development of the subject site are included within LPS 1; and
- d) This clause is not applicable to the proposed rezoning, as it is proposed to subdivide the property into freehold (green title) lots.

It is believed that the proposal complies with all relevant clauses for rural living proposals as outlined in Clause 5.6 of SPP 2.5. SPP 2.5 also outlines the following definitions applicable to the proposed rezoning:

“Rural residential zone / Special rural zone

A sub-set of rural living and a land use zone with land parcels from one to four hectares in size and generally provided with scheme water and power supply.”

The proposal complies with the requirements of the ‘Rural residential zone/Special rural zone’ definition. The Amendment will provide for lots developed for lifestyle purposes.

3.1.3 State Planning Policy No.3 – Urban Growth and Settlement

The purpose of SPP3 is to promote a sustainable settlement pattern across Western Australia. It specifically mentions rural residential development in Section 5.6 “Managing rural-residential growth”. When planning for rural-residential development, it states that development should-

- *“avoid productive agricultural land, important natural resources, areas of high bush fire risk or environmental sensitivity;*
- *avoid future urban areas or areas particularly suitable for urban development in terms of their characteristics and proximity to urban services;*

- *give preference to locations near existing settlements with available services and facilities in order to support the local community and avoid locations where services are not available or costly extensions are necessary;*
- *minimise potential for conflict with incompatible activities associated with productive rural uses or natural resource management;*
- *only include locations which are suitable for this type of development, such as land which is topographically varied, visually attractive and with distinctive environmental attributes or otherwise has potential for lifestyle pursuits; and*
- *take a realistic approach by allocating land based on forecast estimates of demand for rural living not on the speculative development of land."*

The Amendment complies with the requirements of SPP3, as evidenced by the following points:

- As evidenced in the Land Capability Assessment, the majority of the subject site has good capability for rural residential development;
- The land is not considered part of the future urban area of Albany;
- The subject site is located in an existing rural residential settlement area;
- The subject site is surrounded on three sides by rural residential development;
- The property is visually attractive, topographically varied with distinctive attributes that make it suitable for the development of lifestyle pursuits; and
- The identification of the property for these uses in the ALPS indicates that the City of Albany considered it as part of projections for the supply of rural residential land.

3.1.4 Development Control Policy No.3.4 Subdivision of Rural Land

The purpose of DCP3.4 is to provide guidelines for the subdivision of rural land. Applicable to the Amendment is Section 3 of DCP3.4, which is outlined below:

"3 Rural Living

It is the policy of the WAPC that the subdivision of rural land for rural living land uses must be properly planned through the preparation and endorsement of strategies and schemes and be accordingly zoned in local planning schemes prior to subdivision.

Rural living is considered a residential land use and not a rural land use. Therefore, this policy does not apply to rural living proposals or subdivision. Rural living policy is outlined in clause 5.6 of State Planning Policy 2.5 – Land use planning in rural areas.

Accordingly, the requirements of *State Planning Policy 2.5 – Land use planning in rural areas* have been assessed in this document.

Rural Planning Guidelines

The Western Australian Planning Commission has recently released the *Rural Planning Guidelines* for use in the preparation and review of planning documentation relating to rural land use planning, including rural living.

These guidelines have been released for a 6 month monitoring and review process. The guidelines do raise relevant requirements relating to the development of rural living estates, however, in all cases, these requirements have been addressed in other sections of this document.

3.1.5 Draft Country Sewerage Policy

The Department of Health released a draft policy for wastewater treatment and dispersal in 2003. The draft Country Sewerage Policy sets minimum requirements for on-site wastewater disposal. This includes:

- A minimum lot size of 2000m² shall be established in areas proposed to utilise on-site effluent disposal techniques;
- The use of Aerobic Treatment Units (ATU's) where a clearance of 500mm from surface to groundwater can be achieved;
- The use of septic systems where a clearance of 2000mm from surface to groundwater can be achieved and suitable soil types are found; and
- A 30 metre setback to a dam, stream or private water supply.

As is outlined in the Land Capability Assessment, late winter testing of the Amendment Site was undertaken. It identified that the Amendment Site does meet the requirement of the draft Country Sewerage Policy. A 30m setback for ATU's has been imposed to water bodies on the subject site, as well as a 100m setback to Oyster Harbour for the use of on-site effluent disposal.

3.2 Local Planning

3.2.1 City of Albany Local Planning Scheme No.1

Under the City of Albany Local Planning Scheme No. 1 (LPS 1), the subject site is zoned *General Agriculture*. The purpose of the Amendment to LPS 1 is to rezone the subject site to *Rural Residential*. LPS 1 outlines the objectives of the *Rural Residential* zone in Clause 4.2.17:

“(a) Create small rural land holdings for residents who wish to enjoy a residential lifestyle within a rural landscape and environment; and

(b) Provide for residential and limited incidental land uses which:

(i) Are compatible with the preservation and protection of environmentally sensitive areas such as remnant vegetation and groundwater protection areas;

(ii) Do not visually detract from the landscape and the visual amenity of the locality;

(iii) Allow for uses and developments that are fit for purpose and minimise any onsite or off-site impacts such as soil erosion, nutrient loss, drainage and potential land use conflicts; and

(iv) Are located in close proximity to existing urban areas and can enjoy appropriate urban servicing to the lots including rubbish disposal, reticulated water, community facilities and fire infrastructure.”

The proposal complies with the objectives of the *Rural Residential* zone as evidenced by the following:

- The protection of remnant vegetation and ensuring protection of the environment is a priority on the subject site;
- The subject site is well screened from major roads and located low in the landscape, hence will have limited visual impact. The protection of remnant vegetation on the subject site will also ensure visual impacts are reduced;
- Off-site impacts will be minimised; and
- The subject site is appropriately located for rural residential development, being surrounding on three sides by *Rural Residential* zoned land. No reticulated water is connected to the existing rural residential development, nor is it proposed to be connected to the subject site.

LPS 1 also provides for general provisions relating to the *Rural Residential* zone within Clause 5.5.13.2 of the Scheme. Furthermore, Clause 5.5.13.3 outlines the following:

“Prior to considering any additional land to be rezoned to Rural Residential, the Local Government will require the proponent to submit a detailed proposal that addresses the following matters:

(a) Compliance with the outcomes and recommendations of the Albany Local Planning Strategy;

(b) Fire Hazard Assessment and Fire Management Plan;

(c) Land capability and suitability assessment,

(d) Protection and enhancement of the natural environment;

(e) Protection and enhancement of visual amenity;

(f) Provision of infrastructure and services;

(g) Impacts on adjacent land uses;

(h) Any potential for site contamination;

(i) Effluent disposal;

(j) Location of building envelopes etc; and

(k) Preparation of a Guide Plan for the subdivision showing proposed roads and connectivity between proposed/future and existing developments, lots, recreation areas, location of building envelopes etc.”

The Amendment is consistent with Clause 5.5.13.3, as outlined in the following justification:

- (a) As has been outlined in this report, the Amendment proposes a *Rural Residential* zoning for the subject site, as opposed to *Rural Residential* and *Special Residential* as identified in the ALPS. Should *Special Residential* zoning become viable, with a suitable water supply provided, a number of the lots will be able to be rationalised;
- (b) A Bushfire Management Plan is incorporated with this Amendment, with its requirements incorporated within the Scheme Provisions and on the Subdivision Guide Plan. All development can achieve the necessary separations and building requirements compliant with SPP 3.7 Planning for Bushfire Risk Management;
- (c) A Land Capability Assessment has been completed to accompany the Amendment. The findings of the Land Capability Assessment have been incorporated and taken account of in this Amendment and its accompanying Subdivision Guide Plan;
- (d) The Amendment seeks to protect and enhance the natural environment in the following ways:
 - a. Ensuring good quality remnant vegetation is protected; and
 - b. Ensuring that all lots have suitably capable locations for buildings and on-site effluent disposal;
- (e) The Amendment seeks to protect and enhance the visual environment through the protection of remnant vegetation and development in accordance with the general provisions of Clause 5.5.13.2 of LPS 1;
- (f) The Amendment ensures that suitable infrastructure and services are provided to service future residents;
- (g) As is demonstrated throughout this document, the impact on adjacent/adjoining land uses is minimal, given all surrounding land uses are similar in nature;
- (h) The potential for site contamination is regarded as low. The proposal is for rural residential living on properties above 1ha in area, with all land identified as not being capable for this development being excluded from future development;
- (i) Effluent disposal has been given consideration by this Amendment and the Subdivision Guide Plan. As shown on the Subdivision Guide Plan and referenced within the Scheme Provisions, alternative effluent disposal systems will be required to be used on land that is less capable;
- (j) As shown on the Subdivision Guide Plan, building envelopes have been allocated on those properties deemed to be constrained by physical limitations, such as waterlogging, low fuel zones and other buffers. All building envelopes proposed exceed 2000m² in area, demonstrating that each lot is capable of ‘normal’ rural residential development. Where such constraints are lessened, a building envelope has not been allocated, as the location of buildings and structures on this land will be guided by the Scheme Provisions and constraints mapped on the Subdivision Guide Plan; and

(k) A Subdivision Guide Plan has been prepared in accordance with the criteria outlined.

It is believed that the Amendment addresses all criteria listed by the City of Albany Local Planning Scheme No.1 for rezoning the subject site from *General Agriculture* to *Rural Residential*.

3.2.2 Albany Local Planning Strategy

The Albany Local Planning Strategy (ALPS) sets out the long term planning direction for the City of Albany and has regard to all relevant State and regional planning policies.

ALPS identifies the strategic planning direction for the City of Albany over the next 20 years. It draws on the key elements from the City of Albany's strategic planning document, *3D Vision*, and notes that the City of Albany should become a *Learning, Healthy and Thriving City*.

ALPS Strategic Land Use Classification

The subject land is currently classified by ALPS as *Rural Living and Special Residential*. This rezoning proposes land uses that would be consistent with the *Rural Living* classification of ALPS, of which the Strategic Objectives are included in Section 8.3.5 of ALPS. These are:

"In the long term encourage the efficient use of existing rural living areas, based on land capability to maximize their development potential."

"Ensure that future rural living areas are planned and developed in an efficient and co-ordinated manner by being located either adjacent to Albany as designated on the ALPS maps, or within existing rural townsites in accordance with Table 5 along with adequate services and community infrastructure."

ALPS also includes the following objectives for *Rural Living* areas:

- *"Discourage the creation of additional rural townsites for living purposes."*
- *Avoid the development of Rural Living areas on productive agricultural land, other important natural resource areas and areas of high bushfire risk, flooding and environmental sensitivity."*
- *Avoid the development of Rural Living areas on future and potential long term urban areas."*
- *Minimise potential for generating land use conflicts."*

Figures 12 and 13 of the ALPS outline the Special Rural/Residential lot supply available in the City of Albany as at the gazettal of ALPS and estimates approximately 570 lots were available for development in the Albany hinterland. It is understood that the City of Albany will be completing a similar analysis of lot availability upon proceeding with its ALPS review process. In concluding the *Rural Living* section, ALPS identified the following actions relating to this land use (applicable to the Amendment only):

“Give top development priority to the subdivision of land currently zoned Special Residential and Special Rural within the City’s current Town Planning Schemes and as designated on the ALPS maps.

“In the long term, maximise opportunities for existing rural living areas that do not have potential for future urban development to achieve higher sustainable lot yields based on land capability/suitability, service provision and local constraints. These areas would be given second priority to meet future demands.”

The subject site is designated for *Rural Living* and *Special Residential* by the ALPS and is therefore consistent with the first action of ALPS. The second action is that the opportunity for rationalisation is achieved in *Rural Living* areas, which is achieved by the proposal in achieving a minimum lot size of 1ha.

4 SUBDIVISION GUIDE PLAN AND SCHEME PROVISIONS

4.1 Introduction

Whilst this document provides all background and supporting information, the requirements of this document are enabled through the Subdivision Guide Plan and Scheme Provisions relating to Rural Residential Area No. 45. The Subdivision Guide Plan and Scheme Provisions are outlined in the below section. The Subdivision Guide Plan is included within **Appendix E** of this document.

4.2 Subdivision Guide Plan and Scheme Provisions

4.2.1 Design Philosophy

To create rural residential living that is responsive to landform and site opportunities and constraints, and thereby complete the pattern of rural residential subdivision in the locality.

4.2.2 Constraints to Development

Land Capability

As explained through this report and the Land Capability – Geotechnical Assessment and Water Management Strategy, the subject site does have some land capability constraints, however, these are easily managed through the following methods:

- Design limitations and avoidance of area with the highest constraint through the design depicted on the Subdivision Guide Plan;
- Imposition of requirements through the Scheme Provisions, ensuring that each lot is developed in a manner that does not exacerbate land capability constraints.

Examples of how land capability constraints are addressed include:

- The requirements for all proposed new dwellings to utilise Alternative Treatment Unit's for on-site effluent disposal;
- The location of all new building envelopes outside of soils considered to have a lower than fair (III) land capability rating; and
- Ensuring that all new building envelopes have an adequate separation to existing water bodies (i.e. 30m) as well as a 100m setback of development from Oyster Harbour.

The Subdivision Guide Plan and Scheme Provisions adequately address considerations relating to land capability for the subject site.

Remnant Vegetation

As part of its Land Capability – Geotechnical Assessment and Water Management Strategy, Landform Research identified vegetation condition and communities existing on the subject site. These form considerable constraints for development. This has been addressed in the following ways:

- Identification of Vegetation Protection Zone's covering Good to Very Good condition remnant vegetation across the subject site;
- Ensuring that requirements for fire protection do not lead to undue removal of remnant vegetation by the proposed development; and
- Encouragement for remnant trees to be protected as part of the landscape.

The Subdivision Guide Plan and Scheme Provisions will ensure the retention and management of good quality vegetation on the subject site, as well as ensuring the landscape values of the site are not depreciated by the proposed subdivision and development.

Fire Management

As identified within the Bushfire Management Plan prepared by Bio Diverse Solutions, the subject site contains 'Extreme', 'Moderate' and 'Low' bush fire hazards. To protect property and life, the Amendment, through the Subdivision Guide Plan and Scheme Provisions seeks to:

- Enable access throughout the site via a systems of roads and Emergency Access Routes;
- Providing three (3) points of access and egress to the subject site, ensuring good access to the subject site during a bush fire emergency;
- Maintain vegetation in close proximity to houses in a low fuel standard, as directed by the Bushfire Management Plan;
- Provide a water supply at each property through securing the bottom portion of rainwater tank for fire-fighting purposes. The location of a dam on the subject site, as well as a mains water supply being available; and
- Constructing houses to the appropriate Bushfire Attack Level (BAL) rating, as identified within the Bushfire Management Plan, with no construction occurring in areas identified as BAL 40 or BAL FZ.

The Amendment will result in sound fire management practices being applied to the subject site and subsequent development.

Access

Access to the subject site is problematic, due to the two existing road reserves being incapable of being used as the primary means of access, due to:

- Affleck Road being low lying and subject to inundation during winter. Its close proximity to Oyster Harbour also makes upgrading the road difficult; and
- The road reserve adjoining the northeast corner of the property entering an area of very good condition remnant vegetation. The intent of the Amendment is to protect these areas from further clearing;

It is proposed that a new access is established through Lot 184 (No.334) Nanarup Road, Kalgan. This will be in the form of 20m road reserve. This location has excellent sight lines in each direction on Nanarup Road and the location of the proposed road has been agreed to by the landowner.

4.2.3 Opportunities Presented by the Amendment

Completion of Rural Residential Development Front in this Locality

The Amendment will result in logical completion to the *Rural Residential* zoned land in the locality. This is evidenced in the following:

- Land immediately adjoining the northern, southern and eastern boundaries of the subject site is zoned *Rural Residential*;
- The subject site was always intended for *Rural Residential*, through gradual development of the Gull Rock/Swan Point rural residential area;
- The majority of land in this area identified for *Rural Residential* has been developed and subdivided, with only limited lots remaining in the Swan Point development, as well Lot 600 Pine Rise. The proposal forms the logical continuation of development in this locality;

The rezoning of the subject site will complete the precinct and result in well planned, comprehensive development of the site for *Rural Residential* purposes.

Environmental Outcomes

As outlined throughout this report, the Amendment seeks to allow the limited development of the subject site for *Rural Residential* purposes. Through subdivision and development of the subject site will occur as a result of this, it should be noted that the following beneficial environmental outcomes will be achieved:

- Subdivision and development will identify, protect and manage remnant vegetation of the subject site in a manner compliant with regulatory requirements. The current use of the land does not provide for this;
- Subdivision and development will enable regulatory authorities to enforce requirements such as ceding the foreshore fronting Oyster Harbour and prevention of development on low capability land;
- Affleck Road will no longer form the primary access to the land, although will be retained for emergency access and egress. This will remove a maintenance burden of the City of Albany for this low lying road; and
- Fire management of the subject site will be improved.

These are tangible benefits for the land. Subdivision and development will improve the ongoing maintenance and quality of the subject site.

Completion of Strategic Fire Network

As evidenced in this report, the Amendment seeks to complete strategic fire access in this *Rural Residential* zoned locality. This includes the provision of a strategic firebreak connection to Swan Point Road.

Providing Well Located Rural Residential Development

The subject site is located a 15 minute drive from the Albany CBD, providing lifestyle lots in close proximity to employment and amenities within the Albany area. The subject site is served by school bus routes which operate along Nanarup Road, as well as being within easy driving distance of the centre of Albany and services associated with this centre. The popularity of this locality for this form of development is well known and the subject site characteristics make it a sound choice for the completion of *Rural Residential* land uses to the south of Nanarup Road.

Efficient Use of Land for Highest and Best Use

The Amendment presents the opportunity for the highest and best use of the land to be achieved through the rezoning of the land to *Rural Residential* with an applicable minimum lot size of 1ha. The use of the minimum lot size of 1ha is justified by the following:

- It is the minimum lot size permitted within the *Rural Residential* zone;
- The Albany Local Planning Strategy encourages the maximum use of existing and proposed *Rural Residential* zones, prior to identifying new locations for this type of development, which deplete agricultural land stocks; and
- The use and type of development will blend seamlessly with other surrounding rural residential zones.

4.3 Conclusion

The Subdivision Guide Plan and Scheme Provisions applicable to Rural Residential Area No. 45 seek to identify and manage the opportunities and constraints of the subject site in a manner that realises the site's potential for rural residential development.

5 JUSTIFICATION AND CONCLUSION

Amendment No. 15 to City of Albany Local Planning Scheme No.1 seeks to rezone the subject site to *Rural Residential* and insert the Subdivision Guide Plan and Scheme Provisions relating to the Rural Residential Area No. 45 into Schedule 14 of the Scheme.

This Amendment achieves the following objectives:

- Providing suitably located lifestyles uses in an area that will not impact on the future expansion of the Albany urban land area;
- Logically completing rural residential development in this locality;
- Demonstrating that the subdivision and development of the land at this time for *Rural Residential* land uses will not compromise the subdivision and development of *Special Residential* land uses in the future, should the City of Albany wish for this use to occur on the subject site as a result of the Albany Local Planning Strategy review;
- Providing strategic road and fire access routes benefitting the locality;
- Addressing the key constraints and opportunities of the Amendment Site in a sensitive manner that will permit development;
- Ensure the land is capable and suitable for the type of development proposed; and
- Providing for suitable land uses which complement their surrounding context.

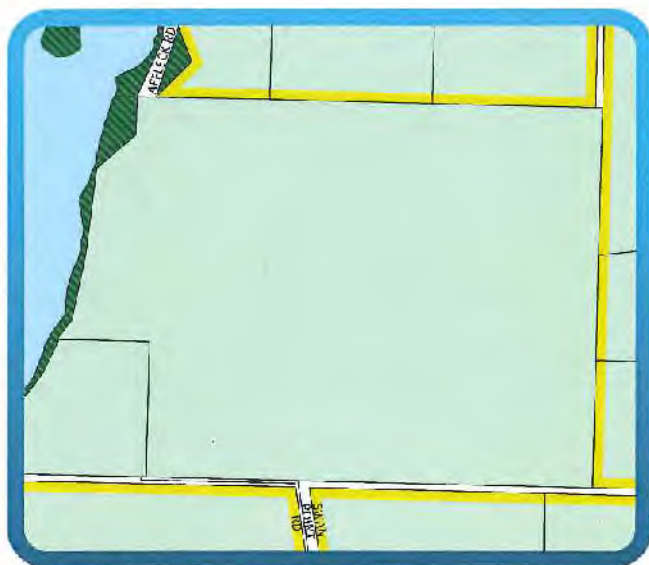
Additional information supporting this Scheme Amendment is contained at **Appendix F**.

Approval of the Amendment and Subdivision Guide Plan is therefore respectively requested.

CITY OF ALBANY

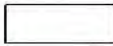

Local Planning Scheme No. 1

Amendment No. 15





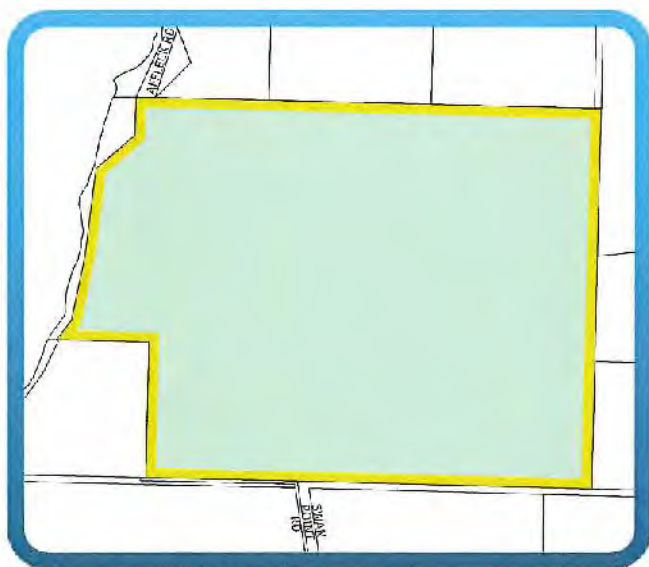
Existing Zoning

LOCAL SCHEME RESERVES

-  Local Roads
-  Parks and Recreation

ZONES

-  Rural Residential
-  General Agriculture



Proposed Zoning



Mapping prepared by Harley Dykstra
116 Serpentine Road Albany WA 6330
Ph 98/1 2333 Fax 98/1 3643
Drawn ABS 05/12/2014, Dwg No. 20328-01A

REPORT ITEM PD132 REFERS

PLANNING AND DEVELOPMENT ACT 2005

CITY OF ALBANY

LOCAL PLANNING SCHEME NO.1

AMENDMENT No. 15

The City of Albany under and by virtue of the powers conferred upon it in that behalf by the Planning and Development Act 2005 hereby amends the above local planning scheme by:

1. Rezoning Lot 422 (No.16) Affleck Road, Kalgan from 'General Agriculture' zone to 'Rural Residential' zone, and amendment in the Scheme Maps accordingly;
2. Inserting provisions relating to the subdivision, development and use of Rural Residential Area No. 45 into Schedule 14 of the Scheme Text.

Schedule 14 – Rural Residential Zone [cl.5.5.13]		
No.	Specified Rural Residential Zone	Special Provisions Applying to Specified Rural Residential Zone
RR45	Lot 422 (No.16) Affleck Road, Kalgan (shown as RR 45 on the Scheme Maps)	<p>1.0 Subdivision of RR 45 shall generally be in accordance with the Subdivision Guide Plan 'RR 45' endorsed by the CEO, with any minor variations approved by the WA Planning Commission.</p> <p>2.0 The minimum lot size shall be one (1) hectare.</p> <p>3.0 The following land uses are 'P' permitted uses: Single House.</p> <p>4.0 The following land uses are 'D' discretionary uses: Ancillary Accommodation, Bed and Breakfast/Farmstay, Home Occupation, Industry – Cottage, Public Utility and Rural Pursuit (which shall be limited to existing cleared and pastured land only) and other incidental or non-defined activities considered by the Local Government to be consistent with the objectives for the zone.</p> <p>5.0 All buildings, structures and water storage systems shall be located wholly within the building envelope depicted on the Subdivision Guide Plan.</p> <p>6.0 Roofing shall be a colour that blends into the landscape of the site. The use of white/off-white and/or reflective materials for roofing shall not be permitted;</p> <p>7.0 Construction material of walls shall be unrestricted. Where white/off-white and/or reflective materials are proposed, the applicant is to demonstrate to the City of Albany that they will not impact amenity of neighbouring residents and the locality generally;</p> <p>8.0 All effluent disposal on the land is to occur through the use of Alternative Treatment Unit's;</p> <p>9.0 Development and Effluent Disposal will not be permitted within the Effluent Disposal/Development Exclusion Zone;</p> <p>10.0 Clearing within the Landscape Protection Zone is not permitted unless to specifically comply with the requirements of the Bushfire Management Plan to reduce</p>

REPORT ITEM PD132 REFERS

		<p>fuel load and implement building protection zones. All other clearing will be subject to planning approval of the City of Albany;</p> <p>11.0 Where lot boundaries traverse Vegetation Protection Area's depicted on the Subdivision Guide Plan, they shall be demarcated by the use of bollards, or other means/method considered suitable by the Local Government, so as to minimise the removal of vegetation;</p>
--	--	--

REPORT ITEM PD132 REFERS

PLANNING AND DEVELOPMENT ACT 2005

CITY OF ALBANY

LOCAL PLANNING SCHEME NO.1

AMENDMENT No. 15

ADOPTION:

Adopted by resolution of the Council of the City of Albany at the meeting of the Council held on the _____ day of _____ 201__:

Mayor

Chief Executive Officer

FINAL APPROVAL:

Adopted for final approval by resolution of the City of Albany at the meeting of the Council held on the _____ day of _____ 201__ and the Common Seal of the municipality was pursuant to that resolution hereunto affixed in the presence of:

Mayor

Chief Executive Officer

RECOMMENDED / SUBMITTED FOR FINAL APPROVAL:

Delegated under s.16 of the PD Act 2005

Date

FINAL APPROVAL GRANTED:

Minister for Planning

Date

APPENDIX A – CERTIFICATES OF TITLE

WESTERN



AUSTRALIA

REGISTER NUMBER 422/DP251058	
DUPLICATE EDITION N/A	DATE DUPLICATE ISSUED N/A

RECORD OF CERTIFICATE OF TITLE
UNDER THE TRANSFER OF LAND ACT 1893

VOLUME
1065FOLIO
927

The person described in the first schedule is the registered proprietor of an estate in fee simple in the land described below subject to the reservations, conditions and depth limit contained in the original grant (if a grant issued) and to the limitations, interests, encumbrances and notifications shown in the second schedule.

REGISTRAR OF TITLES

**LAND DESCRIPTION:**

LOT 422 ON DEPOSITED PLAN 251058

REGISTERED PROPRIETOR:
(FIRST SCHEDULE)

ARCHIPELAGO NOMINEES PTY LTD OF 61 PEELS PLACE, ALBANY
(TP M201066) REGISTERED 5 MARCH 2013

LIMITATIONS, INTERESTS, ENCUMBRANCES AND NOTIFICATIONS:
(SECOND SCHEDULE)

1. *M201067 MORTGAGE TO NATIONAL AUSTRALIA BANK LTD REGISTERED 5.3.2013.

Warning: A current search of the sketch of the land should be obtained where detail of position, dimensions or area of the lot is required.
* Any entries preceded by an asterisk may not appear on the current edition of the duplicate certificate of title.
Lot as described in the land description may be a lot or location.

-----END OF CERTIFICATE OF TITLE-----

STATEMENTS:

The statements set out below are not intended to be nor should they be relied on as substitutes for inspection of the land and the relevant documents or for local government, legal, surveying or other professional advice.

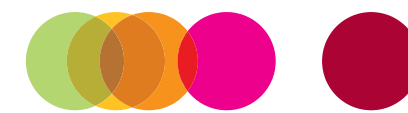
SKETCH OF LAND: 1065-927 (422/DP251058).
PREVIOUS TITLE: 1045-158.
PROPERTY STREET ADDRESS: 16 AFFLECK RD, KALGAN.
LOCAL GOVERNMENT AREA: CITY OF ALBANY.

NOTE 1: A000001A LAND PARCEL IDENTIFIER OF PLANTAGENET LOCATION 422 (OR THE PART THEREOF) ON SUPERSEDED PAPER CERTIFICATE OF TITLE CHANGED TO LOT 422 ON DEPOSITED PLAN 251058 ON 22-MAY-02 TO ENABLE ISSUE OF A DIGITAL CERTIFICATE OF TITLE.

NOTE 2: THE ABOVE NOTE MAY NOT BE SHOWN ON THE SUPERSEDED PAPER CERTIFICATE OF TITLE OR ON THE CURRENT EDITION OF DUPLICATE CERTIFICATE OF TITLE.

NOTE 3: DUPLICATE CERTIFICATE OF TITLE NOT ISSUED AS REQUESTED BY DEALING K580920.

APPENDIX B – SITE PLAN



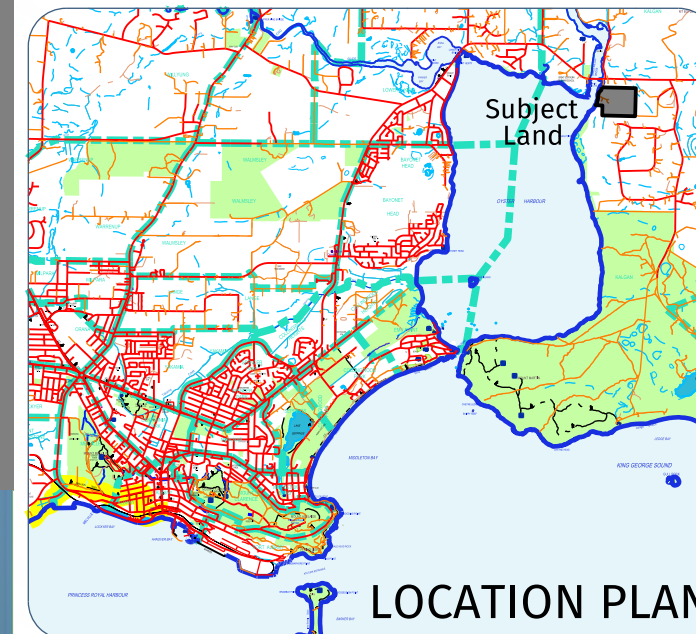
Harley Dykstra

PLANNING & SURVEY SOLUTIONS

0 50 100 150 200 250
ALL DISTANCES ARE IN METRES



DRAWN	CHECKED	DRAWING No
BS 08/12/2014	SDP 08/12/2014	20308-02A.dgn
REV	DESCRIPTION	DATE
A	Original Drawing	08/12/2014



ALBANY OFFICE:
116 Serpentine Road, ALBANY WA 6330
T: 08 9841 7333 F: 08 9841 3643
E: albany@harleydykstra.com.au
W: www.harleydykstra.com.au
Offices also at Bunbury, Busselton, Kelmescott and Perth

Figure 1

COPYRIGHT:
This document is and shall remain the property of HARLEY DYKSTRA.
The document may only be used for the purpose for which it was commissioned and in accordance with the terms of engagement for the commission. Unauthorised use of this document in any form whatsoever is prohibited.

NOTE:
This plan has been prepared for planning purposes. Areas, Contours and Dimensions shown are subject to survey.



APPENDIX C – LAND CAPABILITY – GEOTECHNICAL
ASSESSMENT AND LOCAL WATER MANAGEMNT STRATEGY –
LANDFORM RESEARCH

Land Capability - Geotechnical
Assessment
and
Water Management Strategy

Lot 422, Swan Point Road
Lower Kalgan

City of Albany



Land Capability - Geotechnical
Assessment
and
Water Management Strategy

Lot 422, Swan Point Road
Lower Kalgan

City of Albany

SUMMARY OF LAND CAPABILITY AND GEOTECHNICS

BACKGROUND

It is proposed to subdivide Lot 422 Swan Point Road, Lower Kalgan to a variety of lot sizes but generally between 0.2 and 1.0 hectares.

The site is some 12 km north east from Albany town centre.

It lies on the gentle eastern slopes of the Kalgan River Estuary, rising from sea level at the western edge on the shoreline of the estuary to a gentle ridge of 27 metres AHD in the south eastern corner.

Scenic values can be obtained from the western portion of the site. On the other hand the site is not readily visible from Nanarup Road because of the alignment of the road, and roadside vegetation and tree belts on the site.

The Lower Kalgan area has experienced changes in land uses in recent years with significant portions of the area being converted to small rural holdings and lots. Nearby the land has been subdivided for this purpose.

Some land use diversification has been locally occurring locally on a small scale to orchards, horticulture, small scale tourist accommodation and hobby rural industries.

The Lower Kalgan area has experienced changes in land uses in recent years with significant portions of the area being converted to small rural holdings and lots. The adjoining land to the south across Nanarup Road, which has significant views, has been subdivided for this purpose. Land along Nanarup Road, that also has been subdivided, is often low in the landscape with little access to views.

The subdivision is proposed to be connected to Scheme water.

CONCLUSIONS

From a land capability and geotechnical perspective the constraints identified relate to sloping soils and waste water disposal, which are no different to those in many other parts of the Albany area.

The subdivision has been designed to be sympathetic to the landform, vegetation and environmental values and provide management of identified constraints.

Soil testing and assessment has determined that waste water disposal can comply with the Government Country Sewerage policy, and provide no impact on the Kalgan River estuary.

The site is highly capable, with some manageable limitations.

It must be remembered that the conditions identified in an assessment of the natural soils do not necessarily translate to a developed situation. For example the soil moisture, potential waterlogging and soil movement are all improved through site drainage and the construction of roads that cut off and redirect surface water flows.

Regolith and Soils

The site is gently sloping land rising from sea level at the Kalgan Estuary in the west to a ridge of 25 metres in central parts of the site.

The area is underlain by granite basement which does not outcrop but occurs as weathered subsoil in the central north.

Soils are predominantly sand over silty sand with silty loam and clay at depth in the subsoils. A discontinuous laterite duricrust occurs at the top of the silty subsoils.

Regolith and Soils and Recommended Management

Regolith and Soils	<ul style="list-style-type: none"> • Soils have high capability for development with subdivision design being used to overcome any limitations. • Winter wet soils in some areas can provide constraints on waste water disposal capability before drainage.
Management	<ul style="list-style-type: none"> • <i>Normal practice of soil and development management on sloping loam soils is recommended.</i> • <i>Winter wet and at risk soils are to be excluded from the development area except for the small area in the north east where compliance can be achieved with minimal modifications.</i> • <i>Compliance with the Government Country Sewerage Policy and the use of soil modifications and drainage to improve the capability of any potentially winter wet soils.</i> • <i>Subdivision design and a Water Management Plan incorporating cutoff drains is recommended to mitigate soils that are less capable under natural conditions.</i>
See	<ul style="list-style-type: none"> • <i>Regolith and Soil Assessment page 2, Soil test Hole Logs in Appendix 1, Figure 1.</i>

Site Foundation – Geotechnical Assessment

The loam soils have high stability, apart from the estuarine soils adjacent to the Kalgan River Estuary, which have been excluded from development.

The subdivision has been designed in consideration of these slopes and to provide the best opportunity for views and development.

Foundation Stability Risks Identified and Recommended Management

Dwellings	<ul style="list-style-type: none"> • Foundation stability is generally classified as high (Site Class S (AS 2870)). • Dwellings on soils which require increased cut and fill and surface silty clay will have a lower site class classification. In these situations Site Class M or above depending on the type of development required. • Dwellings will require appropriate design and footings rather than any special construction techniques. • The soils are similar to many of the better soils in the Albany region.
Roads	<ul style="list-style-type: none"> • The slopes are gentle and the soils of relatively high foundation stability to minimise road construction costs. • The location of the roads has been chosen to avoid the worst soils such as the Estuarine Silts. • The design of the roads can be used to provide cutoff and swale drainage to dry wetter and seepage areas.

Landslip	<ul style="list-style-type: none"> Landslip Risk is rated as Very Low and managed through normal foundation design and construction as described in Section 4.2 above.
Dams	<ul style="list-style-type: none"> No risk.
Earthquake	<ul style="list-style-type: none"> No abnormal risk identified. Similar to other developments in the Great Southern. The at risk soils are excluded from development.
Acid Sulfate	<ul style="list-style-type: none"> No risk identified in the area selected for development. The Estuarine Silts are at High Risk of Acid Sulfate and further testing and potential management will be required for deep excavations in those soils, such as for services.
Management	<ul style="list-style-type: none"> <i>Site specific soil testing is required for each dwelling at the design stage in line with normal practice where an engineering certification is provided with the submissions of the drawings.</i> <i>No special requirements for road and other constructions.</i> <i>Testing and potential management will be required for any deep excavations located within the Estuarine Silts.</i>
See	<ul style="list-style-type: none"> <i>Site Foundation and Geotechnical Assessment page 5, Soil test Hole Logs in Appendix 1 and Figures 1, 2 and 5.</i>

Waste Water Capability and Nutrient Management

The soils on site are sand over yellow silty clay subsoils with a laterite duricrust layer on top of the subsoils. The soils are similar to many other parts of the Albany region.

The soils comply with the Government Country Sewerage Policy which permits waste water disposal from lots as small as 0.2 hectares irrespective of soil type.

The development areas and building envelopes have been selected to avoid at risk areas.

The wetter soils occur in the base of the swale and are excluded from developments.

Geotechnical Assessment for Waste Water Disposal and Recommended Management

Waste Water Disposal	<ul style="list-style-type: none"> The whole site is recommended to have alternative or nutrient adsorbing waste water systems.
Waste Water Loading	<ul style="list-style-type: none"> Alternative (nutrient adsorbing) waste water systems are acceptable and comply with the Government Country Sewerage Policy on lots down to 0.2 hectares. Some minor lower lying areas may require minor earthworks and fill as permitted under the Government Country Sewerage Policy to improve waste water disposal capability. The building envelopes and lot sizes have been used to mitigate or minimise requirements for site modification
Nutrient Export	<ul style="list-style-type: none"> The soils on site are capable of accepting the nutrient loading on lots down to 0.2 hectares without any significant risk to the environment, provided alternative waste water systems are used. The silty clay subsoils and laterite duricrust on site have high phosphate retention capability. All soils have high nitrogen capability because of the sand over silty clay nature and moist climatic conditions which lead to denitrification. As the lot sizes vary from 0.2 to 1.0 hectares they comply with the minimums set by the Government Country Sewerage Policy.

- | | |
|-------------------|--|
| <i>Management</i> | <p><i>Waste water disposal systems should be installed according to the;</i></p> <ul style="list-style-type: none"> • <i>Health (Treatment of Sewage and Disposal of Effluent and Liquid Waste) Regulations 1974 – Health Act 1911,</i> • <i>Health Department of Western Australia, 1992, Standard for the Installation and Operation of Aerobic Treatment Units (ATU'S) Serving Single Households,</i> • <i>Health Department of Western Australia, 1992, Specification for Aerobic Treatment Units (ATU'S) Serving Single Households,</i> • <i>Some soils on the lower slopes will need to be modified to comply with the Government Country Sewerage Policy as permitted by that policy.</i> • <i>Grey water disposal systems are acceptable with the greywater systems installed to the Department of Health Greywater Guidelines.</i> • <i>It is recommended that stock not be permitted on lots smaller than 1 hectare.</i> |
| <i>See</i> | <ul style="list-style-type: none"> • <i>Waste water Capability and Nutrient Assessment page 13, Soil Test Hole Logs in Appendix 1 and Figures 1, 2 and 5.</i> |

Hydrological Assessment and Water Management

The site is gently sloping with no water courses and only on dam. A significant proportion of the central area is covered by remnant vegetation which will be retained.

The soils on site are sand over yellow silty clay subsoils with a laterite duricrust layer on top of the subsoils. The soils are similar to many other parts of the Albany region.

On the soils with sandy upper horizons precipitation are sufficiently permeable to minimise the risk of any surface water runoff and are capable of accepting on site storm water disposal. There should be no need for offsite disposal of storm water, or even detention basins if swale drains are used for roads. Two potential areas for detention basins are however nominated on the Subdivision Guide Plan.

Surface Water and Recommended Management

- | | |
|-------------------|---|
| Surface water | <ul style="list-style-type: none"> • There are no limitations from surface water. |
| Groundwater | <ul style="list-style-type: none"> • There are no limitations or risk to groundwater from a subdivision of 0.2 – 1.0 hectare lots. |
| Individual lots | <ul style="list-style-type: none"> • The soils on site are sand over silty clays that are capable from • initial calculations reveal that the soils will be able to accept and retain on site the ARI 1 hour 1 year rainfall and heavier events. • Provided contingencies are used in water management, there are no limitations to development, or any limitations identified can be controlled by good water management. |
| Water Management | <ul style="list-style-type: none"> • There are no limitations imposed by the site on water management that would result from subdivision or development. • Water management actions are able to be incorporated into any development at the subdivision or design stage. |
| <i>Management</i> | <ul style="list-style-type: none"> • <i>Surface water will be treated as part of the normal design of any subdivision or development.</i> • <i>Road and cutoff drains with swale drains are recommended.</i> • <i>The installation of rainwater tanks with a minimum of 5000 litres could be considered subdivision even though the subdivision</i> |

will connected to scheme water.

- *Greywater reuse is encouraged to minimise scheme water use.*
- *Detention basins and sumps for the acceptance of excess surface water are provided for a design contingency but are unlikely to be required if road swale drains are used..*
- *Swale drains and table drains are recommended for road drainage to encourage infiltration and cutoff functions. See DOW (Water and Rivers Commission), 1998, 3.17 (BMP14).*
- *Soakwells should be installed on a sand bed and surrounded by with geofabric.*
- *Easements are recommended for any stormwater, servicing or pipes across lots and private land.*

See

- *Hydrological Assessment page 24 and Local Water Management Plan page 27, Figures 1, 2 and 5.*

Biodiversity and Management

The site is predominantly cleared, apart from several remnant clumps that are mainly dominated by Marri – Jarrah Woodland. The major areas of remnant vegetation are in variable but generally Good condition and are proposed to be retained in Public Conservation Reserves.

No Declared Rare, Priority Species or Significant flora were recorded. No Taxa or plant communities that occur on site are listed under Commonwealth Legislation.

As part of the subdivision the building envelopes are generally located outside remnant vegetation or better and more sensitive vegetation.

Analysis of Biodiversity and Recommended Management

- | | |
|--------------------|--|
| Remnant Vegetation | <ul style="list-style-type: none"> • There are minimal biodiversity limitations for almost all the site now that the vegetation has generally been excluded from development. • The remnant vegetation has a high species diversity and remains in a Good Condition. • The key to flora and fauna protection is the retention of habitat. |
| Management | <ul style="list-style-type: none"> • <i>In order to preserve habitat, the recommendations listed for habitat protection in 8.0 Biodiversity Assessment and Management are suggested.</i> • <i>The subdivision Guide Plan has been designed to minimise impact on remnant vegetation.</i> |
| See | <ul style="list-style-type: none"> • Biodiversity and Management page 44. |

Capability for Changed Landuse

Currently the site is used for grazing.

The site is considered in this report as being suitable for urban lots because of its proximity to the Kalgan River and established facilities such as schooling.

It also provides for an alternative direction for urban development as Albany grows.

Change of Landuse

Potential Impact	<ul style="list-style-type: none"> The surrounding lots are already rural living and this subdivision will match those landuses.
Potential Visual Impact	<ul style="list-style-type: none"> The amount of visual impact from Nanarup Road is limited and can be controlled and will occur as new landholders plant gardens. This will visually protect the site from adjoining lots. This will occur naturally as it does on many other similar subdivisions. Large lots of 0.2 to 1.0 hectares are proposed.
Agricultural Significance	<ul style="list-style-type: none"> The site has agricultural potential, but is just starting to be impinged on by urban and other development. There are significant areas of the local land that under utilised and are used for rural living. Therefore the rezoning of this site will not compromise the agricultural potential of the Lower Kalgan area.
Buffers	<ul style="list-style-type: none"> No particular buffers are required to adjoining land uses. Lot sizes are large enough to provide buffers and match lots in nearby areas.
Fire Management	<ul style="list-style-type: none"> The fire risks are likely to be similar to other hilly sites in the Great Southern and of lower risk than some locations, such as in Denmark. There are standard conditions on the number of fire hydrants and access points for urban developments.
Social and Heritage	<ul style="list-style-type: none"> The old homestead site and access road can be protected and is proposed to be incorporated into public open space.
Recommendations	<ul style="list-style-type: none"> <i>Restrictions could be placed on the use of visually non compatible materials.</i> <i>The colour and style of dwellings and other structures should be visually compatible with the area and to this end developments should be coloured, painted or colour bond sheeting used where applicable.</i> <i>Compliance with Bush Fires Control Act 1954 (as amended) and the City of Albany bylaws.</i> <i>A Fire Management Plan is recommended.</i>
See	<ul style="list-style-type: none"> <i>Capability for Changed Landuse, page 41.</i>

CONTENTS

SUMMARY OF LAND CAPABILITY - GEOTECHNIQUES

1.0	INTRODUCTION	1
2.0	WEATHER CONDITIONS	2
3.0	REGOLITH AND SOIL ASSESSMENT	2
3.1	Geology and Geomorphology	2
3.2	Regolith and Soils	3
4.0	SITE FOUNDATION GEOTECHNICAL ASSESSMENT	5
4.1	Foundation Stability	5
4.2	Landslip Risk	10
4.3	Stability of Dams	10
4.4	Earthquake Risk	11
4.5	Acid Sulfate Risk	11
5.0	WASTE WATER CAPABILITY and NUTRIENT ASSESSMENT	13
5.1	Geotechnical Capability for Waste water Disposal	13
5.2	Nutrient Management	26
6.0	HYDROLOGICAL ASSESSMENT	24
6.1	Surface Water	24
6.2	Groundwater	26
7.0	LOCAL WATER MANAGEMENT PLAN	27
7.1	Background to Water Management	27
7.2	Subdivision or Development Water Input	28
7.3	Water Loading from Hard Surfaces	29
7.4	Design Criteria – Volumes	31
7.5	Treatment of Stormwater on Each Lot	31
7.6	Excess Stormwater and Road Water Treatment	32
7.7	Stormwater Design	32
7.8	Local Water management Plan – Summary	33
8.0	BIODIVERSITY ASSESSMENT and MANAGEMENT	35
8.1	Flora and Fauna	35
9.0	CAPABILITY for CHANGED LANDUSE	41
9.1	Alternative Landuse and Land Capability	41
9.2	Aesthetics	41
9.3	Preservation of Agricultural Land	42
9.4	Land Use Buffers	43
9.5	Fire Control	43
	REFERENCES	51
	TABLES	
Table 1	Observed Soil Properties	3

APPENDICIES

Soil Test Hole Logs
Preliminary Acid Sulfate Assessment

FIGURES

Figure 1	Soil Types
Figure 2	Land Capability
Figure 3	Vegetation Communities
Figure 4	Vegetation Condition
Figures 5A - 5B	Site Photographs
Figure 6	Subdivision Guide Plan

1.0 INTRODUCTION

Site Assessment - Methodology

Landform Research carried out site studies on Lots 422 on 29 July 2009 with a follow up site inspection on 4 October 2009.

On 29 July 2009 a total of 15 soil test holes were excavated using a backhoe, the vegetation was mapped and the soils and geotechnical capability mapped and assessed.

During the follow up site inspection on 4 October 2009 the vegetation was rechecked for additional taxa that may be recorded in Spring. In addition, the groundwater in various parts of the site was checked at the time of highest water table, at a further 19 locations using a hand soil auger.

Landform Research was commissioned to map the soils and hydrology and to provide geotechnical and land systems assessment, to determine the suitability of site to support subdivision to lots down to as small as 2 000 m².

During the studies the soils were surface mapped and examined, the geology, hydrology, soil permeability and geotechnical and land capability issues recorded.

The soil test holes and investigations concentrated on the areas suitable for development. The location of the test holes is shown on the attached aerial photograph, Figure 1.

In addition to field observations, interpretations were made from aerial photography.

A study of the geology can provide valuable background material on the nature of the site and the way that various land uses may impact on the developments. This was completed during the field work.

Site Description

The site is some 12 km north east from Albany town centre.

It lies on the gentle eastern slopes of the Kalgan River Estuary, rising from sea level at the western edge on the shoreline of the estuary to a gentle ridge of 27 metres AHD in the south eastern corner.

Scenic values can be obtained from the western portion of the site. On the other hand the site is not readily visible from Nanarup Road because of the alignment of the road, and roadside vegetation and tree belts on the site.

The Lower Kalgan area has experienced changes in land uses in recent years with significant portions of the area being converted to small rural holdings and lots. Nearby the land has been subdivided for this purpose.

Some land use diversification has been locally occurring locally on a small scale to orchards, horticulture, small scale tourist accommodation and hobby rural industries.

2.0 WEATHER CONDITIONS

Weather data is recorded at Albany, but the local climate may be slightly different due to the orographic effects of the slopes of Mount Boyle.

The overall climate however is warm, dry summers with cool, wet winters.

Rainfall at Albany is just over 800 mm per year and a similar figure for this site is estimated.

Temperatures have summer maxima of 25°C in the hottest months down to just over 15°C in the coldest months, July and August. Minimum temperatures range down to 10 °C in the coldest months. The cool winter temperatures can assist potential fruit crops that require a chill factor. Frosts are not common.

Annual evaporation is less than 1000 mm per year, with rainfall exceeding evaporation for almost nine months of the year.

Weather Conditions

The study was conducted in July and October 2009 when the soils were wet from winter rains. The level of soil moisture on 4 October was at winter maximum because of the nature of the rainfall pattern and evapotranspiration in Albany.

3.0 REGOLITH AND SOIL ASSESSMENT

3.1 Geology and Geomorphology

The site lies on a gentle ridge, rising to 27 metres AHD on the eastern side of the Kalgan Estuary.

Whilst there is no granite on site the study area straddles remnant granite basement with the basement outcropping in the Kalgan River just to the north west of the site and a minor high of granite saprolite below the surface in the central north.

The granite and gneiss are of Proterozoic age, with included occasional dolerite dykes that have been deeply weathered to form a laterite soil profile. The laterite profile extends across the top of the low ridge hill along the central south, extending to the north of the site.

Sheeted around the base of the site, and overlying the laterite profile, are fine overlying sands and silty sands. These represent the edges of the horizontally bedded Plantagenet Group of Tertiary age that occupies the lower elevations below approximately 15 – 20 metres AHD. Over time these beds have been eroded leaving a sheet of fine sand overlying more clayey sediments or loam clays developed on the granitic rocks on the lower slopes, with the remnants of the laterite plateau capping the central ridge.

The laterite itself also has a variable sheet of sand covering it, from remnant sand of the Plantagenet Beds, redistributed during sea level decreases, aeolian and colluvial activity.

A minor western edge of estuarine derived soils occurs along the west of the site below the 3 metre AHD contour.

3.2 Regolith and Soils

A wide range of soils exist across the site. These are described in the key on Figure 1.

The soils reflect the various geological history and the rock types remaining and the nature of the underlying materials.

Estuarine Silts form the western edge of the site below 3 metres AHD. They consist of fine silt and sand of estuarine and alluvial origin with lateral and vertical changes between silts and clay. They lie outside the proposed development area.

Deep Leached Sand is white silica sand with a thin grey upper horizon and topsoil. Depth of the sand is generally in excess of 2 metres. This occurs in the north eastern corner where it forms a winter wet shallow valley floor.

Sand over Silt consists of white sand over yellow clayey silt at depths of 500 – 1000 mm. Occurs on the lower slopes. The winter water table is normally in the range 500 – 1500 mm depth. The subsoil silts are part of the Plantagenet Group.

Sand over Granite Saprolite. This soil unit occurs in one small area in the central north and indicates that the granite basement lies close to the surface in this location, perhaps at a depth of some 3 plus metres.

Sand over Laterite and Silt. These soils consist of dark grey silica sand overlying yellow brown laterite duricrust and gravel at about 500 mm. The duricrust is normally 200 – 500 mm thick and in turn overlies the yellow silty clay subsoils which are part of the Plantagenet Group.

Laterite Duricrust over Silt. These soils have laterite duricrust on the surface. They are the same as the Sand over Laterite and Silt but do not have the overlying sand or only a very thin covering of sand.

The soils types are summarised in the key on the soil map. Figure 1.

Descriptions of the soil test holes are shown in Appendix 1.

The soil test holes were designed to determine the soil profile to provide information on what type of waste water system would be required and the foundation and geotechnical conditions. They were excavated in locations to provide the maximum information and in areas that by visual examination, appeared to be near the limit of reduced capability.

Table 1 Observed Soil Properties

PROPERTY	DESCRIPTION	SOIL SUSCEPTIBILITY	SOILS POTENTIALLY REQUIRING MANAGEMENT
WATER REPELLENCE	Water repellence is the uneven or non wetting characteristic of a soil. This commonly occurs in dry situations and more commonly affects soils that contain less clay such as sands. It may lead to greater surface runoff in summer, resulting in lower soil moisture and reduced crop growth in winter.	Water repellence is unlikely to occur in any soils because of the rainfall through the year. However it is possible in summer when the surface sands dry out.	No issues for development

REPORT ITEM PD132 REFERS

Land Capability - Geotechnical Assessment and Water Management Strategy
Lot 422 Swan Point Road, Lower Kalgan

SOIL COMPACTION	Soil compaction results from tractor and machinery movements compacting soils and reducing aggregates. It leads to reduced root penetration and reduced water infiltration. Compaction hard pans commonly form. Loamy sands are the most susceptible.	The soils on site have low potential for traffic compaction. The Sand over Silt soils are the most at risk although this is minor and has no impact on development.	No issues for development
DISPERSIBLE SOILS	Soils containing sodium in the clay content can disperse when wet, leading to soil erosion and subsoil tunnel formation.	No evidence of soil dispersion was observed. The soils are not saline and there is no evidence of salinity as shown by the quality of the water in the dams. All water is potable.	No issues for development.
WIND EROSION	Wind erosion can impact on sands and loose soil when inadequate soil cover is retained. Duplex and sandy soils are at high risk. The worst times are prior to the winter rains.	The soils are moist for most of the year in Albany with high levels of pasture growth in Albany. Minimal to no risk	No issues for development
WATER EROSION	Water erosion can occur in susceptible soils which have inadequate soil cover, steeper slopes, higher sand content and dispersibility.	Slopes are gentle. And the soil porous. There is minimal risk.	No issues for development
ROOTING DEPTH	The depth roots can penetrate depends on texture changes in the soil such as duplex soils, the proximity of bedrock, stone in the soil, hard clay layers and soil compaction.	The soils are relatively unrestricted apart from the areas of laterite on the surface or under the sand sheet. This restricting layer will provide some impediment to root growth of some species.	Duricrust is present but is not limiting.
SALINITY	Salinity is the proportion of salt in a soil. Often mildly saline soil moisture is concentrated on the surface through evaporation, leading to an inability to support crops and plant growth. Normally worse where ancient soils and laterite profiles are present.	There is no evidence of salinity with the site being elevated. Surface water moves downslope perched on the subsoils and is flushed in winter.	No issues for development
SOIL ACIDITY	Soil acidity depends on a number of factors such as the amount of calcareous material within the soil, the crops grown, fertiliser usage and the proportion of clay. Soils that are too acidic can allow elements such as metals, including aluminium, to dissolve and become toxic.	The soils are neutral to acidic. There is no evidence of acid sulfate conditions on the development area. The estuarine soils are considered at risk, however these will be excluded from development.	No issues for development

SOIL MOISTURE STORAGE	The ability of a soil to retain water determines the potential for crop growth and the amount of rainfall and irrigation required.	The soils have generally high soil moisture retention due to the moisture and rainfall pattern in Albany.	No issues for development
WATER LOGGING	Water can lay on the surface, clogging the pores in the soil. This reduces soil oxygen leading to loss of nitrogen and reduced crop growth	Winter wet soils are present in the north eastern corner and on the west of the site off the ridge. Some management may be required as permitted under the Government Country Sewerage Policy.	Potentially waterlogged soils are generally excluded from development.
SOIL WORKABILITY	Workability is the ease that the soil can be cultivated. Waterlogging, the presence of stone and slope can all impact on the ease of cultivation.	The soils generally are workable apart from the laterite duricrust areas in the centre of the site.	Managed though the subdivision layout, and lot sizes.

Regolith and Soils and Recommended Management	
Regolith and Soils	<ul style="list-style-type: none"> • Soils have high capability for development with subdivision design being used to overcome any limitations. • Winter wet soils in some areas can provide constraints on waste water disposal capability before drainage.
Recommendations	<ul style="list-style-type: none"> • Normal practice of soil and development management on sloping loam soils is recommended. • Winter wet and at risk soils are to be excluded from the development area except for the small area in the north east where compliance can be achieved with minimal modifications. • Compliance with the Government Country Sewerage Policy and the use of soil modifications and drainage to improve the capability of any potentially winter wet soils. • Subdivision design and a Water Management Plan incorporating cutoff drains is recommended to mitigate soils that are less capable under natural conditions.

4.0 SITE FOUNDATION GEOTECHNICAL ASSESSMENT

The Geotechnical Assessment was conducted by Lindsay Stephens to identify issues listed under *Statement of Planning Policy 3.4, Natural Hazards*. The work was conducted to various standards that are listed throughout the report, but particularly to AS 1726 *Geotechnical Site Investigations*, AS 2870 *Residential Slabs and Footings – Construction* and AS 3798, *Guidelines on Earthworks for Commercial and Residential Developments* in addition to Guidelines produced by the *Australian Geomechanics Society*.

A summary of the geotechnical issues is included in the table below.

4.1 Foundation Stability

Foundation Stability relates to the suitability of the soils to accept dwellings or other structures. The assessment of Foundation Stability is conducted using the geotechnical methods outlined in AS 1726, and to the standards outlined in AS 2870, for single storey dwellings.

Foundation stability is related to the ability of a soil to compact and remain stable. Silica sands are best for this. Sloping clay soils, soils loaded with water, or expanding clay, will all lower the stability.

AS 2870 considers foundation stability to a depth of three metres and a 50 year consideration period. The foundation stability rating can be improved by the use of compacted sand fill, pile foundations and heavier footings.

Field assessment is an important part of this assessment to determine what soils factors may impact on soil stability. The type and composition of the soils, the underlying geology, the presence of expansive clays or compressible materials, slope stability, summer and winter soil moisture and vegetation can all influence soil conditions. The interpretation provides background on what soil modifications are appropriate and what changes or improvements might result. Normally on Site Class M soils, a compacted sand pad of 900 – 1200 mm thickness is used to improve the Site Class to Class S.

A number of drainage steps and good construction techniques are normally also used to improve foundation stability

Summary of Soil Conditions

The site is gently sloping, rising from sea level at the Kalgan Estuary to 27 metres in the south eastern corner.

The area is underlain by granite basement at depth although this does not outcrop on site but does outcrop in the Kalgan River to the west.

Soils are predominantly sand over silts and clay silts with or without an intervening laterite duricrust layer.

See 3.2 Regolith and Soils, attached Soil Logs and the attached Figures for detailed descriptions of the soils

Ease of Excavation

The presence of basement rock, shallow groundwater, steep slopes or hard clay can all restrict excavation and increase costs of developments.

All soils are easily excavated for developments.

The main constraining feature is the presence of intermittent duricrust in the central south and north. The duricrust is at variable depth but generally at 0 – 500 mm where present.

Compaction Ability

Some soils such as quartz sands are easier to compact when using cut and fill. Others such as calcareous sands and hard clays can be more difficult to compact under certain conditions such as when dry or non wetting. Under such situations wetting agents, water and efficient compaction in lifts can be used to ensure compaction for developments.

The subsoils have higher clay and loam content, but, being in Albany, are moist throughout the year making compaction capability relatively easy on all soils types year round. Soils are unlikely to be non wetting because of the regular rainfall and weather.

The soils in the upper horizons are sandy and readily compacted. If used the silty subsoils can also be compacted with care even in summer.

Expansive Soils

Some clays such as smectites can be expansive and can swell when wet and shrink when dry. This occurs more commonly in poorly drained, seasonally wet and saline conditions in Western Australia. However in the Eastern States expansive clays are relatively common and occupy 30% of the soils in Australia. To maintain stable foundations under expansive clay conditions the footings may need to be heavier or sand pads thicker in addition to maintaining stable soil moisture.

Salinity levels are low across the site and therefore do not impact on soil stability. There are no clay soils with smectites that are expanding.

Some of the subsoil silty clay soils will be expanding by a relatively small amount but these will not normally be used for construction. Rather dwellings will be constructed using the overlying sand and adding a small amount of fill to provide a sand pad of 900 mm or similar amount to provide adequate foundation stability and capillary action protection.

The estuarine silts are most at risk but these are to be excluded from development.

All other soils of sand over silt and sand over laterite and silt have overlying highly suitable foundation materials.

With such gentle slopes cutoff drains are not likely to be required, with swale drains along roads providing lateral drainage protection.

Karst

Karst is cavity and cave development in limestone, or dolomite that occurs under conditions where groundwater has or had strong flows in the past or where groundwater had contact with acidic organic enhanced conditions such as at the edge of wetlands or where limestone overlies impervious basement such as clay or granite. In such situations the limestone may have cavities developed in it which can reduce foundation stability.

No limestone is present and therefore no karst occurs.

Capillary Action

Capillary action in a soil is the drawing up of water from subsoils or wet areas. Normal design of footings, the thickness of sand pads and the use of impermeable membranes are all used to negate any risk.

As good practise the use of cutoff drains and sand pads on potentially wet areas on slopes is recommended.

The main areas with moist winter soils, and therefore susceptible to capillary action under natural conditions, are the north eastern corner where the building envelopes are located outside the winter wet area that remains vegetated.

The upper soil horizons are sandy and free draining. These materials are also suitable for foundation. They will be filled slightly to provide in the order of 900 mm of sand for foundation stability. In such sand the capillary action is normally in the order of 600 mm. In addition all dwellings constructed on concrete slab are installed with an impermeable membrane designed to mitigate capillary action.

It is normal good practise to have the sand fill a minimum of 600 mm above the natural soil grading back around the perimeters to that natural soil.

The road swale drainage will provide cut-off for water flowing down the gentle slopes.

Developments

The types of developments are likely to be dwellings.

The soils on site are no different than many soils of the Albany and Local area. They are much more capable than many soils in other areas, particularly those that are clay based.

Foundation stability is generally rated as Site Class S (AS 2870). Depending on the nature of the proposed development, the design and earthworks, a lower or higher Site Class may apply, particularly on wetter soils or where the surface sand is removed or absent from the silty clay subsoils. In such cases the Site Class will be Site Class M.

On the estuarine soils the Site Class is H or higher which is one of the reasons that these soils are excluded from development.

It must be borne in mind that the Site Class Rating is for natural soil conditions with a normal minimal amount of sand fill. With development and the preparation of sand pads, addition of fill and the removal of unsuitable materials the "Developed" Site Class will be reduced.

For example a natural Site Class of M can be developed either using footings meeting specifications for Site Class M or the use of sand fill and removal of deleterious materials to lower the Site Class to S or even A. The cost of the heavier footings can be partially offset by the reduced site preparation and volume of sand fill required.

It must also be noted that the rating of soils does not mean that development cannot readily be undertaken, but rather that increased site works and costs may be involved with a lower Site Class Rating.

All of these combinations of Site Class and the design and construction of dwellings are best addressed at the time of design and development of dwellings, when the type of dwelling and exact location on the lot is known. At such time engineering input that will be required to the design of the footings will address the issue of foundation stability and construction.

- Site Class H or P may apply. For example constructions requiring significant fill, steeper slopes or waterlogged areas may be classified as Site Class P to ensure adequate compaction to prevent differential settling and drainage.
- Site specific soil testing is required for each dwelling at the design stage in line with normal practice where an engineering certification is provided with the submissions of the drawings.

A number of good practices can be used to mitigate development on sloping sites. These are of minor importance on a site such as this and might only occur at the time of dwelling construction on the more sloping soils in the central west summarised below.

Management Actions that may be used to improve foundation stability could include, but not be limited, to the following. See Australian Geomechanics Journal March 2000 (*Landslide Risk Management*) and Appendix 2. The following are engineering practices for sloping soils that have been used, for example, for the construction of dwellings within the local area.

Some of these may be desirable. In addition there may be other actions that can be used to decrease the potential risk of foundation movement or failure.

Desirable

- Provide upslope cut off drains and road drainage to reduce surface water flows and drain land downslope.
- Do not load soils with water up slope of developments.
- In some situations sub-surface drainage or cut off drains may be required, particularly upslope of waste water disposal areas.
- Minimise upslope water loading of soils.
- Minimise the depth of cut and fill.
- Provide retaining walls for developments using significant cut and fill and ensure the base of the walls are set on well designed footings suitable for the nature of the wall.
- Ensure natural soil fill is adequately compacted.
- Individual site assessment for each dwelling will be required depending on the nature of the design, footings, proposed foundations and localised variations within each lot.
- Avoid the use of earthy or clayey sands for fill and sand pads unless correctly placed, compacted and tested.
- Avoid the potential for uneven settlement of fill when portion of a solid structure such as brick is perched with one corner on an immovable object such as basement and the remainder is located on fill, particularly fill that has the potential to settle such as some earthy sands, calcareous sands, saline sands and soils.
- Retain trees and plant further trees.
- Design for lateral creep pressures on slopes.
- Use rows of piers or strip footings orientated up slope on sloping ground.
- Design drains to minimise erosion.

May be Required

- Consider the use of flexible or split level structures
- Use lightweight construction such as timber or steel frame and raised wooden flooring.

Dams

There are no dams on the development area. A fresh water seepage dam lies within the remnant vegetation in the central south.

Road Construction

Road construction conditions are high with gentle slopes, where road construction costs are minimized.

Good road drainage is also normal practice on construction in similar soils as these. The location and design of the roads can be used to provide cutoff and swale drainage to dry wetter and seepage areas.

Foundation Stability Risks Identified and Recommended Management	
Dwellings	<ul style="list-style-type: none"> • Foundation stability is generally classified as high (Site Class S (AS 2870). • Dwellings on soils which require increased cut and fill and surface silty clay will have a lower site class classification. In these situations Site Class M or above depending on the type of development required. • Dwellings will require appropriate design and footings rather

	<ul style="list-style-type: none"> than any special construction techniques. The soils are similar to many of the better soils in the Albany region.
Roads	<ul style="list-style-type: none"> The slopes are gentle and the soils of relatively high foundation stability to minimise road construction costs. The location of the roads has been chosen to avoid the worst soils such as the Estuarine Silts. The design of the roads can be used to provide cutoff and swale drainage to dry wetter and seepage areas.
Recommendations	<ul style="list-style-type: none"> Site specific soil testing is required for each dwelling at the design stage in line with normal practice where an engineering certification is provided with the submissions of the drawings.

4.2 Landslip Risk

Landslip Risk is assessed using the methods developed by the Australian Geomechanics Society (Journal Australian Geomechanics, Volume 35, No 1, March 2000). The risk of Landslip or ground movement depends on the geology, soil types, hydrology, landforms and vegetation.

Steep soils that are loaded with water and have the slopes changed or vegetation removed are all at greater risk of soil creep and Landslip.

Slopes on the development area are gentle sand over silt and laterite with minimal to no landslip risk.

The only risk of movement will normally be from inappropriately constructed or compacted fill on slopes cut into the natural soils.

Landslip Risk Identified and Recommended Management	
Landslip	<ul style="list-style-type: none"> Landslip Risk is rated as Very Low and managed through normal foundation design and construction as described in Section 4.2 above.
Recommendations	<ul style="list-style-type: none"> Normal construction practise matched to the soils.

4.3 Stability of Dams

Stability of Dams depends on their location with respect to the underlying geology, the hydrology and the soil types. The proportion of clay, whether the clay is dispersible, slopes and gradients, the water table, rainfall pattern, design and construction of the dam and spillway, and geology, can all impact on the potential stability of a dam.

The salinity of the dam can also impact on the structure of the clays making the clay more dispersible and therefore more susceptible to tunnel and other failure.

There are no dams on site

Risk Identified with Dams and Recommended Management	
Dams	<ul style="list-style-type: none"> No risk.
Recommendations	<ul style="list-style-type: none"> Nil

4.4 Earthquake Risk

Earthquake Risk is dependant on the proximity to the active earthquake areas, mainly in the Wheatbelt, the soil types and the types of construction. Wet unconsolidated sediments carry the highest risk.

The risk has been defined by Geoscience Australia and is based on AS 1170.3:1993.

The soils are well drained, located on a gentle ridge with no greater risk than any other development in the Great Southern.

The soils provide good foundations when correctly developed with the greatest risk being experienced on wet soils that are poorly compacted, and on significant unrestrained fill that is not constrained, if constructed lower in the landscape.

The most at risk soils are the Estuarine Silts that could liquefy under shaking stress. These are excluded from development.

Risk is mitigated by the design and construction of foundations combined with normal practices of using cutoff drains and sand fill and heavier footings in potentially wet areas, and is covered under Foundation Stability.

Earthquake Risk Identified and Recommended Management	
Earthquake	<ul style="list-style-type: none"> No abnormal risk identified. Similar to other developments in the Great Southern. The at risk soils are excluded from development.
Recommendations	<ul style="list-style-type: none"> Use normal testing, design and construction for soils.

4.5 Acid Sulfate Risk

Acid Sulfate Soils can potentially form under reducing conditions when there is a source of carbon and a source of sulfur (normally from sea or saline water). Micro-organisms are thought to play an important role in reducing the sulfates within the sediments to form the iron sulfide. It is a natural phenomena, that can be exacerbated by disturbance.

Potential acid sulfate conditions most commonly form under current or past estuarine conditions, peaty conditions, and may also result from weathering of some geological formations and situations which contain sulfides.

Overall, at risk areas are geologically a minor occurrence, but in some situations can be important, and lead to acidic polluting conditions developing.

Acid conditions can form if soils containing pyrite are exposed to the air, allowing sulfuric acid to be formed. The soils most at risk are normally saline/estuarine soils, gley soils, peat and some organoferricretes.

Planning Bulletin Number 64, Department of Environment Guidelines, the Acid Sulfate Soil Management Advisory Committee NSW, 1998, Acid Sulfate Manual provides the most information on recognition and mitigation of potential acid sulfate conditions.

Potential acid sulfate soils are tested under conditions which speed up the natural oxidation of the soils on exposure to the atmosphere. Natural oxidation can occur within hours and days of exposure and is normally complete for small samples within a month. Laboratory testing speeds up this process with the use of H₂O₂ or other oxidising agent and then tries to quantify the amount of oxidation and acid development. One of the best methods of preliminary assessment is to collect samples and leave them exposed to the atmosphere for one month. The pH of the sample is to be tested immediately on exposure and at the end of one month for changes to pH.

WAPC mapping does not extend this far but the elevation and nature of the soils above the 5 metre contour indicates No Risk. Between the 2 – 5 metre contour the risk is assessed as Low Risk with no issues unless deep excavation extended to below the 2 – 3 metre AHD elevation.

The only potentially affected dwellings are those in the extreme north west of the subdivision. These lots will require fill and not excavation for construction, thereby mitigating the risk of acid sulphate impacts.

All other parts of the site are well drained or the subdivision has been designed to avoid winter wet soils.

The Estuarine Silts have a High Risk of Acid Sulfate conditions. These are excluded from the development areas.

Thirty four soil test holes were excavated across the development area and examined by Lindsay Stephens. See the attached soil test hole logs and Preliminary Acid Sulfate Assessment Sheet. Appendix 1.

The pH was measured in a number of sites and was 5.5 – 6.0 with minor surface grey sands of pH 4.5.

There are some winter wet areas. No soil profile examined in the soil test holes was indicative the constant reducing conditions and did not contain organic matter, both of which are required for the development of acid sulfate conditions.

Salinity levels are low and winter rainfall and soil water movement high, all of which contribute to flushing and oxygenation which negates the potential for acid sulfate conditions to develop.

Acid Sulfate Risk Identified and Recommended Management	
Acid Sulfate	<ul style="list-style-type: none"> No risk identified in the area selected for development. The Estuarine Silts are at High Risk of Acid Sulfate and further testing and potential management will be required for deep excavations in those soils, such as for services.
Recommendations	<ul style="list-style-type: none"> Nil to Low for development area. Testing and potential management will be required for any deep excavations located within the Estuarine Silts.

5.0 WASTE WATER – CAPABILITY AND NUTRIENT ASSESSMENT

5.1 Geotechnical Capability for Waste Water Disposal

The Capability of a Site for Waste Water Disposal depends on a number of geotechnical factors. These include the soil type, depth and permeability of the soil, depth to impermeable layer, depth of perched or other watertables and potential for flooding or waterlogging. Assessment should be made from field investigations because the whole soil profile and local geology can determine the likely path of the waste water.

Interpreted information of water tables from soil profile and geomorphological examination is an important part of the assessment process because conditions vary from year to year and tests conducted in some well below average years may not reflect potential impacts in excessively wet years. The assessment should also take into consideration the potential for soils conditions to be changed through water loading and earthworks as a result of developments.

The mineralogy of the soil profiles can be determined by visual and field examination, with the species and form of iron oxide being particularly useful at providing data on soil moisture conditions through the seasons. Natural site vegetation species are also useful as indicators of historical seasonal soil moisture conditions.

The Government Sewerage Policy, 1996, Government Draft Country Sewerage Policy, 2002, Department of Health Guidelines for the Reuse of Greywater in Western Australia, Department of Health Specification for Aerobic Treatment Units 1992, Health (Treatment of Sewerage and Disposal of Effluent and Liquid Waste) Regulations 1974, AS/NZS1547:2000, all provide input into the acceptable site characteristics. The Health Act Regulations require 1 200 mm of free draining soil beneath waste water disposal areas.

The types of waste water systems all have different installation requirements and potential impacts, and can be selected to alleviate adverse site conditions. Whether a conventional septic system or nutrient or composting waste water system is used will depend on the site conditions.

Soil Type

The soils on site are sandy soils and sand over silty clay with a layer of laterite at the top of the silty clay in central parts.

The soils are similar to many of the other parts of Albany and the local area.

The Government Sewerage Policy, permits waste water disposal from lots as small as 0.2 hectares in leached white sand with little phosphate retention capability. All lots are in excess of 2000 m².

See 3.2 Regolith and Soils and the attached maps and photographs for details of soils.

Waterlogging

Most of the site is well drained with no waterlogging. However in the north east there are some areas where the winter temporary water table approaches 500 mm and in places slightly less.

These are locations where temporary perched winter water tables appear within the upper sandy soil horizons and perched on less permeable silty clay subsoils. The water

infiltrates the soils from precipitation and then runs laterally downslope along the interface of the silty clay subsoils

The subsoils are permeable but more slowly permeable and when winter rainfall exceeds the rate of permeability water will temporarily perch on the underlying silty clay subsoils.

The soil test holes were located in places where the soils are capable of meeting the 500 mm depth to water table. In some wetter areas in the north east the soil test hole site was selected to provide the greatest clearance to the temporary perched winter water table. There were two to three holes where the water table was between 400 and 500 mm depth. Other nearby locations had separations in excess of 500 mm.

The testing showed that there are locations on each lot where the waste water disposal can meet the 500 mm separation criteria.

In addition there will some minor fill required for house construction and, with the road swale drainage all lots when developed will be capable of accepting waste water disposal from alternative or nutrient adsorbing waste water systems in compliance with the Government Sewerage Policy.

The City of Albany has guidelines for placing waste water systems. See Infiltration results.

Surface modifications also permitted under the Government Sewerage Policy include fill.

Water Table

The study was conducted on 29 July and 4 October 2009.

Being located in the Great Southern, with reduced spring evapotranspiration, the elevation of the water tables at the time of the site inspection is regarded as representing the winter maximum.

A total of 33 soil test holes were sunk by backhoe and hand auger.

In general the test holes were located at what was interpreted to be the limits of groundwater depth rather than scattered across the whole site. Areas where the water table obviously touched the surface were not tested as discussed under waterlogging above.

As discussed above under waterlogging there is an area located on each lot that will be capable of complying with Government Country Sewerage Policy for waste water disposal from alternative systems.

The regional water table is deeper and related to the base of the valleys and swales. The only place where the regional water might be intersected is in the extreme north eastern corner and the Estuarine soils along the western edge. Both are to be excluded from the waste water disposal areas.

Setbacks from Water bodies

The Government Sewerage Policy provides guidelines on the setbacks required from water bodies, with which this proposal complies for alternative waste water systems. This is 50 metres for alternative or nutrient adsorbing waste water systems, for creeks.

However the *Health (Treatment of Sewage and Disposal of Effluent and Liquid Waste) Regulations 1974*, provides for a 30 metre buffer under all situations and this will prevail.

The only area where this is a potential issue is on proposed Lot 1 in the north east where waste water disposal is recommended to be disposed of upslope away from the wet swale just outside the lot, and Lot 12 where waste water disposal is recommended to be disposed of on the upslope edge of the lot.

All lots including 1 and 12 can comply with the required separations.

There are no other watercourses, with drainage being swale drainage through pasture with no defined bed. The Health Department Code of practice for ATU's suggests a 10 metre separation to drains, but the Regulations only require 6 metres which would also prevail.

Infiltration results

Infiltration tests were not conducted because the sandy surface soils and laterite obviously comply with the Regulations for permeability.

Nutrient adsorbing waste water systems provide safeguards with the quality of waste water in terms of microbial and nutrient content to ensure that health and environmental impacts are negated or minimised. The required setbacks from boundaries and developments also provide buffering capability which will also reduce the risks of any adverse impacts.

For conventional septic systems, according to *Schedule 8 of the Health Act 1911*, a loading of 20 litres/m²/day is applicable for leach drains in loam soils with alternating leach drains and 10 litres/m²/day for non alternating systems on sites such as this. It is standard practice to use dual leach drains with waste water disposal being able to be directed alternately to each leach drain.

Alternative/nutrient adsorbing (aerobic, Filtrex or Ecomax) effluent disposal systems are also acceptable and require a waste water loading not exceeding 10 litres/m²/day.

Australian Standard 1726 for Geotechnical Investigations permits interpreted assessments. Interpreted assessments are an essential part of site evaluation because it is crucial to know how representative the test hole is and what conditions are indicated by the colour, nature, texture and mode of formation of the soil profile. These observations suggest acceptable infiltration ability.

The City of Albany has guidelines for such systems. The semi inverted waste water leach drain system servicing a conventional septic system is required by the City of Albany to have two 2 x 9 to 2 x 13 metre switchable leach drains. Larger leach drains are required where the loading is increased. This same approach can be used for the waste water disposal areas from Alternative waste Water Systems to increase the permeability in silty subsoils.

To increase infiltration the City of Albany requires that a 3 metre wide area around the leach drain or waste water disposal area is deep ripped and then the leach drain covered with calcareous sand. This increases the infiltration area as described by AS 1726. The City of Albany has found that this design provides long term satisfactory performance with minimal maintenance.

In other areas nutrient adsorbing or alternative waste water systems are required or recommended.

Some sloping areas may require site modifications or drainage and fill to achieve compliance, combined with terracing to provide satisfactory waste water disposal in compliance with the Government Country Sewerage Policy and Government Guidelines for the installation of alternative waste water systems and AS 1726. For nutrient

adsorbing waste water systems clay soils can be replaced, amended soils sheeted across the surface and high water use plants used to increase the sustainability of any waste water system.

Alternative/nutrient adsorbing waste water systems, which spread the waste water loading over a larger area and are designed to overcome any localised lower infiltration rates and provide safeguards with the quality of waste water in terms of microbial and nutrient content to ensure that health and environmental impacts are negated or minimised, are acceptable in all areas.

As soil conditions change laterally and vertically across some soil types it is recommended that individual soil testing be used to determine the permeability of the soil on a particular lot and the best means of providing for sustainable waste water disposal.

The use of greywater recovery systems, which treat the black water separately and use the greywater for subsurface irrigation of plants, are effective and water saving.

Geotechnical Assessment for Waste Water Disposal and Recommended Management	
Waste Water Disposal	<ul style="list-style-type: none"> The whole site is capable of waste water disposal from alternative or nutrient adsorbing waste water systems.
Recommendations	<ul style="list-style-type: none"> Waste water disposal systems should be installed according to the; <ul style="list-style-type: none"> Health (Treatment of Sewage and Disposal of Effluent and Liquid Waste) Regulations 1974 – Health Act 1911, Department of Health, 2001, Code of Practice for the Design, Manufacture, and Operation of Aerobic Treatment Units Servicing Single Dwellings Government Sewerage Policy. Grey water disposal systems are acceptable with the greywater systems installed to the Department of Health Greywater Guidelines. Waste water disposal areas should use the City of Albany Guidelines during construction.

5.2 Nutrient Management

A change in land use may alter the Nutrient Input and Management patterns and loadings. Changed agricultural regimes and more intense development may lead to increased nutrient loading. The pattern of this loading and the ability of the soils to accept the loading depend on many factors, such as the type of land use, lot size, type of waste water system, type of crop, nutrient application rates, soils, depth to groundwater, flow paths of surface and groundwater, permeability of the soils and underlying geology.

The various Government policies and regulations are designed to ensure minimisation of the risk of nutrient export so in many cases compliance with these guiding documents is all that is required. The guidelines take into consideration the soil characteristics as well as setbacks from wetlands and water bodies.

The following documents provide input into the acceptable site characteristics and the acceptable Subdivision or development; Government Sewerage Policy, 1996, Government Draft Country Sewerage Policy, 2002, Department of Health Guidelines for the Reuse of Greywater in Western Australia, Department of Health Specification for Aerobic Treatment Units 1992, Health (Treatment of Sewerage and Disposal of Effluent and Liquid Waste) Regulations 1974, AS/NZS1547:2001.

The type of waste water system and its installation can be used to ameliorate potential problems.

A site specific consideration of the in ground behaviour of phosphorous, nitrogen and microbial inputs is desirable.

Nutrient Loadings and Stocking Rates

Nutrient Management encompasses the management from waste water disposal and land uses. Nutrient management may need to change in order to sustain a new land use. There may also be opportunities to improve the management of nutrients from current land uses.

The management of nutrients is normally linked to other environmental and management issues such as revegetation and the treatment of stormwater.

- **Current Loading**

The site has been used as grazing in recent years.

Stocking rates for arable soils of the site are estimated to be 10 DSE or 1 adult cow per 1.0 hectare. (1 breeding cow equates to 8 – 16 sheep depending on whether N or P are compared).

This equates to 10 DSE (dry sheep equivalents) for dry pasture and where limited supplemental feed is supplied. The nitrogen and phosphorous ratios for sheep and cattle are different.

With a current average stocking rate of 10 DSE, the estimated nutrient loading when fully stocked with equivalent numbers of sheep could be 100.6 kg/N/ha/year and 14.7 kg/P/ha/year (Van Gool et al, 2000). On the other hand for cattle, (Dames and Moore, undated) used 57.49 kg/N/ha/year and 17.60 kg/P/ha/year. An average and realistic figure is used for this site.

- **Proposed Loading**

It should be noted that the Government Country Sewerage Policy permits waste water disposal from lots as small as 0.2 hectares in leached white sand with little phosphate retention capability.

Data on nutrient inputs is taken from Van Gool D, K Angell and L Stephens, 2000, *Stocking Rate Guidelines for Rural Small Holdings Swan Coastal Plain and Darling Scarp*, Department of Agriculture, Miscellaneous Publication 02/2000, Legislative Assembly, 1994, *Select Committee on Metropolitan Development and Groundwater Supplies, Western Australia*, Dames and Moore, undated, *Draft nitrate management in Jandakot UWPCA*, Water Authority of Western Australia.

The following loadings are assumed for urban lots of 2 000 m² or larger. Based on no stock, a dog or cat, small garden and lawn on which fertiliser is used combined with a conventional septic system, equates to a nutrient loading of 25.2 kg/N/year and 8.3 kg/P/year.

This will be added to the soil on the building envelope. A conventional septic system releases 18 kg N and 5.5 kg P per year as a point source. The other nutrients are spread more broadly across the soil surface.

For a nutrient adsorbing waste water system (ATU) a significant proportion of the phosphorous and nitrogen is removed before and within the waste water disposal area and is not directly added to the soil, reducing the overall soil input to 4.5 kg N and 0 kg P per year with a total of 11.7 kg/N/year and 2.8 kg/P/year per lot.

A horse has a typical loading of 11 kgP/year and 60 kgN/year. Horses and other stock will require management of wastes. Best management of manure is outlined in Van Gool D, K Angell and L Stephens, 2000, *Stocking Rate Guidelines for Rural Small Holdings Swan Coastal Plain and Darling Scarp*, Department of Agriculture.

The main risk with stock is the point concentration of manure, for example in a small yard or stable. Manure should be spread broadly across lots, removed from site or substituted for fertiliser on gardens and paddocks where possible. See Van Gool D, K Angell and L Stephens, 2000 and Shire of Serpentine Jarrahdale Guidance for Management of Small Rural Lots on management of stock on smaller holdings.

A range of lot sizes are included below to provide background on the various nutrient input scenarios even though not all will be possible or used on this site.

Typical Nutrient Loading from Land Use Changes

Possible lot size and activity	Nitrogen loading per hectare	Phosphorous loading per hectare	Likely nutrient scenario
Estimated average potential stocking at 10 DSE per hectare	80.0 kgN/ha/year	17.6 kgP/ha/year	Unlikely to be nutrient export based on soil types.
Likely nutrient input after subdivision to lots of 1.0 hectare. Alternative – Nutrient adsorbing waste water disposal system. Small garden, small fertilised lawn, dog or cat. No stock.	11.7 kgN/ha/year	2.8 kgP/ha/year	Reduced nutrient loading to the current stocking rate. Unlikely to be nutrient export based on soil types.
Likely nutrient input after subdivision to 0.2 hectare lots. (4 lots per ha allowing for roads). Alternative/nutrient adsorbing waste water systems. Small garden, small fertilised lawn, dog or cat. No stock.	46.8 kgN/ha/year	11.2 kgP/ha/year	Similar nutrient loading to the current stocking rate. Unlikely to be nutrient export based on soil types.

- A variety of average lot sizes and stocking rates are used to provide an indication of nutrient inputs prior to and following subdivision.
- It should be noted that the nutrient loading differences between a conventional septic system and nutrient adsorbing system are little different in reality. The conventional septic system releases waste water to the natural soils where it is denitrified, phosphorous adsorbed and microbial purification occurs. In a nutrient adsorbing waste water system the phosphorous adsorption is largely completed in the amended soil bed placed on site prior to exit to natural soils. There can be some additional denitrification in some alternative waste water systems.
- **Fate of Nutrients**

Nutrient Management encompasses the management from waste water disposal and land uses.

The ability of soils to adsorb phosphorous, reduce nitrogen and inactivate microorganisms is important.

The main issue with effluent disposal from dwellings, is nitrogenous and phosphate compounds together with organic matter or BOD. This could be released by animals, contained in waste water or introduced in biological matter.

- **Phosphorous**

Phosphorous is the main nutrient implicated in algal blooms in waterways and therefore it is important to limit its loss from the site. Phosphorous is capable of being stored in the basal muddy sediments of water bodies. From there the phosphates are released over time and provide nutrient to fuel algal blooms. In this case phosphorous addition to the soils is the issue.

Phosphorous is readily adsorbed onto clay and sesquioxides of the subsoils, gravels and yellow sands. Calcareous soils and calcretes retain phosphorous as apatite. The soils on site, with their loam nature and increased clay content in the subsoils, have inherently high phosphate retention capability.

Phosphorous adsorbing amended soils would be used for the waste water disposal area of alternative waste water systems on the lower elevations where the sands have low phosphate retention. These systems are nutrient adsorbing, and are designed to adsorb all or almost all the phosphorous released in waste water.

Phosphate Retention (PRI) can be a useful indicator, but the nature of the analysis can understate or overstate the field behaviour. Some soils theoretically can have good phosphate retention characteristics, but the behaviour of the waste water in the field may negate these characteristics. For example particles larger than 2 mm are sieved out prior to analysis and a gravelly sand may therefore have a lower PRI than the field reality. On the other hand clay may have a very high PRI but may not be sufficiently permeable for the waste water to penetrate.

The soils are suitable for all types of waste water systems provided lot sizes of > 0.2 hectares are used, and comply with the Government Draft Country Sewerage Policy, 2002.

The soils are suitable for nutrient adsorbing waste water systems.

Phosphorous is a mineral ion and is only dealt with through adsorption by sesquioxides, clays and calcium enriched processes within soils. It is these factors that provide the phosphate retention capability which is measured by PRI. The adsorption qualities can either be already existing in the soil or added to the waste water disposal areas amended soil.

The sandy upper soil horizons on the sand and sand over granite regolith can result in more rapid infiltration into the subsoils. Nutrients will infiltrate vertically through surface sands. From there the nutrients can potentially move laterally through the soil within the sand sheet. Nutrient adsorbing or alternative waste water systems negate this by spreading the waste water over large areas through irrigation or by the use of amended soils that have high phosphate retention capability.

These systems are nutrient adsorbing, and designed to adsorb all or almost all the phosphorous released in waste water.

Some indication of the improvements to the quality of the waste water leaving the waste water disposal area of nutrient adsorbing waste water systems can be shown from contacts with Ecomax and Filtrex. Ecomax reveal that their unit provides for 95% phosphate adsorption typically present exiting the system to enter the natural soils.

Research by Filtrex has found that phosphate can reduce to less than 1mg/L at the edge of the waste water disposal area, for at least ten years (Filtrex 2009).

If alternative waste water systems are used phosphorous adsorbing amended soils (PRI>20) are required for the waste water disposal area. These systems are nutrient adsorbing, and designed to adsorb all or almost all the phosphorous released in waste water. They are recommended on the lower slopes.

On the Sand over Silt on the northern side of the creekline the infiltration is to the more permeable underlying yellow silts which have much higher inherent phosphate retention capability. The Sand over Laterite and Silt and the Laterite Duricrust over Silts also have higher phosphate adsorption because of the presence of the laterite and gravel.

Ferricrete layers were shown by Lantzke 1997, *Phosphorous and nitrate loss from horticulture on the Swan Coastal Plain*, Department of Agriculture Miscellaneous Publication 16/97. Allen and Jeffrey 1990 found that the PRI of laterite gravels normally falls within the range of 20 – 70.

The key feature is to retain the waste water in the best soil profiles, and, in areas where nutrient retention is low, to use nutrient retaining waste water systems.

Nutrient adsorbing or alternative waste water systems negate reduced capability of the soils or reduced permeability by spreading the waste water over large areas through irrigation or by the use of amended soils that have high phosphate retention capability.

These systems are nutrient adsorbing, and designed to adsorb all or almost all the phosphorous released in waste water.

Some indication of the improvements to the quality of the waste water leaving the waste water disposal area of nutrient adsorbing waste water systems can be shown from contacts with Ecomax and Filtrex. Ecomax reveal that their unit provides for 95% phosphate adsorption typically present exiting the system to enter the natural soils. Research by Filtrex has found that phosphate can reduce to less than 1 mg/L at the edge of the waste water disposal area, for at least ten years (Filtrex 2009).

For these systems phosphorous adsorbing amended soils (PRI>20) are required for the waste water disposal area where the natural phosphate retention is low.

Gerritse et al, 1995B, found that all phosphate was adsorbed within 2 metres from a 7 year old leach drain in Yarrigal loam soils that have similarity for phosphate retention with the site. The critical point is retention times within the soils.

In the yellow silts subsoils of the Sand over Silt and the Gravel and Duricrust soil horizons subsoils the phosphate retention (PRI) of the soil profiles are interpreted to have PRI in excess of PRI 5 – 20 when the depth of profile is considered (compared to the database of type soils held by Landform Research for PRI and with Chemistry Centre data).

At PRI 20, each 1 m³ soil is capable of adsorbing 30 kg P, the equivalent of 5 years' phosphorous released in annual domestic waste water discharge. Even at PRI 10 the adsorbing capacity is 20 kg/m³ which is sufficient for 3.6 years of domestic waste water disposal.

On this site, using nutrient adsorbing or aerobic waste water systems, will reduce the risk of phosphorous loss or export to low levels and there should be nil or minimum phosphorous added to the ground water. The lateral distance to water bodies comply with the Government Country Sewerage Policy.

The laterite soils and yellow silty clay subsoils have high capability for phosphorous retention and combined with the high retention provided by the recommended alternative waste water systems the risk of phosphorous export is regarded as minimal to nil.

- **Nitrogen**

Nitrogen is a prominent part of living matter and is constantly recycled through the organic matter and the atmosphere.

Nitrogen is also held within the soil organic matter and some ions are attached to clay particles. When organic matter breaks down or fertiliser is applied and not taken up by plants, nitrogen is converted to ammonia or rapidly converts to nitrite and then nitrate under the influence of oxygen.

The nitrogenous products are taken up by vegetation, denitrified by bacteria under wet and anoxic soil conditions or lost through volatilisation of ammonia or the conversion of ammonia to soluble nitrogenous ions.

Nitrifying bacteria are widely present in soil and obtain their carbon from CO₂ and energy from the oxidation of NH₄ or NO₂ to NO₃. Denitrifying bacteria on the other hand reduce NO₂ and NO₃ to gaseous N₂O and N₂ which is lost to the atmosphere.

Soil microbes rapidly colonise the interface where waste water contacts the soil, with small amounts of organic matter at the interface providing the energy to sustain the microflora. Nitrates are normally removed by soil micro flora under anoxic conditions in the soils including leached white sands. The microflora remove the oxygen to leave nitrogen gas which is lost to the atmosphere. Inorganic nitrogen can also attach to clay particles.

Nitrogen is not generally responsible for algal blooms in freshwater environments, but high levels of nitrogen can affect the health of saline water bodies.

Nitrogen loss relates to retention times within the soil and microbial activity.

The critical factor in nitrogen loss is retaining water in the soil or on site for as long as possible. Even with the soils having sandy upper soil horizons lateral flow times are sufficiently slow to provide good nitrogen loss.

The removal of nitrogen is related to the oxygen conditions of the soils in addition to the microbial material present. It is not related to the type of soil but rather the combination of retention times, pattern of oxidising and reducing conditions, the amount of organic matter present and the presence of soil microbial materials.

The ammonium compounds that exit the one or two tanks of the waste water system are normally high in ammonia and nitrite and lower in nitrate. With exposure to oxygen the ammonia and nitrite are converted to nitrate. This however depends on the number of chambers and oxygen/microbial regime within the tanks.

In a conventional septic system the nitrogen in waste water is changed to nitrate on exit from the tank and entry to the soil. The waste nitrate is then stripped of oxygen by microflora, in reducing conditions and particles in the soil, in the presence of organic matter. This converts the nitrate to nitrogen gas which is lost to the atmosphere. This occurs in all soil types and is independent of the soil type, and depends on soil oxygen levels and to a lesser extent the nature of the soil particles.

The same process occurs in Alternative waste water systems which use amended soil beds, such as Ecomax and Filtrex systems, and in the soils of the waste water disposal area of all systems. Filtrex found that 75% of the nitrogen was lost in the waste water disposal area by the time the waste water had reached the edge of the system.

Many studies, for example Dawes and Goonetilleke, 2001, have found that nitrogen is readily stripped from waste water released from a septic system to drainage trenches. For example on a sloping sandy loam site in Brisbane the water entering the trenches had a concentration of 171 - 190 mg/L N but within 1 metre of the last trench the nitrogen concentration had dropped to 1.7 to 3.7 mg/L.

Gerritse et al, 1995, recorded a total of 140 mg/L nitrogen (NH_4 - 100 mg/L and NO_2 - 40 mg/L), exiting a leach drain. After a travel distance through shallow soils of 1 metre this had dropped to between 20 and 100 mg/L, and by 3 metres the total nitrogen had dropped to 0.03 to 0.2 mg/L. When loaded with nitrogenous compounds the microflora of soils quickly adjusts to the loading, by increases in the number and type of bacteria. For example, under anaerobic conditions with nitrogen loading, the denitrifying bacteria increase significantly. This can be expected to occur in soil aggregates within the top 2.5 metres of soil, which is regarded as the active bed and root zone for the waste water disposal areas.

The increased effectiveness of nutrient adsorbing waste water systems is shown by research by Filtrex which has found that nitrogen is reduced significantly by the grass cover and by denitrification within the soils.

Lantzke 1997, found high levels of denitrification in moist leached sands on the Swan Coastal Plain indicating that even leached sands can provide good denitrification.

As noted above nitrogen levels are significantly reduced in a very short distance if the water is able to be retained within the soils with microbial activity. The issue is that the waste water is slowed or prevented from quickly dropping vertically downwards below the level of microbial activity. The loam subsoils and loam soils will provide increased subsoil capability for the management of nitrogen. Good moisture levels in the soils in Albany also assist in denitrification.

Nutrient adsorbing waste water systems, if used, are designed to provide greatly increased retention times and conditions for microbial activity either within the system itself or by having an impermeable retaining membrane. Nitrogen loss relates to retention times within the soil, and microbial activity and redox conditions, rather than soil type.

The critical factor is retaining water in the soil or on site for as long as possible. With the proposed lots and loam soils, waste water and nitrogen is likely to be retained on site. The lateral travel distances combined with the larger lots in perimeter areas and the conservation areas will minimise the risk of nitrogen export. In addition the soils conditions with the shallow sand over silty clay will lead to rapid denitrification of water in both the natural soils and the amended soils of the waste water disposal areas.

Nitrogen loading is therefore not regarded as a significant issue from a nutrient adsorbing waste water system.

- **Microbial Purification**

Microbial material from stock or waste water systems can present a health hazard unless the material is deactivated by normal soil microbial organisms. Microbes could consist of thermotolerant bacteria, viruses and other organisms. For deactivation to occur sufficient dilution and retention time in the soils or other media are required.

Microbial purification is an important part of effluent disposal to ensure that all fine organic matter and micro-organisms are broken down.

Soil microbes require a minimum of 5 metres of sandy soil or less (down to 1 metre) for soils of lower permeability such as loams. (Wells and King, 1989).). The longer a soil retains waste water the better the microbial purification.

Organic matter builds up in the soil and supports microbial activity which deactivates and destroys thermotolerant and other organisms.

In many ways the treatment of microbial waste is similar to nitrogen loss. Microbial waste is removed by predation by soil microbial activity. Therefore soil retention times and the flow times, combined with a good soil microflora, are the key to good management. When soil in a waste water disposal area is loaded with waste water the organic matter in the waste water encourages soil microbial material to build up and thrive.

On this site all soils are capable of retaining waste water for adequate microbial purification based on their depth, the long lateral travel distances and earthy and gravel nature of the sands.

Alternative/nutrient adsorbing waste water systems require that 90% of samples have less than 20 mg/L organic matter, with no sample greater than 30 mg/L. Faecal coliforms are required to not exceed 10 per 100 mL of waste water. (*Health Department of Western Australia, 2001*).

The risk of contamination of the ground or surface water can therefore be less than for a conventional septic system. Alternative/nutrient adsorbing waste water systems are appropriate. They are also better at managing waste water in areas where the soil moisture levels are higher or where groundwater is closer to the surface.

The *Health (Treatment of Sewage and Disposal of Effluent and Liquid Waste) Regulations 1974 – Health Act 1911* require the Local Authority to approve the construction or installation of approved systems in Part 2 of the Regulations, which provides for some control.

Analysis of Nutrient Loading and Recommended Management	
Waste Water Loading	<ul style="list-style-type: none"> Alternative (nutrient adsorbing) waste water systems are acceptable and comply with the Government Country Sewerage Policy on lots down to 0.2 hectares.
Nutrient Export	<ul style="list-style-type: none"> The soils on site are capable of accepting the nutrient loading on lots down to 0.2 hectares without any significant risk to the environment, provided the waste water systems are matched to the soil capability and bearing in mind the type and depth of soils and distance of lateral flows. The recommended waste water disposal outlined above complies with the Government Country Sewerage Policy.
Recommendations	<ul style="list-style-type: none"> Installation should be in compliance with <i>Guidelines and Regulations for waste water systems. See previous section on Geotechnical Assessment for waste water disposal above.</i> <i>It is recommended that stock not be permitted on lots smaller than 1 hectare.</i> <i>The recommended alternative or nutrient waste water systems be used.</i>

6.0 HYDROGEOLOGICAL ASSESSMENT

6.1 Surface Water

The impact of the proposal on Rivers, Wetlands and Streams relates to whether the proposal will lead to any adverse effects on the waterbodies. The issues involve setbacks, flows of surface and groundwater, and buffers, and their management.

Soil Moisture

The soils are sandy overlying silty clay subsoils with variable laterite duricrust sitting on the silty subsoils.

Generally, though, all subsoils are silty clay which will need to be factored into the design and size of detention basins.

On the soils with sandy upper horizons precipitation falls on the surface sands and then rapidly infiltrates to the subsoils where permeability is less. When precipitation causes the volume of water to build up or be concentrated, or where the surface sand sheet is thin, the surface sand becomes saturated and the soils become wet in winter. This occurs on the lower slopes. The water then runs laterally downslope along the interface of the loam/clay subsoils.

This causes the development of perched shallow groundwater, that forms in winter and dries up in summer through evapotranspiration and evaporation losses and vertical seepage into the subsoils on some lower slopes.

With road construction, lateral downslope surface or near surface flow will reduce and, after construction of the subdivision, these soils will become drier.

This will assist waste water disposal on the lower slopes and provide for higher levels of soils capability for waste water disposal in those areas.

Drainage

Drainage relates to the water levels in summer and winter, the elevation of perched or regional water tables, the type of soils, underlying geology and hydrology, natural and potential drainage of a site.

Poor drainage can result in waterlogged soils and may impact on foundation stability. Soil moisture can also result in capillary action which can impact on structures.

The site is gently sloping but well drained.

The lower slopes, associated with the central swale, are currently more susceptible to temporary winter water logging.

Soil moisture will have increased with land clearing and removal of the deep rooted trees and shrubs. The road drainage and any other site drainage will simply return the soils to be more similar to the pre-clearing conditions.

Rivers, Wetlands and Streams

The main hydrological feature is the valley of the swale just outside the north eastern corner and the Kalgan Estuary in the west.

Buffers of 30 metres are available from waste water disposal areas in the north east and over 50 metres from the estuary in the west.

Waterlogging

Water logging is discussed in Section 5.1 above. The soils are not waterlogged but the seasonal perched water table does approach 400 mm depth in the north east. The design of the subdivision is such that potential impacts from the winter wet conditions are minimized.

Flood Risk

Flooding relates to the potential of a watercourse to flood a particular area. An area susceptible to flooding can be subject to the flood flow or may lie in a flood fringe. Construction should not impede a flood flow and normally structures are not to be placed in the floodway.

The flood fringe is not subject to the same erosive forces as the floodway and structures may be located in the flood fringe provided they do not increase the elevation of the flood. Normally a 500 mm separation is required between the 1 : 100 year flood level and any floor elevation.

There is no watercourse and therefore no flood risk.

Wetlands

There are no wetlands apart from those associated with the Kalgan Estuary. The wetter soils on the western edge of the site are excluded from the subdivision.

In the central south east within the vegetation protection area there is also a large area of wet site vegetation.

A small triangle of wet site vegetation is also located in the extreme north eastern corner. The building envelope has been located outside this vegetation to provide protection.

Salinity

Salinity depends on the landform, underlying geology and hydrology, as well as the regolith profile. Some regolith has more salt stored in it when compared to other areas.

A consideration of the land use changes and water management is normally required to minimise the risk of additional salinity loading and impact. Vegetation plays a part in the assessment and can be used to mitigate salinity issues.

The soils are well elevated with high rainfall. There is no evidence of salinity. The dam in the south west had a salinity of 130 mSm or 715 mg/L in July 2009, which is potable water.

All water is suitable for stock and gardens.

Surface Water and Recommended Management	
Surface water	<ul style="list-style-type: none"> There are no limitations from surface water. Surface water, Kalgan Estuary and the swale outside the north eastern corner lie outside the proposed development area.
Recommendations	<ul style="list-style-type: none"> <i>The subdivision guide plan provides for protection of the wetlands.</i> <i>As appropriate, conditions can be placed on any subdivision approval.</i>

6.2 Groundwater

There is no evidence of the deep regional groundwater on site.

The groundwater on site is temporary winter wet perching of shallow soil water perched on the less permeable subsoils. The water outside the north eastern corner probably represents regional localised groundwater, as does the groundwater under the Estuarine Silts. Both these areas are excluded from the proposed subdivision.

In summer, evaporation, transpiration and vertical seepage into the subsoils reduces the perched water and its potential to reach deeper into the soil profile.

It is interpreted that the regional groundwater will be variable and undulating across the site due to the nature of the granite basement dropping away from under the central ridge to both the north east and the west. The groundwater in the east outside the subject land has groundwater dropping from 20 metres to below 10 metres AHD at the north east of the study site.

The elevation of the groundwater at the western edge will be near 0 metres AHD. Under the ridge groundwater will rise to above 10 – 15 metres and will flow west and north east-east based on the regolith and geomorphology.

Ground Water and Recommended Management	
Groundwater	<ul style="list-style-type: none"> There are no limitations or risk to groundwater from normal rural living subdivision.
Recommendations	<ul style="list-style-type: none"> <i>No specific site recommendations are required.</i>

7.0 LOCAL WATER MANAGEMENT PLAN

7.1 Background to Water Management

In recent years Urban Water Management has received greater attention during the design phase to ensure that water resources are maximised and that environmental flows are maintained. The considerations and design are also directed to minimising impact during storm events.

The Department of Water, 2008, *Better Urban Water Management* documents the issues.

This is also considered in Department of Planning, *Planning Bulletin 92, Urban Water Management*.

The focus of the Urban Water Management Plan is to provide for surface and groundwater management at all stages of the Planning and Development process to ensure that the management of water works at a Regional and Local level and that as land is progressively developed a situation does not arise where a satisfactory solution or management cannot be found in the later stages of development.

In other words drainage and water management is to be considered up front in the broad scale and from there considered in progressively more detail until the final design at the local level is achieved.

With consideration of water issues up front and through the process there is much more potential to design better management of water. The main trends of the *Better Urban Water Management* are summarised below.

- to increase the potential for sustainability,
- maintain environmental flows,
- maintain and enhance water quality
- minimise the potential impact on the surface and groundwater hydrology both onsite and offsite,
- maintain biodiversity
- provide nutrient retention and management
- minimise flood risk
- encourage water conservation

The key design objectives for a Water Management Plan are to;

- maintain the one year one hour average recurrence interval (ARI) event so that the peak post development flow rates are similar to the pre-development conditions.
- manage the catchment runoff from post development for up to the 1 in 100 year ARI event with runoff similar to the pre-development conditions.
- Try to restrict water use to 100 kL per person/year including not more than 40 – 60 kL per person per year of scheme water.

However as the nature of any development is not known at this stage a Water Management Plan is not appropriate at this time but will be prepared when the design of any subdivision or development is available.

On the other hand some consideration of the main issues is warranted and these are included here.

The water planning structure is;

1. *Regional or subregional land and water planning*

Water planning at a whole of catchment level

2. *District water planning document*

Water planning at the local catchment level or within a planning precinct

3. *Local water planning strategy*

Water planning within part of a catchment or at a subdivision level.

4. *Detailed engineering design with technical calculations*

This is to accompany the site specific design for the subdivision and follows subdivision approval.

At each stage of the water planning, the water balance, design and considerations would integrate both upwards and downwards. In other words the regional or district planning should not preclude development at a local level and in turn development at a local level should not place unacceptable impacts on district or regional water attributes.

On this site, which is a gently sloping ridge that drains east and west off the ridge, the site is not influenced by any other catchments and does not accept water from other catchments, Water Management relates only to development, and therefore at the local water planning strategy or detailed engineering design stage.

The subdivision is urban, with lot sizes of 0.2 hectares to 1.0 hectares.

A preliminary Urban Water Management Plan is provided at this stage to ensure that water management issues are detected and considered prior to the subdivision being locked in.

The land use changes such as the increased hard surfaces are some of the changes that will occur.

In *Better Urban Water Management* the Local Water Management Plan is submitted as part of the subdivision application process. It is not a detailed design document, with complex calculations and pipe widths and the like, but rather a consideration that sufficient land and management is available to manage the water post development. In this case of a rezoning the Local Water Management Plan is often not required. However because of the nature of the site, it is desirable that sufficient consideration of the water management is provided to ensure that the subdivision guide plan is appropriate.

An additional stage of detailed engineering design, to accompany the site specific design for the subdivision, follows subdivision approval.

7.2 Subdivision or Development Water Input

The proposed subdivision will be connected to scheme water. The amount of scheme water used per dwelling will depend on the number of persons, the amount of water added to gardens and whether there is a swimming pool. The volume is normally in the range 200 – 300 kL per year for a family.

On this site with lots between 0.2 and 1.0 hectares the average lot size is just over 0.5 hectares.

For the 0.2 ha lot part of the subdivision at say 4 lots per hectare and 200 kL per lot the scheme water added to the location is 800 kL per hectare per year. At a household use of 300 kL per year the loading is 12 000 kL per year. For 1.0 hectare lots the loading will be 200 – 300 kL per hectare per year. The average for the whole subdivision will be somewhere between. For 69 lots the loading will be 13 800 – 20 700 kL. The average being 17 250 kL per year.

There is potential for rainwater tanks. The use of rainwater tanks will help reduce the water requirements from scheme water.

The other loading is from rainfall, at 800 mm per year, of which most falls from April to November inclusive.

A small tank for gardens of say 5000 litres will effectively attenuate rainfall for summer but not in winter when the tank will be full. On the other hand a small tank used for potable water will help attenuate rainfall throughout the year, but will still depend on the amount of water used daily.

Greywater disposal on site will potentially offset some scheme water use by replacing the need for scheme water for gardens.

For these calculations the potential for some rainwater use and greywater reuse cannot be guaranteed so the volumes of such use cannot be considered. (See treatment of Stormwater below).

7.3 Water Loading from Hard Surfaces – Changes to Soil Moisture as a Result of Subdivision

In order to determine the effects of development, and what should be designed for and considered, an assessment of the likely recharge now and after development is undertaken.

This provides an indication of what effect the road drainage will have in drying or draining the soils.

For lots of 2 000 m², for example, the amount of hard surface will increase with dwellings, driveways and roads. Generally a total hardstand for the house, patios, paths, sheds etc is assumed to be 350 m² per lot. To this is added 50 m² of driveway

If rainfall from roofs is retained on lots either through soakwells or rainwater tanks and on site waste water disposal, there will be no change to the water loading from development. There may be a small change as a result of reduced evapotranspiration on hard surface areas.

However if the storm water is to soak into the ground around the dwellings and within swale drains the subdivision can be designed so that there will be little net increase in recharge apart from the small addition from scheme water.

With the sandy soils all stormwater should be able to be retained on individual lots. The only change will be the reduced evapotranspiration from hard surfaces.

For 69 lots at 400 m² per lot hard surface;

$69 \times 400 \text{ m}^2 \times 0.8 \text{ m rainfall} \times 90\% \times 20\% \text{ change to evapotranspiration} = 3\,974 \text{ m}^3 \text{ or kL (increase)}$

If all the water from the roads is contained within swale drains and infiltration basins then there will be no overall change in recharge on site from hard surfaces. There may

however need to be some overflow from each basin in the event of sustained rainfall on already wet soils.

There will also be some increases from scheme water.

Currently rainfall which falls on the subject land either soaks into the soils or runs from the site.

To this must be added some 2 km of roads at 8 metres wide allowing for pavements gutters and the like. This forms 16 000 m² hardstand. If all this water is retained within swale roadside drains there will be no change to the water balance apart from a change to recharge as a result of less evapotranspiration.

The additional recharge associated with the roads at 90% runoff from hard surfaces is;

16 000 m² x 0.8 m rainfall x 90% x 20% change to evapotranspiration = 2 304 m³ or kL (increase).

The only likely change to loading is the planting of additional trees on say 20 hectares. At a low change to recharge as a result of additional tree planting of say 5% the reduction in recharge for the subdivision will be;

200 000 m² x 0.8 m rainfall x 5% change to evapotranspiration = 8 000 m³ or kL per year (decrease).

At a 10% change for the 20 hectares, which is not unreasonable, the total decrease will be 16 000 kL per year.

The above information can be used to estimate the increased total of the subdivision including scheme water

All water will be retained on site. There is not anticipated to be any water running from the gently sloping land of sandy soils.

The change to water balance as a result of the subdivision, and the Soil Water Balance of the subdivision is given as follows;

Scheme water + increased recharge from roofs + increased loading from roads and driveways + increased loading from roofs to soakwells – drainage from roads (this includes the recharge from the roads and driveways plus the water running off the sloping land that is collected by the roads) – increased evapotranspiration as a result of tree planting -- any water substituted for scheme water use from greywater recovery or rainwater tanks.

As noted previously greywater recovery and rainwater tank use is not likely to occur on all lots and so is not included.

Therefore the Soil Water Balance is;

17 250 kL scheme + 3 974 kL roofs + (2 304 roads + driveways) - (0 kL offsite runoff from roads + driveways) – kL water collected by roads that runs off from land – 8 000 increased evapotranspiration – 0 kL rainwater and greywater = + 15 528 kL or m³ year.

This is the estimated net volume annually added to the site. If the evapotranspiration as a result of tree planting is 10% over 20 hectares the change drops to 7 528 kL per year.

This means that the soils will be slightly wetter as a result of subdivision. The 15 528 kL amount is equivalent to 408.6 kL per hectare or 0.04 kL per hectare or 40 mm rainfall, dropping to less if evapotranspiration increases more than 5%.

This is an addition that will assist in minimising reducing rainfall that may occur as a result of climate change.

With that in mind the impact of the subdivision is to maintain the environmental flows at about the current levels.

7.4 Design Criteria - Volumes

Department of Water seek to retain on site rainfall from a 1 in 1 year ARI 1 hour event on site with the excess directed to stormwater. Also directed to stormwater is the runoff from hard surfaces such as roads.

All water will be retained on each lot in soakwells.

All stormwater from roads will be retained in swale drains.

As such the storm event loading does not really need to be considered.

7.5 Treatment of Stormwater on each Lot

The volume of water directed to soak wells can be reduced correspondingly for dwellings with rainwater tanks in excess of say 5 000 litres.

A minimum 5 000 litre rainwater tank is recommended provided it is plumbed into a system that is used all year round, such as potable water, washing, toilet use or a combination. For toilet use alone, at say a volume of 2.5 L per average flush with 6 flushes per person, the daily use will be $2.5 \times 7 = 17.5$ L per person per day.

For an average 2.5 person family over a month this amounts to 1 300 L per month or 1.3 m^3 per month. Even piping rainwater for toilet use represents a water saving, but is not sufficient alone in any month to effectively attenuate a storm event. The use of the rainwater tank to attenuate stormwater flows is therefore not included in the calculations because at this stage the actions of individual owners cannot be anticipated.

In Albany a rainfall design criteria of 14 mm is normally used to provide the ARI hourly one year design flow volume. At that criteria 93% of all water will be retained on site. (Department of Water Information). This is the design volume that Department of Water designs for, with the excess being directed to stormwater runoff. For Albany a 1 hourly 1 year return event is rated as 14 mm.

For a dwelling on a subdivision a hard surface area of 350 m^2 is assumed, including dwelling, driveways, sheds and garages.

As the surface area directed to soakwells is assumed to be 300 m^2 , from the above, and the rainfall criteria is 14 mm with a 0.9 runoff coefficient from hard surfaces, then a volume of up to

$$300 \text{ m}^2 \times 0.9 \times 14/1000 \text{ mm} = 3.78 \text{ m}^3$$

is generated from 93% of the rainfall events and is the volume that Department of Water recommends be retained on site.

Typical soakwells of 1300 mm diameter x 1200 mm depth hold a volume of 1.59 m^3 . With two such soakwells a total storage volume will be 3.18 m^3 or 73% of the 300 m^2 roof area used. Therefore, to round the figure off, a roof area of 200 m^2 will require two 1300 x 1200 mm soakwells with a larger roof area requiring correspondingly more or three soakwells to achieve a 1 in 1 hour ARI rainfall event.

The site has permeable sandy upper soil horizons with in most cases a depth of 0.5 metres for that sand that will enclose any soak wells and allow lateral flows from them.

Geofabric may be required to prevent sand from flowing into the soakwell when full.

7.6 Excess Stormwater and Road Water Treatment

Based on the proposed subdivision, the soils and the slopes and the calculations above, all stormwater will be able to be retained on site.

A rainfall design criteria of 14 mm is normally used to provide the ARI hourly one year design flow volume. At that criteria 93% of all water will be retained on site. (Department of Water Information).

This is the design volume that Department of Water designs for, with the excess being directed to stormwater runoff. For Albany a 1 hourly 1 year return event is rated as 14 mm.

The calculation for the 1 hour 1 year return volume is determined in the same manner as the yearly volume but uses only 14 mm.

The runoff from the 2 km road which is 8 metres wide is;

$8 \times 1 \times 0.014 \text{ m per linear metre} = 0.11 \text{ kL or m}^3 \text{ per linear metre}$. With two swale drains this amount is easily retained in the swale drains. To contain this volume the two swale drains only have to be 1 metre wide and 10 cm deep. Swale drains are typically larger in cross sectional area. The other factor is that the design volume of 14 mm is spread over an hour and, with rapid seepage into the sandy soils, the actual required volumes will be less.

On slopes, rip rap and other slowing features are recommended to slow the flows and increase infiltration.

On this basis there should be no need to utilise detention basins. To cope with some excess a larger swale depression could be used in public open space, but no detention basin should be required.

7.7 Stormwater Design

Stormwater from the internal roads is recommended to be directed the swale drains.

If roads are kerbed the water may still be able to be directed to swale drains. If not detention basins will be required.

It is recommended that detention basins are not used within the general subdivision, because of maintenance issues.

For a 1 : 1 ARI one hour event, $0.11 \text{ kL or m}^3 \text{ per linear metre}$ of road will be required. To cover the storm events greater than one year the volumes will have to be correspondingly larger depending on the design frequency. A volume more than double this can easily be treated by swale drainage.

Depending on the use of kerbing a detention basin may be required in the public open space. Any such basin can be used to deal with flood event volumes.

Soil Erosion and Management depends on the landforms, types of development, land uses, geology and soils, all of which can affect the potential for soils to erode.

Stormwater Management in Western Australia aims to ;

- Protect water quality,
- Protect infrastructure from flooding and inundation,
- Minimise runoff,
- Maximise local infiltration,
- Use natural drainage features,
- Minimise changes to water balance,
- Integrate stormwater treatment into the landscape,
- Convert drains to "naturalised" streams.

The methods for achieving these aims are well explained in the documents below. The most appropriate management can be selected from these documents.

However, on this site, any detention basin or sump is recommended to be naturalised, with more gently sloping edges to the basins, to enable access for maintenance, and vegetated as a naturalised wetland or, for overflow storm volume, formed as a grassy swale.

- *Stormwater Management Manual for Western Australia*, Department of Environment WA, 2004.
- *Guidelines for Groundwater Protection in Australia*, ARMCANZ, ANZECC, September 1995.
- Department of Water, 2008, *Better Urban Water Management*
- Environmental Protection Authority Victoria/ Melbourne Water, undated, *Urban Stormwater, Best Practice Environmental Management Guidelines*
- Water and Rivers Commission, 1998, *Manual for Managing Urban Stormwater Quality in Western Australia*.
- *Western Australian Water Quality Guidelines for Fresh and Marine Waters*, EPA Bulletin 711, 1993.
- ANZECC, 1992, *Australian Water Quality Guidelines for Fresh and Marine Waters*.
- Engineers Australia 2003, *Australian Runoff Quality*, National Committee on Water Engineering.

7.8 Local Water Management Plan Summary

SECTION	ITEM	REFERENCE	COMMENTS
Executive Summary			
Introduction	Context	1.0 page 1	
Proposed Development	Site Context	1.0 page 1	See remainder of Geotechnical and Land Capability Report
	Proposal Plan	Figure 6	
	Landscape Plan	Figures 1 - 6	
Design Criteria	Design Objectives	Page 17 Figure 5	
Pre-Development Environment	Site Assessments	See Geotechnical	
	Site Condition	See Geotechnical Figures 1 - 5	
	Geotechnical Conditions	3.0 page 2 4.0 page 5 5.0 page 13 Appendix 1	
	Environmental Issues	8.0 page 35	No wetlands, watercourses or vegetation to be disturbed
	Existing Surface Water Flows	6.1 page 24	None present
Water Use Sustainability Initiatives	Groundwater	6.2 page 26	
	Water efficiency	7.5 page 31	
	Water Supply	7.2 page 28	
	Wastewater Management	5.0 page 13	

REPORT ITEM PD132 REFERS

Land Capability - Geotechnical Assessment and Water Management Strategy
Lot 422 Swan Point Road, Lower Kalgan

Stormwater Management Strategy	Flood Parameters	Figures 1 - 6	No watercourses or floods on site. Figure 6.
	5 Year Event		
	1 Year Event	7.0 pages 27 - 33	
	Groundwater Management		No groundwater impact
	Acid Sulfate	4.5 page 11	No acid sulfate on development area. At risk areas are excluded.
Future Water Management			Detailed designs will be required after approvals are gained and the subdivision is finalised.
Implementation	Developer		This document is to support application for subdivision.
	Roles - Funding		
	Review		

Analysis of Stormwater and Recommended Management	
Individual lots	<ul style="list-style-type: none"> The soils on site are sandy upper soil horizons. The initial calculations reveal that the soils will be able to accept and retain on site the ARI 1 hour 1 year rainfall events. Provided contingencies are used in water management, there are no limitations to development, or any limitations identified can be controlled by good water management.
Road drainage	<ul style="list-style-type: none"> The initial calculations reveal that swale drains will be able to accept and retain on site the ARI 1 hour 1 year rainfall events. Provided contingencies are used in water management for kerbing, there are no limitations to development, or any limitations identified can be controlled by good water management.
Water Management	<ul style="list-style-type: none"> There are no limitations imposed by the site on water management that would result from subdivision or development. Water management actions are able to be incorporated into any development at the subdivision or design stage.
Recommendations	<ul style="list-style-type: none"> The installation of rainwater tanks with a minimum of 5000 litres can be considered but will not impact on water management. Greywater reuse is encouraged to minimise scheme water use. Detention basins and sumps for the acceptance of excess surface water from roads if kerbed may be required. Swale drains and table drains are recommended for road drainage to encourage infiltration and cutoff functions. See DOW (Water and Rivers Commission), 1998, 3.17 (BMP14). Soakwells should be installed on a sand bed and surrounded by 300 mm under and 600 mm on the side with geofabric, and overflows to retain stormwater on site. Easements are recommended for any stormwater, servicing or pipes across lots and private land.

8.0 BIODIVERSITY ASSESSMENT and MANAGEMENT

8.1 Flora and Fauna

This relates to whether the proposal will have significant impacts on the existing Flora and Fauna of the area under assessment.

Remnant Vegetation

The vegetation is summarised on the attached vegetation Figures. During the site inspections, numerous traverses were made through the remnant vegetation to identify species present and to search for Declared Rare, Priority and other listed taxa.

The databases of the DEC and Commonwealth were checked prior to the site inspection.

The communities and vegetation condition are shown with photographs of typical vegetation attached.

The Vegetation Community Figure provides the summary of the plant communities.

In the central part of the site on the ridge lies Jarrah Marri – Low Forest. This grades to a partial Casuarina Low Forest in the central east, but on the attached plans is still classified as part of the Jarrah Marri – Low Forest.

A predominantly wetland vegetation community occurs in wetter areas with the main species being *Taxandria parviceps* and other species. This also occurs in the north east.

Also in the north east is a small area of *Eucalyptus megacarpa* woodland over *Taxandria*.

A small area of *Agonis flexuosa* regrowth lies in the north west and south west.

An estuarine low heath occurs along the western edge adjacent to the estuary. This is dominated by *Melaleuca cuticularis* over chenopod vegetation.

A total of 80 taxa were recorded. Some exotic, weed and pasture species were also noted. These are not recorded and they do not appear to be impacting on the remnant vegetation to any great extent.

No Declared Rare, Priority Species or Significant flora were recorded.

No Taxa or plant communities that occur on site are listed under Commonwealth Legislation.

As part of the subdivision the building envelopes are generally located outside remnant vegetation or better and more sensitive vegetation.

The vegetation complexes of the Albany area were studied by ATA 2001.

ATA 2001, list the vegetation across most of the site and surrounding area as Vegetation Complex 126, *Eucalyptus marginata/Corymbia calophylla* Medium Forest F, with the remainder being *Eucalyptus marginata/Corymbia calophylla* Medium Forest B and *Eucalyptus marginata/Corymbia calophylla* Medium Forest E.

These vegetation complexes adequately describe the vegetation on site. ATA 2001. ATA notes in Appendix 3 of their report that the amount of original vegetation remaining of each of the complexes is listed in the data below.

Eucalyptus marginata/Corymbia calophylla Medium Forest F 32.9%

Eucalyptus marginata/Corymbia calophylla Medium Forest B 23.1%

Eucalyptus marginata/Corymbia calophylla Medium Forest E 11.8%

EPA Position Statement No 2, December 2000, *Environmental Protection of Native Vegetation in Western Australia*, specifically targets the retention of native vegetation in the Agricultural Areas in 4.1, *Clearing in the agricultural areas for agricultural purposes*. In 4.3, *Clearing in other areas of Western Australia*, it is unclear what "other areas" refers to, but may refer to retention of a 30% threshold in non agricultural areas.

Section 4.3 *Clearing in other areas of Western Australia*, (EPA Position Statement No 2, December 2000) expects that clearing will not take vegetation types below the 30% of the pre-clearing vegetation as recommended by ANZECC, 1999, *National Framework for the Management and Monitoring of Australia's Native Vegetation*. The National Objectives and Targets for Biodiversity Conservation 2001 - 2005 (Commonwealth of Australia 2001) also recognise 30% as the trigger value. For constrained areas such as the Perth Metropolitan Area and Greater Bunbury Area, and presumably urban areas of Albany, a figure of 10% representation is provided for by State Government Policy.

The remnant vegetation is worthy of retention and this is proposed by the location of building envelopes outside the remnants and its use as public open space.

The ATA data shows that only Forest F is above the ideal threshold. Therefore the subdivision has been designed to retain most of the better remnant vegetation within Public Conservation reserves and larger lots.

The vegetation condition varies from Degraded to Very Good across the site.

On the site the remnant vegetation has been subjected to significant grazing, to the point that the northern area of Jarrah Marri Forest is reduced in quality, particularly through edge effects and the introduction of pasture species. The same has occurred in the south and can be seen in the Vegetation Condition mapping as shown on the attached plans. The grazing has reduced the taxa and introduced pasture species.

Fencing should be such to enable exchange of flora and fauna. Firebreaks cutting the vegetation are not recommended.

Native species recorded during the site inspections

FAMILY	GENUS - SPECIES	TAXA RECORDED	
		WOODLAND	WET AREAS
Lindsaeeae	<i>Lindsaea linearis</i>	x	
Dennstaedtiaceae	<i>Pteridium esculentum</i>	x	
Anthericaceae	<i>Chamaescilla corymbosa</i> var <i>corymbosa</i>	x	
	<i>Johnsonia lupulina</i>	x	
	<i>Thysanotus manglesianus</i>	x	
Apiaceae	<i>Xanthosia rotundifolia</i>	x	
Asteraceae	<i>Lagenophora huegelii</i>	x	
Casuarinaceae	<i>Allocasuarina fraseriana</i>	x	
Colchichaceae	<i>Burchardia congesta</i>	x	
Cyperaceae	<i>Cyathochaeta avenacea</i>	x	
	<i>Evandra aristata</i>		x
	<i>Lepidosperma effusum</i>		x
	<i>Mesomelaena tetragona</i>	x	
	<i>Dasypogon bromeliifolius</i>	x	
Dasypogonaceae	<i>Lomandra</i> sp	x	
	<i>Kingia australis</i>	x	

REPORT ITEM PD132 REFERS

Land Capability - Geotechnical Assessment and Water Management Strategy
Lot 422 Swan Point Road, Lower Kalgan

Dilleniaceae	<i>Hibbertia cunninghamii</i>	x	
Droseraceae	<i>Drosera erythrorhiza</i>	x	
	<i>Drosera macrantha</i> subsp <i>macrantha</i>		
	<i>Drosera menziesii</i>	x	
Epacridaceae	<i>Leucopogon parviceps</i>	x	
	<i>Leucopogon reflexus</i> ?	x	
	<i>Leucopogon verticillatus</i>	x	
Goodeniaceae	<i>Dampiera</i> sp <i>linearis</i> ?	x	
Haemodoraceae	<i>Anigozanthos manglesii</i>	x	
	<i>Conostylis setigra</i> subsp <i>setigra</i>	x	
Iridaceae	<i>Patersonia occidentalis</i>	x	
Juncaceae	<i>Juncus pallidus</i>		x
Loranthaceae	<i>Nuytsia floribunda</i>	x	
	<i>Acacia littorea</i>	x	
Mimosaceae	<i>Acacia myrtifolia</i>	x	
	<i>Acacia pulchella</i>	x	
Myrtaceae	<i>Agonis flexuosa</i>	x	
	<i>Agonis linearifolia</i>	x	
	<i>Callistemon glaucus</i>		x
	<i>Eucalyptus calophylla</i>	x	
	<i>Eucalyptus marginata</i>	x	
	<i>Eucalyptus megacarpa</i>		x
	<i>Eucalyptus staeri</i>		x
	<i>Melaleuca cuticularis</i>		x
	<i>Melaleuca preissiana</i>		x
	<i>Melaleuca raphiophylla</i>		x
	<i>Melaleuca thymoides</i>	x	
	<i>Taxandria marginata</i>	x	
	<i>Taxandria parviceps</i>		x
Orchidaceae	<i>Caladenia flava</i>	x	
	<i>Pterostylis vittata</i>	x	
	<i>Thelymitra</i> sp	x	
Papilionaceae	<i>Bossiaea linophylla</i>	x	
	<i>Calistachys lanceolata</i>		x
	<i>Chorizema rhombeum</i>	x	
	<i>Daviesia inflata</i>	x	
	<i>Hardenbergiana comptoniana</i>	x	
	<i>Hovea chorizemifolia</i>	x	
Proteaceae	<i>Adenanthos cuneatus</i>	x	
	<i>Adenanthos obvata</i>	x	
	<i>Banksia ilicifolia</i>	x	
	<i>Hakea trifurcata</i>	x	
Restionaceae	<i>Anarthria prolifera</i>	x	
	<i>Anarthria scabra</i>	x	
	<i>Desmocladius flexuosus</i>	x	
	<i>Lyginia barbata</i>	x	
	<i>Loxocarya cinerea</i>	x	
Rubiaceae	<i>Opercularia hispidula</i>	x	
Rutaceae	<i>Boronia anceps</i>	x	
Stylidiaceae	<i>Stylidium spathulatum</i> subsp <i>spathulatum</i>	x	
Tremandraceae	<i>Tetratheca affinis</i>	x	
Xanthorrhoeaceae	<i>Xanthorrhoea gracilis</i>	x	
	<i>Xanthorrhoea platyphylla</i>	x	
	<i>Xanthorrhoea preissii</i>	x	
TOTAL NATIVE SPECIES		80	

Note

The use of *Dryandra* is continued because the incorporation of *Dryandra* into the Genus *Banksia* is not recognised by all botanists or in the literature (eg Collins et al 2008, and

Cavanagh and Pieroni, 2006). Moreover, the proposed name change removes the classification of a group of closely related plants and results in a loss of botanical knowledge and understanding for most of the community.

Controls

Building envelopes have been placed in already cleared areas.

Restrictions are recommended to cover the marking of lot boundaries, the use of strategic firebreaks rather than boundary fire breaks, allocation of building envelopes and the management of stock.

These can be provided for under conditions of subdivision. It is also possible for a covenant or other mechanism to be used to assist in the protection of the existing vegetation.

Vegetation – Habitat Recommendations

- Remnant vegetation should be retained in as large an area as possible. This has been completed with the creation of recommended Public Conservation Reserves.
- Roads and building envelopes have been located in already cleared areas.
- Lot boundaries through remnant vegetation can be marked by poles or fenced with stranded wire in which the bottom wire is left off to enable small fauna to move through. This mainly only applies to proposed Lots 8 and 9.
- Clearing of lot boundaries through remnant vegetation is not recommended. Surveying and the construction of fences can be undertaken without significant clearing, leaving sufficient remnant vegetation to enable maintenance, but not to significantly compromise biodiversity or visual issues.
- No boundary fire breaks are recommended through remnant vegetation. Strategic fire breaks, combined with the building envelopes located on cleared land, can assist with fire management.
- Protection of the remaining remnant vegetation on lots, by planning or other mechanisms, should be considered.
- Consideration can be given to providing a public education program or notes to local residents with respect to caring for remnant vegetation and the adjoining covenanted land to try and limit dumping of garden rubbish.
- When clearing native vegetation and during construction, provide weed and dieback managed construction techniques.
 1. All vehicles and equipment to be used during land clearing or land reinstatement should be clean or cleaned prior to being brought on site from an infected area. They should be washed down prior to leaving the infected site, using the procedures in DEC Guidelines for Dieback Management.
 2. Access to vegetated areas should be discouraged and minimised.
 3. Runoff from roads is recommended to be to table drains.
 4. Any materials to be used in rehabilitation should be dieback free.

5. Earthworks and construction machinery should push material from remnant vegetation towards previously cleared areas to minimise the spread of weed species and plant diseases.
6. Earthworks should be carried out to comply with DEC Best Practice Guidelines for the Management of *Phytophthora cinamomi*, draft 2004, and Dieback Working Group 2005, Management of *Phytophthora* Dieback Guidelines for Local Government. As the site is a working rural property quarantine and a split operation are most relevant.

Wetlands

The only wetlands are associated with the Kalgan River Estuary. Assessment of the site to DEC and EPA biophysical guidelines were used to set back the building envelopes from those wetlands. This assessment was based on the vegetation and the soil conditions as shown in the attached figures.

The wetter soils in the north eastern corner as delineated by *Taxandria* Thicket are excluded from impact, with building envelopes located outside that vegetation. *Taxandria* grows on dry to moist and wet soils depending on the species. In the north east corner the wettest soils are outside the study site. Within the study site the vegetation is representative of moist soils rather than a wetland, and does not have definitive wetland species. Even so, sufficient buffer to the vegetation is provided from the building envelope.

The same applies in the west and north western corner. The wetland vegetation is associated with the Kalgan River Estuary and lies outside the developable area. This provides for an 80 metre lateral buffer three vertical buffer to that wetland. The *Agonis flexuosa* Forest is regrowth. *Agonis flexuosa* is not a wetland indicator species as it grows in a wide variety of habits and soil conditions in the south west of Western Australia.

There are two building envelopes, for proposed Lots 8 and 9 in the south west, which impinge on some of the remnant vegetation.

The Kalgan Estuary also represents a wetland. This will also be excluded from development.

Fauna

Fauna is advantaged by the presence of habitat. The more native vegetation retained the better the habitat for fauna. Habitat protection is the key to fauna management.

Vegetation on site will be providing habitats for birds and other small fauna.

The vegetation may be used by a variety of fauna, some of which may be significant such as the Black Cockatoos which are listed under State and Commonwealth Legislation.

All three species of Black Cockatoo *Calyptorhynchus baudinii*, *C. banksii* and *C. latirostris* are listed under State Legislation, and *C. baudinii* and *C. latirostris* under Commonwealth Legislation.

The protection of fauna becomes a protection of habitat issue. In other areas fauna still make good use of areas such as this with similar or much smaller lot sizes. For example Black Cockatoos are regular visitors to the urban areas of the Perth Hills.

Peppermint Trees *Agonis flexuosa* are favoured by the Western Ringtail Possum. Some of these are located on site and, if removed, should be replaced by clumps of additional

plants. The Western Ringtail Possum is very comfortable with living in relatively dense urban situations such as Busselton.

Most remnant vegetation is proposed to be retained or included in larger lots with building envelopes located outside that vegetation.

Any clearing for roads or building envelopes can be offset by providing additional revegetation. Prior to clearing an assessment should be of the vegetation to be removed and its significance for habitat; for example potential habitat large trees or Peppermint. Where taking of this vegetation cannot be avoided, replanting with clumps of similar species is recommended to provide for replacement in the longer term.

There are currently a significant number of kangaroos on site that access adjoining lots. These animals will be advantaged if they can continue to move freely across the site, and into the remnant vegetation.

The inclusion of most of the remnant vegetation in better condition in conservation areas has been provided for within the subdivision Guide Plan.

Analysis of Biodiversity and Recommended Management	
Remnant Vegetation	<ul style="list-style-type: none"> • There are some biodiversity limitations for the site related to the Kalgan River and remnant native vegetation. These can be provided for within the proposed conservation areas. • The remnant vegetation has a high species diversity and remains in a generally Good to Very Good Condition. • The key to flora and fauna protection is the retention of habitat. • See Attached Figures.
Recommendations	<ul style="list-style-type: none"> • <i>The larger vegetation remnants are recommended to be retained in conservation areas which has been done.</i> • <i>The style of fences cutting the remnant vegetation should enable the exchange of flora and fauna.</i> • <i>Where possible firebreaks are not recommended to cut remnant vegetation.</i>

9.0 CAPABILITY FOR CHANGED LANDUSES

The following items are identified as the most likely to impact on the environment. These items can be managed by the implementation of the management recommendations. Other items are unlikely to impact or the impact is regarded as small.

9.1 Alternative Landuse and Land Capability

Currently the site is used for grazing. It lies in an area that is experiencing change to smaller lots with some urban sized lots, similar to those proposed for this subdivision.

The site is considered in this report as being suitable for small rural living as that land use is compatible with the local area.

The site is considered in this report as being suitable for urban lots because of its proximity to the Kalgan River and established facilities such as schooling.

It also provides for an alternative direction for urban development as Albany grows.

Change of landuse	
Potential Impact	<ul style="list-style-type: none"> The surrounding lots are already rural living and this subdivision will match those landuses.
Recommendations	<ul style="list-style-type: none"> No recommendations required.

9.2 Aesthetics

Aesthetics is the visual impact that the proposal may have on the local area.

The site is located in a gently sloping area on the eastern shore of the Kalgan Estuary.

The site is partially elevated from roads such as Nanarup Road and with the set back from that road, the visual impact risk is considered low apart from the dwelling on the western edge of the site on the gentle rise in that area.

Strategically located larger lots are proposed and, with the number of trees that are normally planted on such rural living lots, will provide adequate protection of the views from outside the site.

The main aims are to;

- Preserve the amenity of deriving from the scenic value of the Lower Kalgan Area.
- Maintain the integrity of landscapes in Lower Kalgan.
- Protect and enhance the landscape, scenic and townscape values through recommendations over design, building materials and siting of developments and land uses rather than prohibition of land use.

The proportion or impact of a dwelling that may be visible from the west will depend on a number of factors as listed below. In turn the minimisation of visual impact is to consider the listed factors and design accordingly. This is more likely to occur at the time of house and garden design and construction.

- The amount of cut that is used. The more cut the less the elevation of the fill.
- Additional trees that are normally planted on 2 000 m² plus lots, will provide adequate protection of the views from outside the site.

- Sympathetically designed and constructed developments can be used to minimise visual impact.
- The elevation of the fill. Dwellings can be pier construction rather than using fill.
- The type of dwelling, whether single or double storey.
- The pitch of the roof.
- The along slope dimension of the dwelling.
- The elevation of the trees to the west.
- The number of trees planted by a lot owner.
- Lot sizes.
- The colour and style of dwellings and other structures should be visually compatible with the area and to this end developments should be coloured, painted or colour bond sheeting used where applicable. The use of grey galvanised or zinc/alum sheeting should be avoided unless as an integral part of a development such as a roof on a "country style" home or shielded from key sight lines.

Analysis of Visual Impact and Recommended Management		
Potential Visual Impact	Visual	<ul style="list-style-type: none"> • The amount of visual impact is readily controlled and will occur as new landholders plant gardens. This will visually protect the site from adjoining lots. This will occur naturally as it does on many other similar subdivisions. • Larger lots of 0.2 to 1.0 hectare and larger are proposed.
Recommendations		<ul style="list-style-type: none"> • <i>Restrictions could be placed on the use of visually non compatible materials.</i> • <i>The colour and style of dwellings and other structures should be visually compatible with the area and to this end developments should be coloured, painted or colour bond sheeting used where applicable.</i>

9.3 Preservation of Agricultural Land

The Preservation of Agricultural land is a comment on the quality of the land for agricultural purposes. The quality of the land depends on a number of things such as the soils, water availability and surrounding land uses. The comments relate to effects the proposal may potentially have on sterilising, fragmenting or removing high quality land from production.

The land is relatively small and currently only of hobby size.

The soils are suitable for grazing but the small lot size and the changing local landuse provide for an acceptable loss of a small parcel of agricultural land.

Analysis of Agricultural Significance and Recommended Management	
Agricultural Significance	<ul style="list-style-type: none"> • There is a need for this type of lot size and the proposal represents a balanced compromise between the loss of agricultural land, the need for urban lots and better preservation of the remnant vegetation.
Recommendations	<ul style="list-style-type: none"> • Nil

9.4 Land Use Buffers

Land Use Buffers relate to the potential for land use conflicts between the proposed and existing land uses and dwellings. The buffers could relate to noise, dust, odour, spray drift or other potential conflicts.

Buffers to significant environmental features such as watercourses, wetlands, and heritage areas are also important and are considered separately.

The potential land uses, on site conditions, location and distance to other properties, do not require any particular buffers. The land uses are the same as proposed, rural living and increasingly smaller lots.

Land Use Buffers and Recommended Management	
Buffers	<ul style="list-style-type: none"> No particular buffers are required to adjoining land uses.
Recommendations	<ul style="list-style-type: none"> No significant buffers required.

9.5 Fire Control

Fire Management is a normal summer practice on all properties. The risk can be reduced through a range of activities such as the provision of fire breaks, providing fuel reduction zones, grazing or slashing and the provision of emergency facilities, procedures and exits.

Fire risk is best described in FESA, 2001, Planning for Fire, Fire and Emergency Services Authority of Western Australia.

Dwellings can be designed to comply with Australian Standard 3959 to assist in protection.

Fire Control falls under the *Bush Fires Control Act 1954* (as amended) and the City of Albany bylaws.

The main issues with fire management are the reduction in fuel, the maintenance of firebreaks, the availability of machinery and water to fight fires and the provision of emergency escapes. The location adjacent to the townsite is close to existing facilities.

Planning For Fire, 2010 (WAPC and FESA) provides guidance on the management of the subdivision-rural land and pasture interface. The requirements for fuel reduction zones is also addressed.

Much of the land is similar to other sites on the perimeter of the Albany Townsite and therefore the fire management issues will be similar.

The management of fire risk can be dealt with through the use of a Fire Risk Assessment and a Fire Management Plan

REPORT ITEM PD132 REFERS

Land Capability - Geotechnical Assessment and Water Management Strategy
Lot 422 Swan Point Road, Lower Kalgan

Fire and Recommended Management	
Fire Management	<ul style="list-style-type: none">• The change to fire risk is best addressed through a Fire Management Plan.• There are standard conditions on the number of fire hydrants, water sources and access points for small rural subdivisions.• The dam is already in place for emergency water supply from helitanker.• The fire risks of this site are no different to any other subdivision of this type in the local area. The supplies of water across the site and the provision of better access will assist with risk management.
Recommendations	<ul style="list-style-type: none">• <i>Compliance with Bush Fires Control Act 1954 (as amended) and the City of Albany bylaws.</i>• <i>A Fire Risk Assessment and Fire Management Plan is recommended.</i>

REFERENCES

- Allen D G and R C Jeffery, 1990, *Methods for Analysis of Phosphorous in Western Australian Soils*, Chemistry Centre Report on Investigation No 37.
- ANZECC, 1992, *Australian Water Quality Guidelines for Fresh and Marine Waters*.
- Appleyard S J 1993, *Explanatory Notes for the Groundwater Vulnerability to Contamination Maps of the Perth Basin*, Geological Survey of Western Australia, Record 1993/6.
- ATA, 2001, *Vegetation Survey of the Albany Hinterland*, City of Albany
- Australian Health and Medical Research Council, 1996, *Australian Drinking Water Guidelines*.
- Berkman D A, 1995, *Field Geologists Manual*, The Australian Institute of Mining and Metallurgy.
- Coles and Moore, 1998, *Runoff and Water Erosion*, IN Soil Guide, WA Department of Agriculture, Bulletin 4343.
- Dames and Moore, undated, *Nitrate Management* in the Jandakot UWPCA.
- Data from Select Committee on Metropolitan Development and Groundwater Supplies, Legislative Assembly 1994.
- Dawes L and A Goonetilleke, 2001, *The importance of site assessment in designing effluent disposal areas*, Proceedings of the 2nd Australia and New Zealand Conference on Environmental Geotechnics - Geoenvironment, University of Newcastle New South Wales.
- Department of Environment WA, 2004, *Stormwater Management Manual for Western Australia*.
- Department of Health, 2001, *Code of Practice for the Design, Manufacture, and Operation of Aerobic Treatment Units Servicing Single Dwellings*
- Department of Natural Resources, and Department of Local Government and Planning, Queensland, 1997, *Planning Guidelines Separating Agricultural and Residential Land Uses*.
- Department of Water, September 2006, *Wastewater treatment – on site domestic systems*, Water Quality protection Note.
- Department of Water. 2008, *Better Urban Water Management*.
- Engineers Australia 2003, *Australian Runoff Quality*, National Committee on Water Engineering.
- Environment Australia, 2002, *Introduction to Urban Stormwater Management in Australia*.
- Environmental Protection Authority Victoria/ Melbourne Water, undated, *Urban Stormwater, Best Practice Environmental Management Guidelines*
- EPA Bulletin 711, 199, *Western Australian Water Quality Guidelines for Fresh and Marine Waters*.
- FESA, 2001, *Planning for Fire*, Fire and Emergency Services Authority of Western Australia.

Gerritse et al, 1995, *Retention of Nitrate and Phosphate in Soils of the Darling Plateau in Western Australia: Implications for Domestic Septic Tank Systems*, Aust. J. Soil Res. 33, 36367.).

Gerritse R G and J A Adeney, *Nutrient export from various land uses on the Darling Plateau in Western Australia*, CSIRO Report 92141.

Gerritse R G, C Barber and J A Adeney, 1990, *The Impact of Residential Urban Areas on Groundwater Quality: Swan Coastal Plain, Western Australia*, CSIRO Water Resources Series No 3.

Gerritse R, 1993, *The influence of landuse and soil type on nutrient losses*, IN Swan River - The Future, Swan River Trust Report No 8.

Government of Western Australia, 2003, *Health (Treatment of Sewage and Disposal of Effluent and Liquid Waste) Regulations 1974, Health Act 1911*.

Guidelines for Groundwater Protection in Australia, ARMCANZ, ANZECC, September 1995.

Jones T, M Middleton and N Corby, 2005, *Natural hazard risk in Perth, Western Australia*, Australian Government, Geoscience Australia.

King P D and M R Wells, 1990, *Darling Range Rural Land Capability Study*, Department of Agriculture and Food Land Resources Series No 3

Muhling P C and A T Brakel, 1985, *Mount Barker - Albany 1 : 250 000 Geological Series*, Geological Survey of Western Australia.

Poinke H B, M L Sharma and J K Hosking, *Effect of Irrigated Horticultural Cropping on Groundwater Quality: Swan Coastal Plain, Western Australia*, CSIRO Water Research Series No 2.

Van Gool D, K Angell and Lindsay Stephens, 2000, *Stocking Rate Guidelines for Rural Small Holdings, Swan Coastal Plain and Darling Scarp, Western Australia*, Department of Agriculture, Miscellaneous Publication 02/2000.

Water and Rivers Commission, 1998, *Manual for Managing Urban Stormwater Quality in Western Australia*.

Water and Rivers Commission, 1998, *Stabling and Agistment of Horses*, Water Quality Protection Note.

Wells M R and P D King, 1989, *Land Capability Assessment Methodology*, Western Australian Department of Agriculture.

Whitehead J H and P M Geary, 2005, *Geotechnical Challenges for Onsite Wastewater Management in the Hunter Region*, Australian Geomechanics Vol 40, No 2, June 2005.

ACID SULFATE ASSESSMENT FORM

This assessment sheet is modified from Planning Bulletin 64, Draft December 2003.

Location	Lots LOT 422 Swan Point Road, Lower Kalgan
Date	Field work 29 July and 4 October 2009

	QUESTION	YES	NO	COMMENT
STEP 1				
1	Is the land depicted in Figures 1 - 10 of the Western Australian Planning Commission's Planning Bulletin No 64: Acid Sulfate Soils, as having a "high risk of Actual Acid Sulfate Soil (AASS) and Potential Acid Sulfate (PASS) < 3 m from surface?"		X	Mapping does not extend this far
2a	Is the land located in an area whether depicted in Figures 1 - 10 or not, where site characteristics and local knowledge suggest that there is a significant risk of disturbing acid sulfate soils at this location?		X	The mapping does not suggest a risk apart from the estuarine soils. The land is elevated, generally well drained but drops to wet soils on the lower slopes and valley floor.
2b	Does site interpretation suggest that there is a significant risk of disturbing acid sulfate soils at this location; soils, peat or sulfides in rock?		X	No sulfide, peat or grey shales that contain sulfides or organic matter were observed. The western edge estuarine silt soils below the 2 - 3 m AHD contour are at risk of acid sulphate conditions if disturbed.
STEP 2		IF YES TO ANY OF THE ABOVE GO TO STEP 2		
3a	Are any dewatering works to be undertaken?		X	Not proposed and not recommended.
3b	Is the extraction of superficial groundwater likely to expose peaty soils?	?		It is possible if the estuarine soils are excavated.
4a	Is the surface elevation <= 5 m AHD and is excavation of >= 100 m ³ of soil proposed?	?		The western edge is <5 m AHD and there is one lot in that area in the north west. This land will be filled rather than excavated.
4b	Are drainage or earthworks likely to expose subsoils potentially susceptible to acid sulfate conditions?	?		The estuarine soils are excluded from subdivision, but could be subject to excavations depending on service locations.
5a	Is the surface elevation > 5 m AHD and is excavation of >= 100 m ³ with an excavation depth of >= 2 metres proposed in potential sulfide containing materials?		X	No excavations proposed. No sulfide materials were observed in the granitic rocks, no peat or organoferricrete was observed.
5b	Are peaty soils likely to be exposed through excavation		X	The vegetation in the north eastern and north western corners outside the building envelopes may require testing if they are to be disturbed.
5c	Are sulfide containing rocks or materials to be processed?		X	No mining and these geological materials are not present.
STEP 3		IF YES TO ANY OF THE ABOVE, CARRY OUT A PRELIMINARY SITE ASSESSMENT IN ACCORDANCE WITH DEPARTMENT OF ENVIRONMENT GUIDELINES		
6	Did the Preliminary Site Assessment reveal the presence of acid sulfate soils?	?		There is no risk on the development areas. There may be a risk from excavations for servicing outside the subdivision.
STEP 4		IF YES, CARRY OUT A DETAILED SITE ASSESSMENT IN ACCORDANCE WITH DEPARTMENT OF ENVIRONMENT AND CONSERVATION GUIDELINES		
7	Did the Detailed Site Assessment reveal the presence of acid sulfate soils?	?		See 6 above. The detailed soil mapping identified and excluded the at risk areas.
		IF YES, MODIFY THE DESIGN OF THE PROPOSAL OR PREPARE AN ACID SULFATE MANAGEMENT PLAN		

Comment	<i>There is no observable risk on the development areas. There may be a risk from excavations for servicing in the estuarine soils and the vegetation in the extreme north east and north west outside the building envelopes.</i>
---------	--

3

Available Reports	X	Geotechnical Report and 34 soil test holes and scattered pH tests.
	X	Preliminary Site Assessment Results
		Detailed Site Assessment Results and sampled assessments.
	X	The proposal has been designed to avoid disturbance of acid sulfate soils at this location
		Completed acid sulfate management plan

SIGNATURE

DATE.....

ASSESSORS NAME

Lindsay Stephens / Landform Research

Landform Research

Lindsay Stephens BSc (Geology), MSc (Botany), MEIANZ

25 Heather Road, Roleystone, WA 6111, Phone 9397 5145 Mem. Aus.Geomechanics Soc. - Mem. WA Env. Cons. Assoc.



Regolith and Hydrological Logs

Lindsay Stephens BSc (Geology) MSc (Botany)
25 Heather Road Roleystone 6111
Phone 9397 5145 Fax 9397 5350

Project		Site Assessed by	L Stephens
Location	Lot 422 Swan Point Road, Lower Kalgan	Date of Inspections	29 July and 4 October 2009

Test Hole Number	1	Natural Surface		
Location	29 July 2009	Base of Hole		
Test Hole Type	Backhoe	Depth		
Diameter		Depth of static water level		
Depth	Description	Comments		
0 - 110 mm	Dark grey sand	pH 5.5		
110 - 600 mm	Grey sand with minor water flow at the base.			
600 - 800 mm	Yellow plastic silty clay			
800 - 2400 mm	Grey silty sand with light grey clay and yellow vertical silty sand striping			
Groundwater	Minor water seepage at 600 mm			
Comment				

Test Hole Number	2	Natural Surface		
Location	29 July 2009	Base of Hole		
Test Hole Type	Backhoe	Depth		
Diameter		Depth of static water level		
Depth	Description		Comments	
0 - 100 mm	Dark brown sandy loam			
100 - 460 mm	Brown sandy loam		pH 6	
460 - 600 mm	Brown sandy loam with minor gravel			
600 - 850 mm	Light creamy brown gravelly loam, wet and light coloured to bleaching, but no seepages.			
850 - 1150 mm	Yellow silty loam			
1150 - 1400 mm	Pale yellow mottled granite saprolite?			
1400 - 1900 mm	Light creamy white granite saprolite with red and lighter mottles. Hole dry			
Groundwater	Water table not intersected			
Comment				

Test Hole Number	3	Natural Surface		
Location	29 July 2009	Base of Hole		
Test Hole Type	Backhoe	Depth		
Diameter		Depth of static water level		
Depth	Description	Comments		
0 - 120 mm	Grey brown sand			
120 - 600 mm	Light brown sand			
600 - 1400 mm	White granite saprolite and silty clay with red mottles			
Groundwater	Water table not intersected			
Comment				



Regolith and Hydrological Logs

Lindsay Stephens BSc (Geology) MSc (Botany)
25 Heather Road Rolleston 6111
Phone 9397 5145 Fax 9397 5350

Project		Site Assessed by	L. Stephens
Location	Lot 422 Swan Point Road, Lower Kalgan	Date of Inspections	29 July and 4 October 2009

Test Hole Number	4	Natural Surface		
Location	29 July 2009	Base of Hole		
Test Hole Type	Backhoe	Depth		
Diameter		Depth of static water level		
Depth	Description	Comments		
0 - 90 mm	Dark brown sand			
90 - 600 mm	Brown sand			
600 - 1400 mm	Laterite, yellow brown that can be fractured and broken			
1400 – 1450 mm	Silty sand			
Groundwater	Water table not intersected			
Comment				

Test Hole Number	5	Natural Surface		
Location	29 July 2009	Base of Hole		
Test Hole Type	Backhoe	Depth		
Diameter		Depth of static water level		
Depth	Description		Comments	
0 - 110 mm	Dark grey sand			
110 - 650 mm	Light grey sand		pH 5.5	
650 - >900 mm	Laterite duricrust			
600 - 850 mm	Light creamy brown gravelly loam, wet and light coloured to bleaching, but no seepages.			
Groundwater	Water table not intersected			
Comment				

Test Hole Number	6	Natural Surface		
Location	29 July 2009	Base of Hole		
Test Hole Type	Backhoe	Depth		
Diameter		Depth of static water level		
Depth	Description	Comments		
0 - 50 mm	Dark grey sand			
50 - 420 mm	Grey sand			
420 - 610 mm	Grey sand with large gravel particles			
610 - 800 mm	Laterite duricrust over yellow silty clay			
Groundwater	Water table not intersected			
Comment				

Test Hole Number	7	Natural Surface		
Location	29 July 2009	Base of Hole		
Test Hole Type	Backhoe	Depth		
Diameter		Depth of static water level		
Depth	Description	Comments		
0 - 150 mm	Dark grey	pH 4.5		
150 - 480 mm	Grey sand			
480 - 760 mm	Dark brown organoferricrete	pH 5		
760 - 870 mm	Yellow brown laterite			
870 - 1400 mm	Yellow clay silt with lighter yellow and darker yellow mottles			
1400 - 1800 mm	Light coloured clay silt with red brown and yellow mottles			
Groundwater	Water table not intersected			
Comment				



Regolith and Hydrological Logs

Lindsay Stephens BSc (Geology) MSc (Botany)
25 Heather Road Roleystone 6111
Phone 9397 5145 Fax 9397 5350

Project		Site Assessed by	L. Stephens
Location	Lot 422 Swan Point Road, Lower Kalgan	Date of Inspections	29 July and 4 October 2009

Test Hole Number	8	Natural Surface		
Location	29 July 2009	Base of Hole		
Test Hole Type	Backhoe	Depth		
Diameter		Depth of static water level		
Depth	Description		Comments	
0 - 350 mm	Light grey sand			
350 - 460 mm	White sand			
460 - 600 mm	Brown sandy loam with minor gravel			
600 - 850 mm	Light creamy brown gravelly loam, wet and light coloured to bleaching, but no seepages.			
Groundwater	Water table not intersected and no seepages noticed although it is felt that the water table will be at 900 – 1000 mm if left for as sufficient time.			
Comment				

Test Hole Number	9	Natural Surface		
Location	29 July 2009	Base of Hole		
Test Hole Type	Backhoe	Depth		
Diameter		Depth of static water level		
Depth	Description		Comments	
0 - 80 mm	Dark grey brown sand		pH 5	
80 - 600 mm	Grey sand			
600 - 670 mm	Yellow brown laterite			
Groundwater	Water table not intersected			
Comment				

Test Hole Number	10	Natural Surface		
Location	29 July 2009	Base of Hole		
Test Hole Type	Backhoe	Depth		
Diameter		Depth of static water level		
Depth	Description	Comments		
0 - 200 mm	Dark grey sand	pH 5.5		
200 - 350 mm	Grey sand			
350 - 800 mm	White sand			
800 - 1100 mm	Yellow brown laterite, could not penetrate			
Groundwater	Small seepage at 750 mm.			
Comment				

Test Hole Number	11	Natural Surface		
Location	29 July 2009	Base of Hole		
Test Hole Type	Backhoe	Depth		
Diameter		Depth of static water level		
Depth	Description		Comments	
0 - 100 mm	Dark grey sand			
100 - 640 mm	Light grey sand			
640 - 800 mm	Yellow brown laterite			
Groundwater	Water table not intersected			
Comment				



Regolith and Hydrological Logs

Lindsay Stephens BSc (Geology) MSc (Botany)
25 Heather Road Rolleston 6111
Phone 9397 5145 Fax 9397 5350

Project		Site Assessed by	L Stephens
Location	Lot 422 Swan Point Road, Lower Kalgan	Date of Inspections	29 July and 4 October 2009

Test Hole Number	12	Natural Surface		
Location	29 July 2009	Base of Hole		
Test Hole Type	Backhoe	Depth		
Diameter		Depth of static water level		
Depth	Description		Comments	
0 - 50 mm	Dark grey sand			
50 - 560 mm	Light grey sand			
560 - 940 mm	Laterite gravel and duricrust. Could not penetrate.			
Groundwater	Water table not intersected			
Comment				

Test Hole Number	13	Natural Surface		
Location	29 July 2009	Base of Hole		
Test Hole Type	Backhoe	Depth		
Diameter		Depth of static water level		
Depth	Description	Comments		
0 - 30 mm	Dark grey sand			
30 - 320 mm	Grey sand			
320 - 840 mm	White sand			
840 - 1050 mm	Laterite gravel and duricrust. Could not penetrate.			
Groundwater	Water table not intersected			
Comment				

Test Hole Number	14	Natural Surface		
Location	29 July 2009	Base of Hole		
Test Hole Type	Backhoe	Depth		
Diameter		Depth of static water level		
Depth	Description		Comments	
0 - 90 mm	Dark grey sand			
90 - 330 mm	Light grey sand			
330 - 710 mm	White sand			
710 - 720 mm	Dark brown stained sand			
720 - 1340 mm	Yellow clay silt with darker mottles			
1340 - 1750 mm	White clay silt with red brown mottles			
Groundwater	Water table not intersected			
Comment				

Test Hole Number	15	Natural Surface		
Location	29 July 2009	Base of Hole		
Test Hole Type	Backhoe	Depth		
Diameter		Depth of static water level		
Depth	Description		Comments	
0 - 30 mm	Dark grey sand			
30 - 490 mm	Grey sand			
490 - 700 mm	Brown sandy loam with minor gravel			
700 - 850 mm	Laterite gravel and duricrust, yellow brown. Could not penetrate			
Groundwater	Water table not intersected			
Comment				



Regolith and Hydrological Logs

Lindsay Stephens BSc (Geology) MSc (Botany)
25 Heather Road Rolleston 6111
Phone 9397 5145 Fax 9397 5350

Project		Site Assessed by	L Stephens
Location	Lot 422 Swan Point Road, Lower Kalgan	Date of Inspections	29 July and 4 October 2009

Test Hole Number	16	Natural Surface		
Location	4 October 2009	Base of Hole		
Test Hole Type	Hand Auger	Depth		
Diameter		Depth of static water level		
Depth	Description	Comments		
0 - 100 mm	Dark brown sand			
100 - 650 mm	Brown sand			
650 mm	Light brown gravel			
Groundwater	Water table not intersected			
Comment				

Test Hole Number	17	Natural Surface		
Location	4 October 2009	Base of Hole		
Test Hole Type	Hand auger	Depth		
Diameter		Depth of static water level		
Depth	Description	Comments		
0 - 250 mm	Brown gravel			
250 - 550 mm	Light brown gravel			
Groundwater	Water table not intersected			
Comment				

Test Hole Number	18	Natural Surface		
Location	4 October 2009	Base of Hole		
Test Hole Type	Hand auger	Depth		
Diameter		Depth of static water level		
Depth	Description		Comments	
0 - 350 mm	Grey sand			
350 - 600 mm	White sand			
Groundwater	Water at 480 mm			
Comment				

Test Hole Number	19	Natural Surface		
Location	4 October 2009	Base of Hole		
Test Hole Type	Hand auger	Depth		
Diameter		Depth of static water level		
Depth	Description	Comments		
0 – 620 mm	Grey sand			
620 - > 800 mm	White sand			
Groundwater	Water table 620 mm			
Comment				



Regolith and Hydrological Logs

Lindsay Stephens BSc (Geology) MSc (Botany)
25 Heather Road Rolleston 6111
Phone 9397 5145 Fax 9397 5350

Project		Site Assessed by	L Stephens
Location	Lot 422 Swan Point Road, Lower Kalgan	Date of Inspections	29 July and 4 October 2009

Test Hole Number	20	Natural Surface		
Location	4 October 2009	Base of Hole		
Test Hole Type	Hand auger	Depth		
Diameter		Depth of static water level		
Depth	Description	Comments		
0 - 500 mm	Dark grey sand			
500 mm	Light brown sand			
Groundwater	Water table 600 mm			
Comment				

Test Hole Number	21	Natural Surface		
Location	4 October 2009	Base of Hole		
Test Hole Type	Hand auger	Depth		
Diameter		Depth of static water level		
Depth	Description	Comments		
	Grey sand over white sand at depth			
Groundwater	Water table at 450 mm			
Comment				

Test Hole Number	22	Natural Surface		
Location	4 October 2009	Base of Hole		
Test Hole Type	Hand auger	Depth		
Diameter		Depth of static water level		
Depth	Description	Comments		
	Grey sand over white sand at depth			
Groundwater	Water table at 410 mm			
Comment				

Test Hole Number	23	Natural Surface		
Location	4 October 2009	Base of Hole		
Test Hole Type	Hand auger	Depth		
Diameter		Depth of static water level		
Depth	Description	Comments		
	Grey sand over white sand at depth			
Groundwater	Water table at 440 mm			
Comment				

Test Hole Number	24	Natural Surface		
Location	4 October 2009	Base of Hole		
Test Hole Type	Hand auger	Depth		
Diameter		Depth of static water level		
Depth	Description	Comments		
	Grey sand over white sand at depth			
Groundwater	Water table at 520 mm			
Comment				



Regolith and Hydrological Logs

Lindsay Stephens BSc (Geology) MSc (Botany)
25 Heather Road Roleystone 6111
Phone 9397 5145 Fax 9397 5350

Project		Site Assessed by	L Stephens
Location	Lot 422 Swan Point Road, Lower Kalgan	Date of Inspections	29 July and 4 October 2009

Test Hole Number	25	Natural Surface		
Location	4 October 2009	Base of Hole		
Test Hole Type	Hand auger	Depth		
Diameter		Depth of static water level		
Depth	Description		Comments	
	Grey sand over white sand at depth			
Groundwater Comment	Water table at 650 mm			

Test Hole Number	26	Natural Surface		
Location	4 October 2009	Base of Hole		
Test Hole Type	Hand auger	Depth		
Diameter		Depth of static water level		
Depth	Description		Comments	
	Grey sand over white sand at depth. Gravel at 800 mm.			
Groundwater	Water table at 500 mm			
Comment				

Test Hole Number	27	Natural Surface		
Location	4 October 2009	Base of Hole		
Test Hole Type	Hand auger	Depth		
Diameter		Depth of static water level		
Depth	Description		Comments	
	Grey sand over white sand at depth			
Groundwater	Water table at 600 mm			
Comment				

Test Hole Number	21	Natural Surface		
Location	4 October 2009	Base of Hole		
Test Hole Type	Hand auger	Depth		
Diameter		Depth of static water level		
Depth	Description		Comments	
	Grey sand over white sand at depth			
Groundwater Comment	Water table at 600 mm			

Test Hole Number	28	Natural Surface		
Location	4 October 2009	Base of Hole		
Test Hole Type	Hand auger	Depth		
Diameter		Depth of static water level		
Depth	Description		Comments	
	Grey sand over white sand at depth			
Groundwater	Water table at 850 mm			
Comment				



Regolith and Hydrological Logs

Lindsay Stephens BSc (Geology) MSc (Botany)
25 Heather Road Roleystone 6111
Phone 9397 5145 Fax 9397 5350

Project		Site Assessed by	L Stephens
Location	Lot 422 Swan Point Road, Lower Kalgan	Date of Inspections	29 July and 4 October 2009

Test Hole Number	29	Natural Surface		
Location	4 October 2009	Base of Hole		
Test Hole Type	Hand auger	Depth		
Diameter		Depth of static water level		
Depth	Description		Comments	
	Grey sand over white sand at depth			
Groundwater	Water table > 1000 mm			
Comment				

Test Hole Number	30	Natural Surface		
Location	4 October 2009	Base of Hole		
Test Hole Type	Hand auger	Depth		
Diameter		Depth of static water level		
Depth	Description		Comments	
	Grey sand over white sand at depth			
Groundwater	Water table > 1000 mm			
Comment				

Test Hole Number	31	Natural Surface		
Location	4 October 2009	Base of Hole		
Test Hole Type	Hand auger	Depth		
Diameter		Depth of static water level		
Depth	Description		Comments	
	Grey sand over white sand at depth			
Groundwater	Water table > 1000 mm			
Comment				

Test Hole Number	32	Natural Surface		
Location	4 October 2009	Base of Hole		
Test Hole Type	Hand auger	Depth		
Diameter		Depth of static water level		
Depth	Description		Comments	
	Grey sand over white sand at depth			
Groundwater	Water table > 1000 mm			
Comment				

Test Hole Number	33	Natural Surface		
Location	4 October 2009	Base of Hole		
Test Hole Type	Hand auger	Depth		
Diameter		Depth of static water level		
Depth	Description		Comments	
	Grey sand over white sand at depth			
Groundwater	Water table > 1000 mm			
Comment				



Regolith and Hydrological Logs

Lindsay Stephens BSc (Geology) MSc (Botany)
 25 Heather Road Roleystone 6111
 Phone 9397 5145 Fax 9397 5350

Project		Site Assessed by	L Stephens
Location	Lot 422 Swan Point Road, Lower Kalgan	Date of Inspections	29 July and 4 October 2009

Test Hole Number	34	Natural Surface		
Location	4 October 2009	Base of Hole		
Test Hole Type	Hand auger	Depth		
Diameter		Depth of static water level		
Depth	Description		Comments	
	Grey sand over white sand at depth			
Groundwater	Water table > 1000 mm			
Comment				

CONSTRAINTS ON SOILS FOR LAND USE AND DEVELOPMENT

	CONSTRAINTS IDENTIFIED	POSSIBLE ENVIRONMENTAL MANAGEMENT STRATEGIES
a	Soil permeability limitations	<ul style="list-style-type: none"> • Provide appropriate waste water disposal systems.
b	Foundation soundness	<ul style="list-style-type: none"> • Requires fill pads of sufficient depth to counteract potential clay or expanding sub-soils. • Organic subsoils may need to be removed if present.
c	Potential slope instability	<ul style="list-style-type: none"> • AS 2870 Site Class P generally applies to cut and fill. • Provide appropriate foundation design. • Upslope cutoff drains recommended. • Upslope water loading to be avoided. • Trees to be retained/planted. Pasture cover to be maintained
e	Water erosion risk	<ul style="list-style-type: none"> • Maintain soil cover of crops, pasture, trees or shrubs • Use contour drains and agricultural practices. • Stormwater to be controlled.
d	Steep slopes that require significant management	<ul style="list-style-type: none"> • Steep slopes that will require significant management to develop. • The slopes are often associated with a landscape feature. • Pier-pole foundations may be more appropriate than cut and fill. • Larger lot sizes recommended; > 1000 m².
f	Potential flooding	<ul style="list-style-type: none"> • Requires sand pad to be set sufficiently (0.5m) above highest known water level to minimise capillary effects. • Locate developments outside areas of flooding.
i	Subject to winter wet conditions or water logging risk in wet years.	<ul style="list-style-type: none"> • Alternative waste water treatment systems likely to be required. • Cut off drains and other drainage likely to be required. • Raise waste water disposal areas. • Fill may be required for developments. • Floor elevations to have clearance above water risk levels. • Reduce stock in winter.
k	Soil workability	<ul style="list-style-type: none"> • Remove or avoid rock, clay subsoils or other restrictions.
m	Low moisture availability of soil	<ul style="list-style-type: none"> • Manage or reduce stock to ensure pasture cover through summer. • Restrict clearing to building envelopes.
n	Low nutrient retention ability	<ul style="list-style-type: none"> • Alternative waste water treatment systems may be required. • Leach drains may need to be inverted or semi-inverted, banded by natural soil or impermeable membrane on downslope side. • Setback developments appropriate distances from water bodies/wetlands. • Use reticulated sewerage. • Feed stormwater through detention basins and swale drains. • Manage nutrient and fertiliser applications and stock • Restrict clearing to building envelopes. • Restrict the density of development.
o	Water pollution risk by overland flow	<ul style="list-style-type: none"> • Retain surface water in basins, use swale and grass filters. • Manage stock and potentially polluting land uses.
p	Potentially low microbial purification	<ul style="list-style-type: none"> • Alternative waste water treatment systems may be required. • Correctly install waste water systems. • Bund waste water disposal areas sufficiently.
r	Restricted rooting conditions	<ul style="list-style-type: none"> • Avoid rock, hardpan or other restrictions.
s	Water pollution risk by subsurface flow	<ul style="list-style-type: none"> • See (n) above.
t	Low topsoil nutrient retention	<ul style="list-style-type: none"> • See (n) above.
v	Remnant vegetation	<ul style="list-style-type: none"> • Restrict clearing to building envelopes. Maintain linkages.
w	Wind erosion risk	<ul style="list-style-type: none"> • Manage or reduce stock, irrigate and improve pasture. • Maintain vegetation/stubble cover through summer. • Restrict clearing to building envelopes.
x	Reduced ease of excavation	<ul style="list-style-type: none"> • Remove rock or avoid constrained areas.
y	Salinity risk	<ul style="list-style-type: none"> • Provide drainage and reduce ponding. • Plant deep rooted species including deep rooted crops.
z	Wetland conservation	<ul style="list-style-type: none"> • Exclude building envelopes and developments. • Provide appropriate buffer distances. • Place conservation covenants on wetlands and/or vegetation.
&	Potential for acid sulfate conditions	<ul style="list-style-type: none"> • Minimise deep excavations or bulk earthworks; use fill. • Neutralise removed affected soils. • Minimise or exclude dewatering and lowering of groundwater.
\$	Restricted water availability	<ul style="list-style-type: none"> • Water may be restricted for some horticulture land uses
#	Semi-inverted leach drains	<ul style="list-style-type: none"> • Leach drains should be semi-inverted, banded by natural soil or impermeable membrane on the downslope side.
@	Alternative waste water treatment system required	<ul style="list-style-type: none"> • Unsuitable for conventional septic systems. All lots will be required to use alternative waste water treatment systems to comply with Regulations, Policy and Department Guidelines.

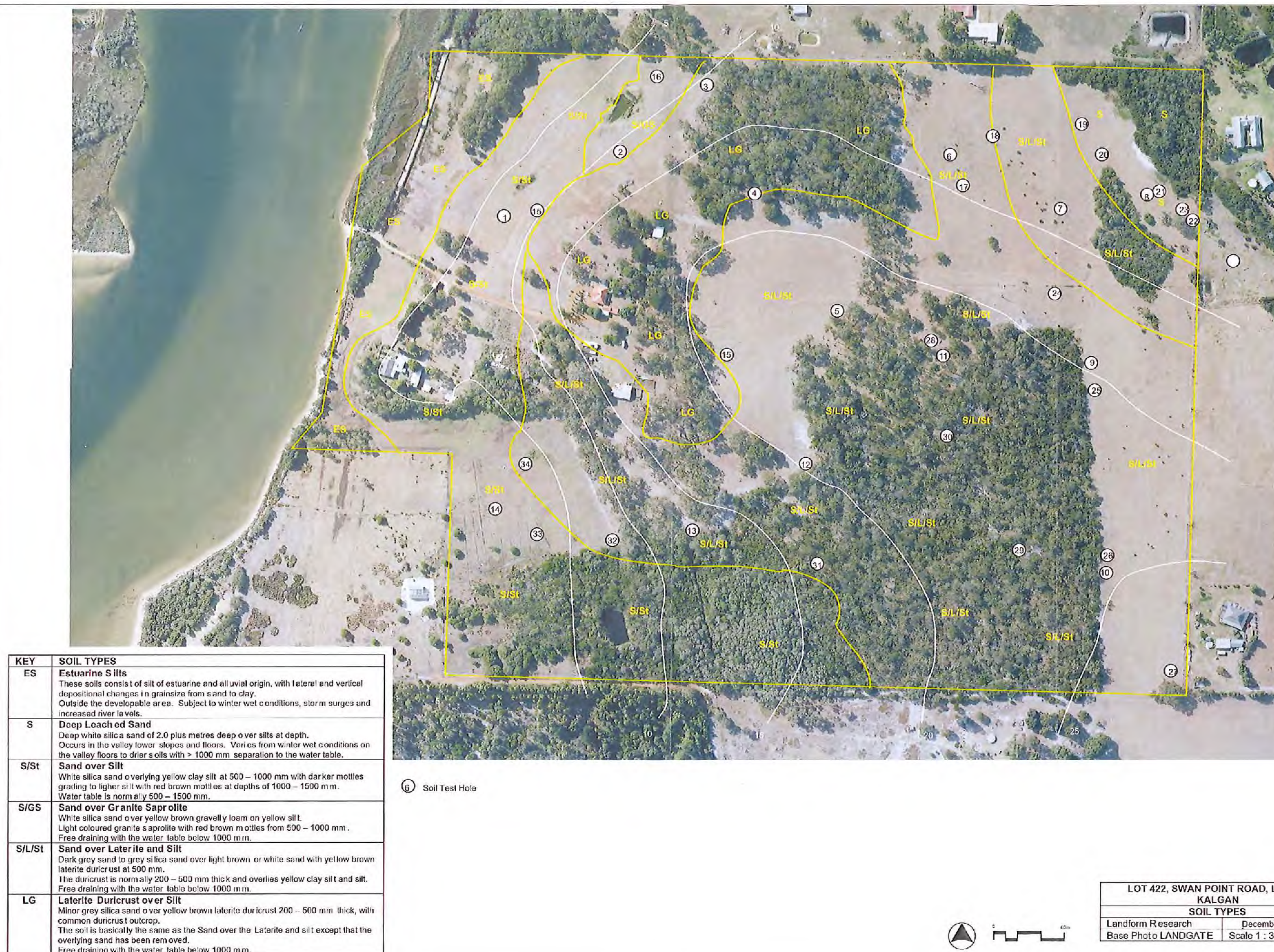




Figure 2



Figure 3



Figure 4



Typical of much of the site with pasture on well drained sand over laterite



Edge of the remnant Eucalypt Forest in the central south



Eastern edge of pasture with sand over laterite



Remnant Eucalypt Forest in the central south, showing the removal of all understorey native species



Remnant Eucalypt Forest in the central north, showing the grazing, reduction in species and exotic *Acacia longifolia*



Acacia longifolia incursion into remnant vegetation in the south



Wetland *Taxandria* spp Thicket in the central south



Wetland *Taxandria* spp Thicket in the central south



Eucalyptus megacarpa over *Taxandria* spp Thicket in the north east corner

LOT 422,
SWAN POINT ROAD,
LOWER KALGAN

Figure 5A



Test hole 2, showing well drained loam soils with high phosphate retention capability



Test Hole 1, showing sand over yellow silt, with the layer of clay at the top of the silt subsoils. NOTE Clay has been spread deeper down the hole by the bucket.

Dark grey sand
pH 5.5

Grey sand*

Yellow plastic
silty clay

Silt with yellow
and grey vertical
striping between
large peds



Loam silt soils that have high phosphate retention



Hole 8, showing deep sand, light grey over white to very pale brown



Typical soils of much of the site, with grey and white sand over laterite over yellow silt



Typical soils of much of the site, with grey and white sand over laterite over yellow silt



Open pasture with sand over laterite and yellow silt



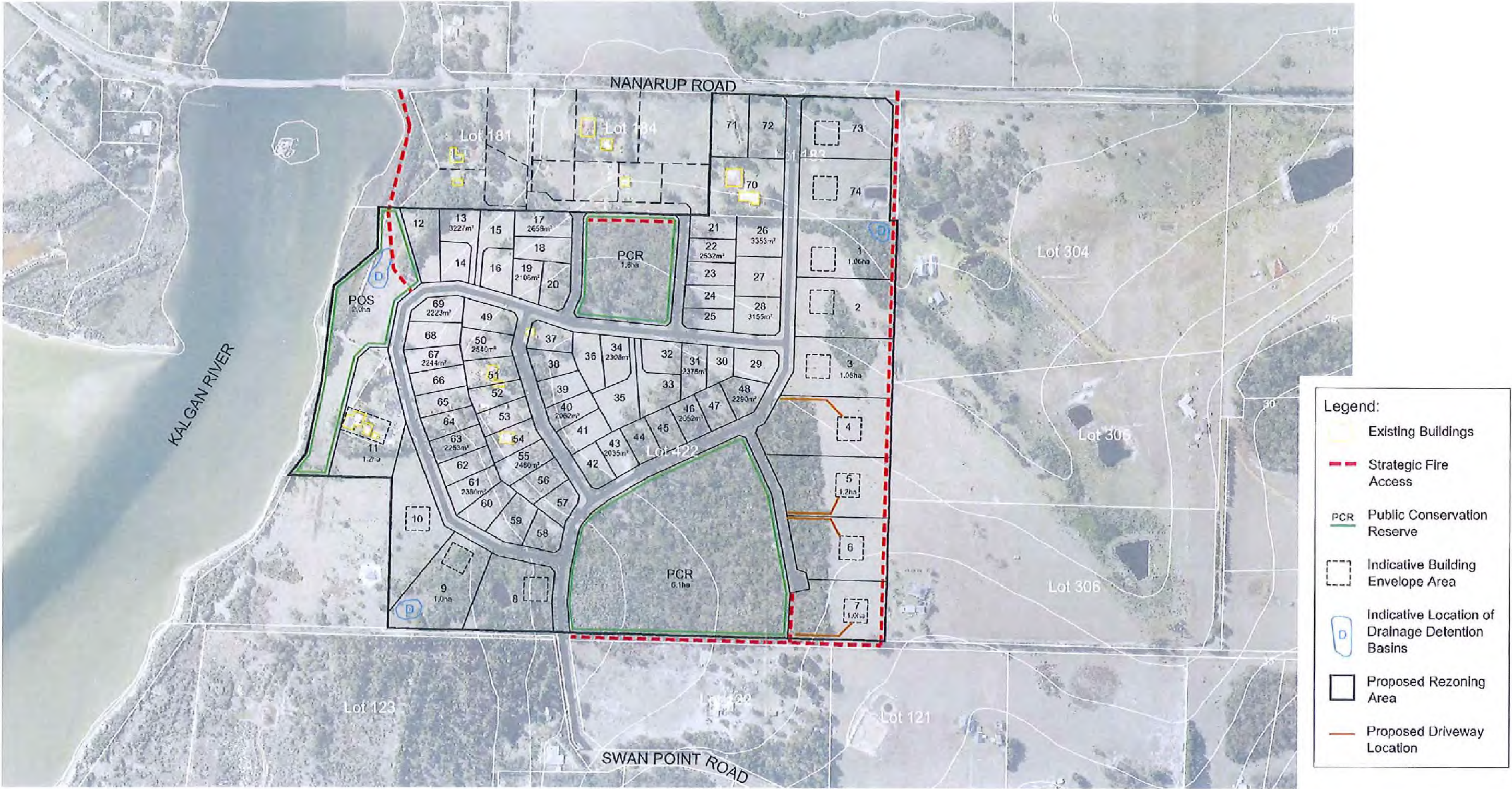
Yellow orange silt subsoils that has weak laterite developed at the top



North west corner showing, the estuarine soils from the well drained plateau edge

LOT 422,
SWAN POINT ROAD,
LOWER KALGAN

Figure 5B



SUBDIVISION GUIDE PLAN

Lots 422 Swan Point Road & 183 Nanarup Road, KALGAN



Subdivision, Rezoning, Structure
Planning, Development Planning,
Design, Advocacy
2953 Albany Highway,
Kelmesscott WA 6111
T: 9495 1947
F: 9485 1946
admin@dykstra.com.au

13 December 2010



1:5000 @ A3

Figure 6

Notes:
• This document may only be used for the purpose for which it was commissioned and in accordance with the Terms of Engagement.
• The dimensions, areas and number of lots are subject to survey and also the requirements of all authorities.
075996054-2-101213E

APPENDIX D – FIRE MANAGEMENT PLAN

**Lot 422 Swan Point
Road Lower Kalgan
WA**

Bushfire Management Plan



22/12/2015

Kathryn Kinnear

Bio Diverse Solutions

DOCUMENT CONTROL

TITLE

Lot 422 Swan Point Road Lower Kalgan Bushfire Management Plan

Author (s): Kathryn Kinnear

Reviewer (s): Scott Penfold

Job No. : HD025

Client: Harley Dykstra

REVISION RECORD

Revision	Summary	Revised By	Date
Draft Id 4/3/2015	Planning review	S.Penfold	04/03/2015
Draft Id 9/3/2015	Client review	Harley Dykstra	09/03/2015
Final Id 03/06/2015	Issued to client	K.Kinnear	03/06/2015
Final Id 22/12/2015	Updated with new guidelines and BAL mapping	K.Kinnear	22/12/2015

DISCLAIMER

The recommendations and measures contained in this assessment report are based on the requirements of the Australian Standards 3959 – Building in Bushfire prone Areas, , WAPC SPP3.7, Guidelines for Planning in Bushfire Prone Areas (WAPC, 2015) and CSIRO's research into Bushfire behaviour. These are considered the minimum standards required to balance the protection of the proposed dwelling and occupants with the aesthetic and environmental conditions required by local, state and federal government authorities. They DO NOT guarantee that a building will not be destroyed or damaged by a bushfire. All surveys and forecasts, projections and recommendations made in this assessment report and associated with this proposed dwelling are made in good faith on the basis of the information available to the fire protection consultant at the time of assessment. The achievement of the level of implementation of fire precautions will depend amongst other things on actions of the landowner or occupiers of the land, over which the fire protection consultant has no control. Notwithstanding anything contained within, the fire consultant/s or local government authority will not, except as the law may require, be liable for any loss or other consequences (whether or not due to negligence of the fire consultant/s and the local government authority, their servants or agents) arising out of the services rendered by the fire consultant/s or local government authority.



Bio Diverse Solutions
55 Peppermint Drive
Albany WA 6330

© Copyright: This document has been prepared by Bio Diverse Solutions for use by the client only, in accordance with the terms of engagement, and only for the purpose for which it was prepared.

CONTENTS

1.	INTRODUCTION	4
	1.1. STATUTORY CONDITIONS	4
	1.2. SUITABLY QUALIFIED BUSHFIRE CONSULTANT	5
2.	AIMS OF THIS PLAN	6
	2.1. PLANNING CONTEXT	6
	2.2. SITE INSPECTION	6
	2.3. OBJECTIVES	6
3.	DESCRIPTION OF THE AREA	7
	3.1. LOCATION	7
	3.2. DEVELOPMENT PROPOSAL	7
4.	DESKTOP ASSESSMENT – REGIONAL SETTING	8
	4.1. CURRENT SITE LAND USE	8
	4.2. SURROUNDING LAND USES	9
	4.3. CLIMATE	10
	4.3.1. RAINFALL	10
	4.3.2. TEMPERATURE	11
	4.3.3. WIND	11
	4.4. PREVALENT FIRE WEATHER	12
	4.5. CLIMATE CHANGE	13
	4.6. TOPOGRAPHY	13
	4.7. BUSHFIRE FUELS – VEGETATION	13
	4.8. ASSETS	16
	4.9. ACCESS	16
	4.10. WATER SUPPLY	16
	4.11. FIRE BREAKS	16
5.	POTENTIAL BUSHFIRE ISSUES AND BUSHFIRE HAZARDS	17
6.	BUSHFIRE MANAGEMENT/MITIGATION PLAN	19
	6.1. ELEMENT 1: LOCATION	19
	6.2. ELEMENT 2: SITING AND DESIGN OF DEVELOPMENT	20
	6.2.1. ASSET PROTECTION ZONES (APZ) (ACCEPTABLE SOLUTION A2.2)	20
	6.2.2. HAZARD SEPARATION (ACCEPTABLE SOLUTION A2.1)	21
	6.3. ELEMENT 3: VEHICLE ACCESS - PERFORMANCE CRITERIA	24
	6.3.1. TWO ACCESS ROUTES (A3.1)	24
	6.3.2. PUBLIC ROADS (A3.2)	24
	6.3.3. CUL DE SACS (A3.3)	24
	6.3.4. BATTLE AXES (A3.4)	24
	6.3.5. PRIVATE DRIVEWAYS (A3.5)	25
	6.3.6. EMERGENCY ACCESS WAYS (A3.6)	25
	6.3.7. FIRE SERVICE ACCESS ROUTES (A3.7)	25
	6.3.8. INDIVIDUAL FIRE BREAKS (A3.8)	25
	6.3.9. GATES	25
	6.3.10. SIGNAGE	26
	6.4. ELEMENT 4 WATER – PERFORMANCE CRITERIA	27
	6.4.1. RETICULATED AREAS (A4.1)	27
	6.4.2. NON-RETICULATED AREAS (A4.2)	27
	6.5. OTHER FIRE MITIGATION MEASURES	28
	6.5.1. EVAPORATIVE AIR CONDITIONERS	28
	6.5.2. BARRIER FENCING	28
	6.5.3. LANDSCAPING/STREETSCAPING AREAS	28
	6.5.4. STAGING	29
	6.5.5. FUEL HAZARD REDUCTION – PRESCRIBED BURNING	29
7.	CITY OF ALBANY FIRE PROTECTION PLAN	30
	7.1. FIRE FIGHTING FACILITIES	30
	7.2. FIRE SUPPRESSION ACTIONS CoA	30
	7.3. HOMEOWNER PROTECTION	30
	7.4. BUSHFIRE PLAN	31
8.	SUMMARY	32
	8.1. OVERALL FIRE THREAT	32
	8.2. FUTURE LOT OWNERS RESPONSIBILITY	33
	8.3. DEVELOPERS RESPONSIBILITY	34
	8.4. CITY OF ALBANY RESPONSIBILITY	35
9.	CONCLUSIONS	36
10.	REFERENCES	37

APPENDICES

- APPENDIX A – LOCATION MAPPING
- APPENDIX B – SUBDIVISION GUIDE PLAN
- APPENDIX C – VEGETATION MAPPING
- APPENDIX D – BAL CONTOUR PLAN
- APPENDIX E – BUSHFIRE HAZARD RATING
- APPENDIX F – DFES INFORMATION
- APPENDIX G – BUSHFIRE MANAGEMENT PLAN
- APPENDIX H – WORKS PROGRAM
- APPENDIX I – DFES CHECKLIST



1. Introduction

Harley Dykstra commissioned Bio Diverse Solutions (Bushfire Consultants) to undertake a bushfire hazard assessment and prepare a Bushfire Management Plan to guide all future bushfire management as part the planning process for a proposed subdivision development of Lot 422 Swan Point Road Lower Kalgan.

The basic requirements of any Bushfire Management Plan (BMP) is to identify potential issues or problems relating to environmental fire threats and recommend specific actions by certain persons, agencies, authorities and developers to ensure, as much as practical, that the lives and assets of the location are not put at undue threat from any unplanned fire event. A BMP takes into account various physical attributes of the land, including topographical and vegetation properties, local climatic impacts, biodiversity, past and current land use, past fire history and management practices, local authority fire management obligations, road access, water supplies, adjacent property and tenure, and future obligations by various parties should the subdivision application be successful.

Such planning takes into consideration standards and requirements specified in various documents such as Australian Standard (AS) 3959-2009, Guidelines for Planning in Bushfire Prone Areas (WAPC, 2015) and State Planning Policy 3.7 (WAPC, 2015). These plans have been developed to ensure uniformity with interpretation of onsite vegetation types, site design, and building standards.

The subject area is described as Lot 422 Swan Point Road Lower Kalgan and is shown in Appendix A and the Subdivision Guide Plan (SGP) at Appendix B.

1.1. Statutory Conditions

This Bushfire Management Plan has been prepared for Lot 422 Swan Point Road Lower Kalgan to address fire management issues associated with the proposed Subdivision Guide Plan (SGP). The BMP is consistent with State and Local Government planning instruments, in particular the Guidelines for Planning in Bushfire Prone Areas (WAPC, 2015) and State Planning Policy 3.7 (WAPC, 2015). The Plan aims to resolve any conflicts and provide planning information and guidance for the City of Albany (CoA), DFES, and present and future lot owners.

On the 7th December 2015 the *Fire and Emergency Services (Bush Fire Pone Areas) Order 2015; Planning and Development (Local Planning Scheme) Amendment Regulations 2015; Planning and Development Act 2005 State Planning Policy 3.7 - Planning in Bushfire Prone Areas* and the *Building Amendment Regulations (No.3)* were published in the WA Government Gazette. The Western Australian State Bushfire Prone Mapping was also publicly released.

This means that:

- **Emergency Services (Bush Fire Prone Areas) Order 2015:** 4 (1) *The areas of the state described in the Bushfire Prone Areas dataset are designated as bush fire prone areas.*
- **Planning and Development (Local Planning scheme) Amendment Regulations 2015:** 78D (1) *Unless subclause (2) applies, before commencing any development on a development site a person (the developer) must cause to be prepared a bushfire attack level assessment for the development site if the development site _*
 - (a) *is in a bushfire prone area; and*
 - (b) *has been in a bushfire prone area for a period of at least 4 months.*
- (2) *A developer is not required under subclause (1) to cause to be prepared a bushfire attack level assessment for a development site if:*
 - (a) *a BAL contour map has been prepared in relation to the development site; or*
 - (b) *because the terrain of the development site it is not possible to calculate the bushfire attack level of the development site.*
- **Planning and Development Act 2005 State Planning Policy 3.7 (SPP 3.7)- Planning in Bushfire Prone Areas:** *The intent of this 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. The application of SPP 3.7 applies to all higher order strategic*

planning documents, strategic planning proposals, subdivision and development applications located in designated bushfire prone areas.

- **Building Amendment Regulations (No.3):** Outlines the definition of the bushfire prone area as designated under the *Fire and Emergency Services Act 1998* Regulation 31BA applicable building standards for buildings and incidental structures in bushfire prone areas.

(WA Australian Government Gazette, 2015)

The publicly released bushfire prone mapping (Bushfire Prone Area Mapping, OBRM, 8/12/15) outlines the site to be Bushfire Prone as per the above regulations as is situated within 100m of >1 ha of bushfire prone vegetation. Refer to extract from the Office of Bushfire Risk Management (OBRM) as released in December 2015 Appendix A.

This document and the recommendations contained are aligned to the following policy and guidelines:

- AS 3959-2009 “Construction of Buildings in Bushfire Prone Areas” current and endorsed standards;
- “Planning for Bushfire Protection Edition 2” WAPC (2010);
- Draft “Planning for Bushfire Risk Management Guidelines (WAPC, 2014);
- *Bushfires Act 1954*;
- CoA Annual Fire Break Notice; and
- Proposed *Planning and Development (Bushfire Risk Management) Regulations 2014*.

1.2. Suitably Qualified Bushfire Consultant

This BMP has been prepared by Kathryn Kinnear (nee White), who has 10 years operational fire experience with the (formerly) DEC (1995-2005) and has the following accreditation in Bushfire Management:

- Incident Control Systems;
- Operations Officer;
- Prescribed Burning Operations;
- Fire and Incident Operations;
- Wildfire Suppression 1, 2 & 3;
- Structural Modules – Hydrants and hoses, Introduction to Structural Fires, and Fire extinguishers; and
- Ground Controller.

Kathryn Kinnear currently has the following Tertiary Qualifications:

- BAS Technology Studies & Environmental Management;
- Diploma Business Studies; and
- Graduate Diploma of Environmental Management.

Kathryn Kinnear is presently pending approval as a Level 1 BAL Assessor and is classified as an “Experienced Practitioner” pending provisional accreditation. Kathryn Kinnear is presently a member of Fire Protection Australia Association and a committee member of the Bushfire Subcommittee Western Australia. Kathryn is a suitably qualified Bushfire Practitioner to prepare this Bushfire Management Plan.

2. Aims of this Plan

The aim of this BMP is to reduce the occurrence of, and minimise the impact of bushfires, thereby reducing the threat to life, property and the environment. The BMP has been prepared by Bio Diverse Solutions (Bushfire Practitioner) for the client with the “Subject site” being Lot 422 Swan Point Road Lower Kalgan, see Appendix A.

2.1. Planning Context

The BMP has been prepared to support a Subdivision Guide Plan (SGP) proposal on Lot 422 Swan Point Road Lower Kalgan. The proposed Subdivision Guide Plan as prepared by Harley Dykstra is located in Appendix B.

2.2. Site inspection

To ensure that every aspect of the proposed subdivision meets the planning requirements as set out in Guidelines for Planning in Bushfire Prone Areas (2015) (Appendices, 2, 3 and 4), a site inspection was undertaken on the 29th January 2015 by Kathryn Kinnear (Bushfire Practitioner, Bio Diverse Solutions) to assess the vegetation and the site conditions.

The site was assessed as having a “**Moderate- Extreme**” bush fire hazard rating due to the presence of internal and adjacent Forest and Woodland vegetation.

The “Elements” which are to be met either through the objectives of the “Performance Principle” or “Acceptable Solutions” (WAPC, 2015) for the subject site include:

- Element 1 - Location;
- Element 2 - Siting and design of development.
- Element 3 - Vehicular access; and
- Element 4 – Water.

2.3. Objectives

The objectives of this BMP are:

- Achieve consistency with objectives and policy measures of SPP 3.7 (WAPC, 2015), AS3959-2009 (current and endorsed standards), and the Guidelines for Planning in Bushfire Prone Areas (2015);
- Understand and document the extent of the bushfire risk to the subject site
- Prepare bushfire risk management measures for bushfire management of all land within the subject area with due regard to people, property, infrastructure and the environment;
- Nominate individuals and organisations responsible for fire management and associated works within the subject area; and
- Aligned to the recommended assessment procedure which evaluates the effectiveness and impact of proposed, as well as existing, bushfire risk management measures and strategies.

3. Description of the area

3.1. Location

The subject site is 18 km north east of the Albany Central Business District (CBD), within the municipality of the City of Albany. The subject site is located in the locality of Lower Kalgan adjacent to Oyster Harbour/Kalgan River and consists of approximately 40ha with cleared paddock areas and remnant vegetation with two existing dwellings and a cottage on site. Please refer to Figure 1 below - Locality Map, and Site Location Mapping Appendix A.

Figure 1 – Subject site locality



3.2. Development proposal

The development at the subject site contemplates rural residential development with 23 new lots being created. The lot sizes range from 1.01ha to 3.44ha with building envelopes.

The BMP has been prepared as part of the planning process to prescribe bushfire management measures for the proposed development as State Planning Policy 3.7 Planning in Bushfire-Prone Areas (2015), and the Guidelines for Planning in Bushfire Prone Areas (2015) (Appendices, 2, 3 and 4).

Please refer to the proposed SGP in Appendix B.

4. Desktop Assessment – Regional Setting

4.1. Current site land use

The subject site has been traditionally used as a small farm for dairy, sheep and cattle. Most of the out buildings associated with the farm have been removed (sheds, cattle yards etc) with two dwellings and a small cottage remaining. Please refer to Photographs 1 and 2 below.



Photograph 1 – View of existing dwelling central to the property.



Photograph 2 – View of small cottage in the north of the property.

The paddock areas on the property have been regularly grazed (historically) or slashed (recently). There are areas of remnant vegetation and various dams located across the property. Refer to Photographs 3 -6.



Photograph 3 – View of grazed paddock areas, now maintained through slashing in the west of the property.



Photograph 4 – View of grazed paddock areas, now maintained through slashing in the north east of the property.



Photograph 5 – View of remnant vegetation on site.



Photograph 6 – View of dam located in the southern portion of the property.

4.2. Surrounding land uses

Adjacent to the subject site to the west is Oyster Harbour and the Kalgan River and associated foreshore/riverine areas. Please refer to Photographs 7 and 8 below.



Photograph 7 – View of Kalgan River to the west of the property and foreshore area (foreground).



Photograph 8 – View of Kalgan River and Oyster Harbour foreshore area adjacent to the property.

To the north, east and south there are small to large rural properties with remnant vegetation, cleared paddock areas and dwellings. Refer to Photographs 9 to 11.



Photograph 9 – View of property to the south west of the subject site.



Photograph 10 – View of property boundary and adjacent farm to the south east.



Photograph 11 – View of property to the north (north/east) also owned by the client.

4.3. Climate

The lower south-west of Western Australia has a Mediterranean climate with mild to moderately hot dry summers with cool evenings. Winters are typically cool and wet and are punctuated by periodic winter fronts bearing strong winds and rainfall (BOM, 2014).

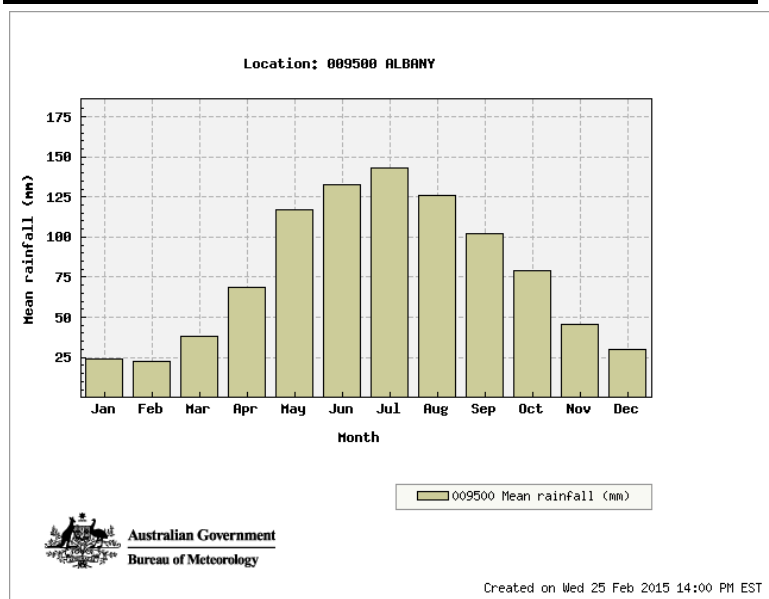
A major factor influencing Albany's climate is the Southern Ocean. The city is situated on the southern coast of WA and the ocean imparts a moderating influence via sea breezes in the warmer months and more generally through the effects of a relatively mild and moist air mass at any time of the year. Another significant factor is the position of a band of high pressure known as the sub-tropical ridge, and seasonal variations are mainly due to the north-south movement of this ridge.

An easterly broad scale flow prevails in summer when the ridge is south of the State. However, the movement of high pressure cells from west to east along this ridge brings a commonly repeated pattern of wind changes to south coast locations. Albany's south coast aspect means that the progression of winds from east through north, west, south and returning to east over periods of several days to a week or more during summer can bring a large variation in weather from fine and mild, to hot with thundery showers, to cool and cloudy with drizzle. When the ridge moves north in the cooler months, the moisture-laden westerly winds south of the ridge deliver much of Albany's annual rainfall. Atmospheric disturbances embedded in the westerly's are common in the winter months with sometimes several cold fronts passing through southwest WA in a week (BOM, 2014).

4.3.1. Rainfall

Albany's long-term median annual rainfall is approximately 927.8mm (BoM, 2015) (Albany BOM Station # 9500) though there can be considerable variation in the total rainfall from year to year. Approximately 72 per cent of the annual rainfall occurs between May and October. Although cold fronts are responsible for much of the recorded rainfall total, a moist onshore flow can occur in any season and bring showers or drizzle. Thus the area records rainfall on average 102.5 days annually (BOM, 2015).

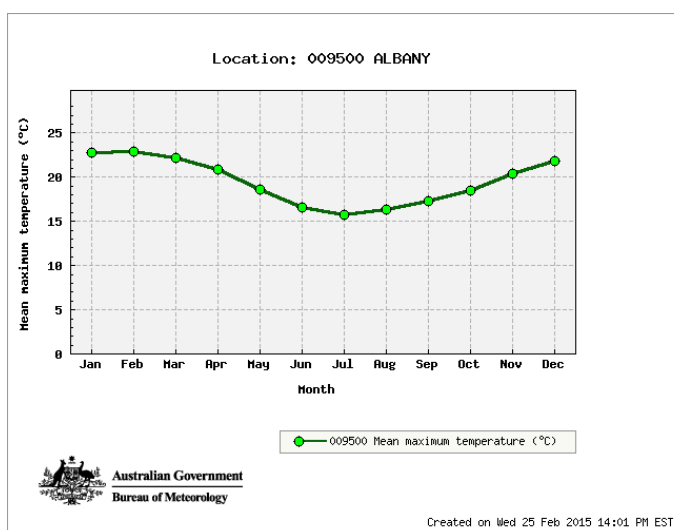
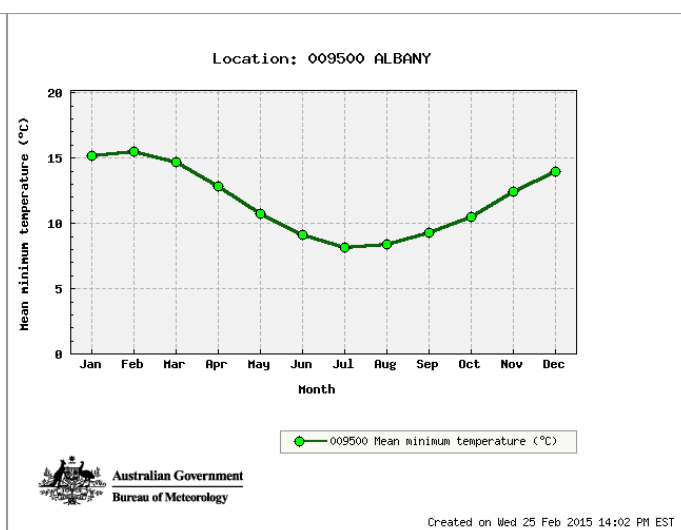
July is the wettest month, with the wettest month recorded in June 1970 of 421.5mm. Rain occurs on two days out of every three during an average winter. The driest month is February with a mean of 22.6mm and in winter the average is 143.1mm (July). In 2013 Albany recorded an annual rainfall of 967.8mm (2014 not available at time of printing). Please refer to Figure 2 - Mean Rainfall Albany from 1877-2014 (BOM 2014).

Figure 2 – BoM Rainfall for Albany BOM Station (9500)

4.3.2. Temperature

Average maximum temperatures peak in January and February in Albany, with monthly mean maximum temperatures of 20-22°C although temperatures above 35°C sometimes occur when hot, dry northerly winds arrive from the interior of WA. Overnight mean minimums also peak in January and February at a mild 14-15°C, on average.

Winter daily maximum temperatures average approximately 15.8°C (July), while the average mean minimum is approximately 8.2°C in July and August. Daily minimum temperatures below 5°C can be expected about once or twice a month in winter. Please refer to Figure 3 illustrating Average Temperatures Albany from 1880 to 2014 (BoM 2015).

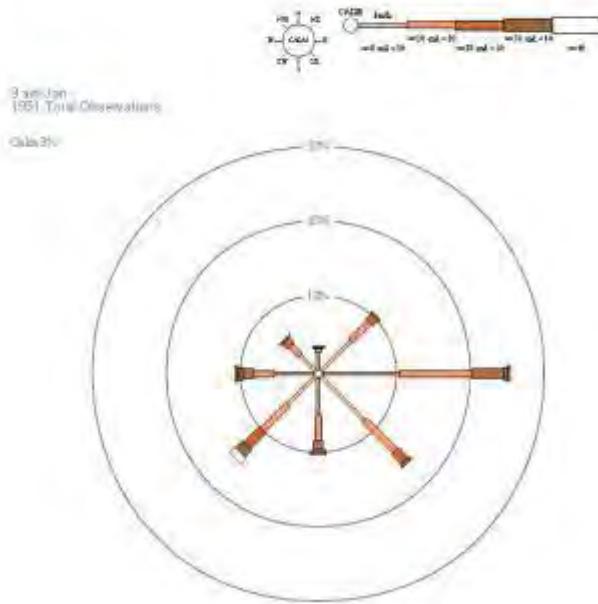
**Figure 3 –Mean Maximum Temperatures
Albany Station (BOM, 2015)****Figure 4 –Mean Minimum Temperatures
Albany Station (BOM, 2015)**

4.3.3. Wind

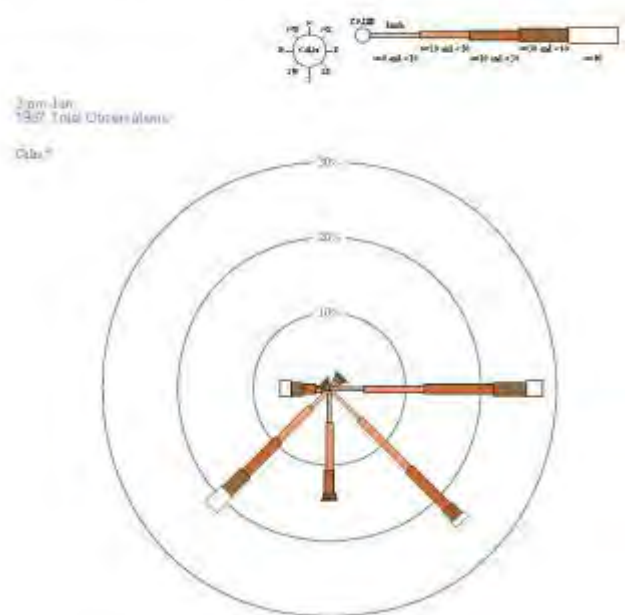
The dominant wind direction in summer is from the southwest, east and southeast and afternoon sea breezes occur from October to March. During winter, west and northwest wind prevail from which most storm events occur (BoM, 2015). Although fronts and depressions may bring strong to gale force winds, winter winds are more variable and generally lighter than those of summer. Please refer to Figure 4 and 5 (BoM, 2015).

Figure 4 – Summer (Jan) 9am and 3pm wind rose BoM

Rose of Wind direction versus Wind speed in km/h (01 Jan 1967 to 30 Sep 2010)
 Climate Data on Wind Speed and Direction for Albany
ALBANY
 Site No: 00550 - Opened Jan 1971 - 09/09/2010 - Lat: -35.025° - Long: 117.880° - Elevation: 3m
 An asterisk (*) indicates that data is less than 0.5%
 Other important info about this analysis is available in the accompanying notes



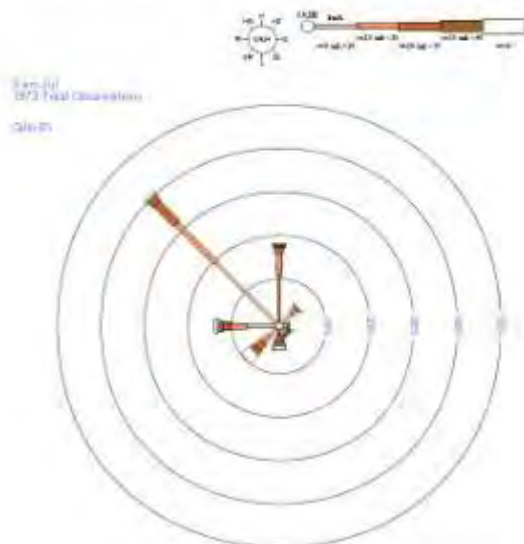
Rose of Wind direction versus Wind speed in km/h (01 Jan 1967 to 30 Sep 2010)
 Climate Data on Wind Speed and Direction for Albany
ALBANY
 Site No: 00550 - Opened Jan 1971 - 09/09/2010 - Lat: -35.025° - Long: 117.880° - Elevation: 3m
 An asterisk (*) indicates that data is less than 0.5%
 Other important info about this analysis is available in the accompanying notes



(Source BOM 2015)

Figure 5– Winter (Jul) 9am and 3pm wind rose BoM

Rose of Wind direction versus Wind speed in km/h (01 Jan 1967 to 30 Sep 2010)
 Climate Data on Wind Speed and Direction for Albany
ALBANY
 Site No: 00550 - Opened Jan 1971 - 09/09/2010 - Lat: -35.025° - Long: 117.880° - Elevation: 3m
 An asterisk (*) indicates that data is less than 0.5%
 Other important info about this analysis is available in the accompanying notes



Rose of Wind direction versus Wind speed in km/h (01 Jan 1967 to 30 Sep 2010)
 Climate Data on Wind Speed and Direction for Albany
ALBANY
 Site No: 00550 - Opened Jan 1971 - 09/09/2010 - Lat: -35.025° - Long: 117.880° - Elevation: 3m
 An asterisk (*) indicates that data is less than 0.5%
 Other important info about this analysis is available in the accompanying notes



(Source BOM 2015)

Figure 4 wind roses indicate there are variable morning (summer) breezes with strong afternoon winds from the south west, east and south east directions in dry, summer periods.

4.4. Prevalent Fire Weather

Fire weather is characterised by mid-level disturbances across the south west of Western Australia, bringing unstable atmospheric conditions (thunder and lightning) from the north or north-west wind directions. This is characteristic of “Extreme” Fire Weather conditions to the area with

hot dry conditions prior to storm events. Risk of lightning strikes, spark ignition, arson and other causes of fire give rise to wild fires under these conditions.

Prevalent winds which most wildfire events occur in the region are from the north-west, east and north-east direction. Conditions tend to be dry with low relative humidity. High winds and excess fuels can lead to hazardous conditions for residents.

Prevailing strong south west, south east and south easterly winds exist at the subject site during dry summer afternoon periods (Figure 4). These circumstances place the most risk from wildfire events. The vegetated private properties to the north east, and south pose a bushfire risk from prevailing winds during summer afternoon periods (Figure 4).

4.5. Climate Change

Climate change is expected to impact on the future rainfall pattern of the area. It is recognised that the average rainfall has already declined by 20%-30% over the past few decades and that the long term impact of climate change may lead to a shift in rainfall, as well as dryer climatic conditions for the region. The long term changes are predicted to impact on the flora, fauna and water availability for the region. (Climate Commission 2010)

The Climate Commission (Climate Commission 2010) estimates that

“...Rainfall patterns in Western Australia have changed over the last 40 years. There is significant evidence that climate change has contributed to the marked drying trend in the southwest of the state.”

The proposed subdivision could be affected from climate change through increased intensity rainfall events or extended drying periods. Increased extreme weather from climate change could affect fire frequency and behaviour in Western Australia (DEC, 2012), this BMP has been prepared to reduce the risk of bushfire on the environment and any adjacent properties.

4.6. Topography

The subject site is located on a gentle western facing ridge beside the Oyster Harbour Estuary and Kalgan River. The highest point is 25m AHD in the south east, with most of the site being at or on the 5-20m AHD. Please refer to Vegetation Mapping - Appendix C.

The “Effective slopes” (as per AS3959-2009) under the classifiable vegetation is measured between 2.2°-8.6° (degrees) with an average of 4.2° calculated over 7 slopes. Refer to the slope analysis on the Vegetation Mapping - Appendix C.

4.7. Bushfire fuels – Vegetation

The subject site lies within the Jarrah Forest IBRA bioregion, (JF2 – Jarrah Forest 2 subregion). This subregion is characterised by: *Jarrah-Marri forest on laterite gravels and, in the eastern part, by Wandoo - Marri woodlands on clayey soils. Eluvial and alluvial deposits support Agonis shrublands. In areas of Mesozoic sediments, Jarrah forests occur in a mosaic with a variety of species-rich shrublands.* (Hearn et al., 2002).

The vegetation has been mapped on a broad scale by JS Beard (Shepherd *et al* 2002) in the 1970's, where a system was devised for state-wide mapping and vegetation classification based on geographic, geological, soil, climate structure, life form and vegetation characteristics (Sandiford and Barrett 2010). A search of JS Beard's vegetation classification database for the general area places the site within 1 broad Vegetation Association for the site:

1. System Association: Kwoornicup

Vegetation Association number: 3

Vegetation Description: Medium forest; jarrah-marri (e2,3Mc)

Vegetation assessment was undertaken by Landform Research in 2010 (Stephens, L., 2010) whereby 6 vegetation communities were described across the subject site.

These were described as:

- Jarrah-Marri Low Forest;
- Peppermint Forest;
- Melaleuca Thicket;
- Estuarine low heath; and
- Eucalyptus-Taxandria Low Woodland; and Taxandria Thicket.

Refer to the full report from Landform Research (Stephens, L., 2010) for full vegetation descriptions, vegetation condition and mapping.

The site assessment revealed five vegetation types for the area (internal and external to the subject site) classified as per the AS3959-2009 criteria as:

- **Low Open Forest (Type A)** – *Trees over 30m high; 30-70% foliage cover (may include understorey of sclerophyllous low trees and tall shrubs or grass). Typically dominated by Eucalypts Casuarinas (AS3959-2009);* Internal and adjacent to the north and south in private property.
- **Woodland (Type B)** – *Trees 10 -30m high; 10-30% foliage cover dominated by Eucalypts; understorey low trees to tall shrubs dominated by Acacia, Callitris or Casuarinas (AS3959-2009);* Internal Jarrah/marri Woodland and Peppermint Woodland which has been grazed/parkland cleared.
- **Scrub (Type D)** - *Found in areas wet enough to support eucalypt trees, which are affected by poor soil fertility or shallow soils. >30% foliage cover. Dry heaths occur in rocky areas. Shrubs 1-2m high. Typical of coastal wetlands (AS3959-2009) located in the Oyster Harbour and Kalgan River foreshore areas.*
- **Grassland (Type G)** – *Open paddock areas, overstorey foliage <10%. (AS3959-2009),* internal and adjacent to the subdivision.
- **Low threat vegetation (AS3959-2009)** – *Non- Vegetated areas, including waterways, roads, footpaths, buildings and rocky outcrops; and Low threat vegetation including managed grassland, maintained lawns, golf courses, maintained public reserves and parklands, botanical gardens, vineyards, orchards, cultivated ornamental gardens, commercial nurseries, nature strips and wind breaks (AS3959-2009). Internal existing dwellings, gravel pit, roads and dams.*

These assessments are based on dominant tree heights and vegetation structure according to Table 2.3 AS3959-2009 and are located within 100m of the boundary of the subject site. Please refer to Photographs 12 to 21 showing vegetation types classified as per AS3959-2009 (and descriptions above) and also shown in Vegetation Mapping Appendix C.



Photograph 12 – View of Woodland Type B along dominant ridge, Jarrah/Marri parkland cleared.



Photograph 13 – View of Woodland Type B in central east side of subject area, Jarrah/Marri parkland cleared.



Photograph 14 – View of Forest type A – Low open Jarrah/Marri forest in the south east of subject area.



Photograph 15– View of Forest type A – Low open Jarrah/Marri forest in the north of subject area



Photograph 16 – View of Grasslands Type G to the north east of the subject site.



Photograph 17– View of Grasslands Type G from the property to the south east of the subject site.



Photograph 18 – View of Low Threat Vegetation – dam and banks, Forest Type A in background (*Taxandria juniperina*).



Photograph 19– View of Low threat vegetation around existing building central to the subject site. View from the east.



Photograph 20 – View of Shrublands Type D to the west of subject area along the Oyster Harbour/Kalgan River foreshore.



Photograph 21– View of Shrublands Type D to the west of subject area along the Oyster Harbour/Kalgan River foreshore.

4.8. Assets

The subject site is predominantly cleared of remnant vegetation with no infrastructure, once developed, the values which will be potentially affected by bushfire include:

- **Human lives:** It is likely that more than 60-90 people could be resident at the newly created subdivision;
- **Assets:** The development will contain dwellings and valuable infrastructure; and
- **Environmental Conservation Values:** there will be remnant flora and fauna protected in the adjacent foreshore reserve at the Oyster Harbour/Kalgan River and conservation of flora and fauna in “Vegetation Protection Zones” across the site (see SGP Appendix B).

4.9. Access

Vehicle access to the subject site is from presently along Affleck Road off Nanarup Road.

4.10. Water Supply

There is presently mains scheme water supplied to the existing dwellings on site.

4.11. Fire Breaks

There are existing firebreaks around the property, refer to Photograph 22 below.



Photograph 22– View of firebreak along the southern boundary of the subject site.

5. Potential Bushfire Issues and Bushfire Hazards

The bushfire hazard assessment provides a measure of the fire intensity and likelihood of bushfire attack measures on a dwelling, subdivision or residential area (Planning for Bushfire Protection, Edition 2 2010). This measure can provide an assessment of the land for suitability for residential construction and takes into account:

1. Vegetation Assessment – type and class in each direction;
2. Distance - between the predominant vegetation class and proposed building;
3. Topography and slope – with reference to accessibility; and
4. Land use – surrounding and internal to the proposal.

(Refer to Planning for Bushfire Protection, Edition 2, WAPC 2010)

The Vegetation type for the subject site and adjacent (to 100m from boundary) has been classified as per AS3959-2009 as Forest Type A, Woodland Type B, Shrubland Type D, Grassland Type G and Low threat Vegetation (as per vegetation classifications outlined in AS3959-2009). The bushfire hazard (risk) ratings have been assessed as per the methodology as outlined in the Guidelines for Planning in Bushfire Prone Areas (2015) (Appendix 2). Please refer to Table 1 below.

Table 1 – Bushfire Hazard Level Categories

Table 3: Hazard levels and characteristics

HAZARD LEVEL	CHARACTERISTICS
Low	<ul style="list-style-type: none"> • devoid of standing vegetation (less than 0.25ha cumulative area); • areas which, due to climatic conditions or vegetation (e.g. rainforest), do not experience bushfires; • inner urban or suburban areas with maintained gardens and very limited standing vegetation (less than 0.25ha cumulative area); • low threat vegetation, including grassland managed in a minimal fuel condition (i.e. to a nominal height of 100mm), maintained lawns, vineyard and orchards; and • pasture or cropping areas with very limited standing vegetation that is shrubland, woodland or forest with an effective up slope*, on flat land or an effective down slope* of less than 10 degrees, for a distance greater than 100 metres;
Moderate	<ul style="list-style-type: none"> • areas containing pasture or cropping with an effective down slope* in excess of 10 degrees for a distance greater than 100 metres; • unmanaged grasslands; • open woodlands; • open shrublands; • low shrubs on areas with an effective up slope*, on flat land or an effective down slope* of less than 10 degrees, for a distance greater than 100 metres or flat land; • suburban areas with some tree cover; and • forest and woodlands with a permanent grass understorey or at most, a scrub understory structure consisting of multiple areas of <0.25ha and not within 20 metres of each other or single areas of <1ha and not within 100 metres of other scrub areas.
Extreme	<ul style="list-style-type: none"> • forests with a scrub understorey which is multi-tiered; • woodlands with a scrub understorey which is multi-tiered; • tall shrubs; and • any area of vegetation not otherwise categorised as low or moderate.

(WAPC, 2015)

Internal Bushfire Risks

The subject site has regular slashing of the cleared paddock areas, firebreaks, and around infrastructure at least twice a year and is presently Grassland Vegetation, which is classified as a **“Low”** threat of bushfire (as per WAPC Guidelines, Table 1). Isolated Peppermint, Jarrah and Marri trees occur in paddock areas however the site is approximately 60% grassland vegetation Type G. Occurring in remnant patches through the central area of the subject site Woodland Type

17

B, the slopes are low (between 2°-6°) this would be classified as **Moderate** threat of bushfire (as per WAPC Guidelines, Table 1). In the north, south and north east there are patches of Low Open Forest (Type A) vegetation with regenerating understorey and midstorey, the slopes are low (between 2°-4°) this would be classified as **Extreme** threat of bushfire (as per WAPC Guidelines, Table 1).

Refer to Bushfire Hazard Mapping Appendix D.

External Bushfire Risks

Adjacent to the subject site along the Kalgan River and Oyster Harbour foreshore is remnant tidal wetland vegetation – classified as Shrubland Type D. To the north east there is remnant Woodland Type B in private property. There are low effective slopes (<10°) for these vegetation classifications, with the adjacent Woodland Type B and Shrubland Type D classified as a **Moderate** threat of bushfire (as per WAPC Guidelines, Table 1).

To the south east, south west, east and north there are adjacent private properties with grassland paddocks and dwelling infrastructure. These areas would be classified as **Low** threat of bushfire (as per WAPC Guidelines, Table 1).

To the south and north east there are remnant patches of Forest Type A with regenerating understorey and midstorey, the slopes are low (between 2°-4°) this would be classified as **Extreme** threat of bushfire (as per WAPC Guidelines, Table 1).

Refer to Bushfire Hazard Mapping Appendix D.

Proposed Subdivision Fire Risk Rating

The bushfire hazard for this subdivision has been rated at a **Moderate – Extreme** risk due to the site having internal and external patches of Woodland and Forest remnant native vegetation. The overall slopes for the vegetated areas are low-moderate <10°, however setback distances of over 100m from native vegetation cannot be achieved from the proposed lots.

Where 100m cannot be achieved from Bushfire Prone Vegetation, the Guidelines for Planning in Bushfire Prone Areas (2015) states that building to Bushfire Attack Levels (BAL) and AS3959-2009 can apply to dwellings to assist in achieving “Acceptable Solutions” to the subdivision.

The subdivision will be located within 100m of Bushfire Prone vegetation and is located within the WA State Bushfire Prone Area (OBRM, 2015). The proposal can meet the minimum “Acceptable Solutions” as per the newly released “Guidelines for Planning in Bushfire Prone Areas” (WAPC, 2015). These are outlined in Section 6 – **Bushfire Management/Mitigation Plan**.

6. Bushfire Management/Mitigation Plan

The management issues (Elements) which relate to this proposal include:

- Location
- Siting and Design of Development
- Vehicle Access; and
- Water

(WAPC, 2015)

The Development is required to meet the “Performance Principles” and/or “Acceptable Solutions” of each “Element”.

The site has been classified as a **Moderate-Extreme** Bushfire Risk (forest and woodlands and low effective slopes). The design allows for an appropriate level of bushfire risk with mitigation measures applied to the level of risk. The following sections outline the bushfire mitigation procedures and how the design will be assessed against the Acceptable Solutions as per the newly released Guidelines for Planning in Bushfire Prone Areas (WAPC, 2015).

These include:

- Meeting “Acceptable Solutions” for location (Element), see Section 6.1;
- Meeting “Acceptable Solutions” for Siting of the development (Element), see Section 6.2;
- Meeting “Acceptable Solutions” for Vehicles (Element) see Section 6.3; and
- Meeting “Acceptable Solutions” for Water (Element) see Section 6.4.

The following sections outline the bushfire mitigation procedures and how the design meets the Acceptable Solution as per the Appendix Four of the Guidelines for Planning in Bushfire Prone Areas (WAPC, 2015).

6.1. Element 1: Location

Intent: To ensure that strategic planning proposals, subdivision and development applications are located in areas with the least possible risk of bushfire to facilitate the protection of people, property and infrastructure.

Assessment to the Acceptable Solutions.

Acceptable Solution applied A1.1: *the strategic planning proposal, subdivision and development application is located in an area that is or will, on completion, be subject to either a moderate or low Bushfire hazard level, or BAL-29.*

The subdivision is located on land that will not require construction standards to greater than **BAL 29**. The subdivision has a **Moderate - Extreme** Bushfire Risk (Table 1, WAPC 2014) due to the presence of remnant forest and woodland vegetation areas (internal and external). The bushfire hazard level is manageable and adequate setbacks can be achieved through careful design and after construction of dwellings to AS3959-2009. Prevailing winds are from the south west, south east and south easterly winds (see Figure 4) for the site.

Further information outlining meeting this Acceptable Solution is outlined in Section 6.2.

6.2. Element 2: Siting and design of development

Intent: To ensure that the siting of development minimises the level of bushfire impact.

Assessment to the Acceptable Solutions.

The site has been classified as a **Moderate - Extreme** Bushfire Risk (Table 1, WAPC 2014). The design of the development allows for an appropriate level of bushfire risk with mitigation measures applied to the level of risk.

The Acceptable Solutions which will be applied to this development include:

- **A2.1: Asset Protection Zone (APZ):** Every building is surrounded by a 20m APZ (see Section 6.2.1).
- **A2.2 Hazard Separation:** Building to AS3959-2009 where setbacks of 100m cannot be achieved to Bushfire Prone Vegetation (see Section 6.2.2); and

The development is able to meet the Acceptable Solutions as demonstrated in the proceeding sections.

6.2.1. Asset Protection Zones (APZ) (Acceptable Solution A2.2)

Assessment to the Acceptable Solutions.

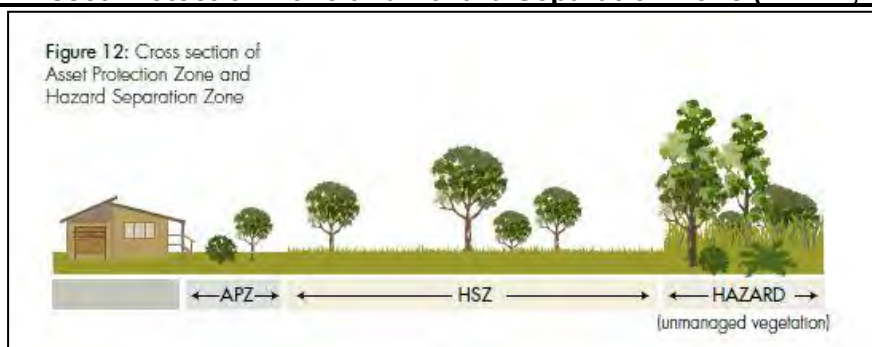
The aim of the Asset Protection Zone (APZ) is a low fuel area immediately surrounding a habitable building, and is designed to minimise the likelihood of flame contact with buildings (WAPC, 2015). APZ will minimise the risk of the building igniting, (thus protecting the occupants), and with the reduced fuel quantities, allow safer and more effective conditions for fire-fighters to contain wildfires. Roads, pathways, lawns, and other low hazard items should be placed within this zone to improve the effectiveness of the zone. The APZ is required in addition to HSZ (see Section 6.2.2).

It is recommended that a 20 metre wide APZ as the minimum width to be constructed around all buildings. Activity within the APZ (as per WAPC, 2015) must include:

- Width: 20 metres measured from any external wall of the building or building envelope;
- Location: within the boundaries of the lot on which the building is situated;
- Fine fuel load: reduced to and maintained at 2 tonnes per hectare;
- Trees (crowns) are a minimum of 10 metres apart;
- Trees are low pruned at least to a height of 2 metres;
- No tall shrub or tree is located within 2 metres of a building;
- No tree crowns overhang the building;
- Fences and sheds within the APZ are constructed using non-combustible materials (e.g. colour bond iron, brick, limestone, metal post and wire); and
- Sheds within the APZ should not contain flammable materials.

An example of APZ from the “Guidelines for Planning in Bushfire Prone Areas (WAPC, 2015) is shown in Figure 8.

Figure 8 – Asset Protection Zone and Hazard Separation Zone (WAPC, 2015)



The lots are large (1.5ha to 3.12ha) with Building Envelopes (BE's) >2000m² allowing areas for APZ to be achieved within the lots. Most of the buildings utilise cleared areas or areas of Low threat and non vegetated areas (as classified by AS3959-2009) and shown on BAL Contour Plan Appendix E to achieve a 20m APZ, either through the maintained grassland areas, low fuel areas, driveways, or road reserves.

6.2.2. Hazard Separation (Acceptable Solution A2.1)

Assessment to the Acceptable Solutions

A Hazard Separation (HS) of >100m cannot be achieved from the external bushfire hazards for the dwellings for the SGP as outlined in the Bushfire Hazard Mapping Appendix D. Proposed dwellings which cannot meet >100m HSZ from Woodland and Scrub Bushfire Prone Vegetation require a Bushfire Attack Level (BAL) and building to AS3959-2009 to apply to the lot (dwelling).

BAL is the process for measuring the severity of a buildings potential exposure to ember attack, radiant heat and direct flame contact. The threat or risk of bushfire attack is assessed by an accredited BAL Assessor. BAL rating determinations are of 6 levels BAL-LOW, BAL-12.5, BAL-19, BAL-29, BAL-40, BAL FZ. Building is generally not recommended in BAL-40 or BAL-FZ areas. The BAL rating is determined by the distance of the building to vegetation, slope and vegetation type adjacent to the dwelling. The standards outlined in AS 3959-2009 provide reference to specific items of building and it is recommended that the future lot owner discuss these in detail with the builder.

Table 2 outlines some of the construction consideration to AS3959-2009 when building in bushfire prone areas. Construction standards are to be approved by the CoA prior to construction. Building to AS3959-2009 applies to buildings as defined in the Building Code of Australia (BCS).

Table 2 – AS3959-2009 Construction Requirement (Example)

Construction requirement AS3959-2009
Flooring systems
Supporting posts, columns, stumps, piers and poles
External Walls
Windows
External Doors
Vents and weep holes
Roof
Eaves
Fascia's
Gutters and downpipes
Veranda and decks
Service Pipes (water and gas)

The construction standard that can apply to the dwellings in the subject site is shown in Table 3 – Minimum Setback Distances and Construction Standards. This is a guide and can be subject to change at detailed building construction stages (dependant on final location of dwelling in relation to vegetation).

An allocation of BAL and the Hazard Separation distance (HS) required (as per Table 2.4.3 from AS3959-2009) has been provided to the lots of the subdivision (BAL Contour Mapping Appendix E) which is measured from the edge of woodland and forest vegetation in the developable areas.

The minimum of a 20m APZ (see Section 6.2.2 for more detail) must apply to all dwellings and recommended around infrastructure buildings. An additional HS (17m to 27m depending on vegetation and slope) is required and dictates the BAL construction (and AS3959-2009) standard depending on the distance to vegetation and slope as shown in Table 3 and shown on the BAL Contour Plan Appendix E.

Table 3 – Minimum Setback Distances and Construction Standards Class 1 Buildings

Location on SGP (lot numbers)	Vegetation Type & Slope	Distance to Vegetation	BAL Rating	Construction
17, 18, 19 & 20	Forest Type A All upslopes & flat land	21-<31 metres	BAL 29	AS3959-2009 to apply
17, 18, 19 & 20	Forest Type A All upslopes & flat land	31-<42 metres	BAL 19	AS3959-2009 to apply
17, 18, 19 & 20	Forest Type A All upslopes & flat land	42-<100 metres	BAL 12.5	AS3959-2009 to apply
1, 2, 3, 4, 8-16	Forest Type A Downslope 0 - 5 degrees	27-<37 metres	BAL 29	AS3959-2009 to apply
1, 2, 3, 4, 8-16	Forest Type A Downslope 0 - 5 degrees	37-<50 metres	BAL 19	AS3959-2009 to apply
1, 2, 3, 4, 8-16	Forest Type A Downslope 0 - 5 degrees	50-<100 metres	BAL 12.5	AS3959-2009 to apply
Lot 5, 7,	Woodland Type B All upslopes and flat land	22-<31 metres	BAL 29	AS3959-2009 to apply
Lot 5, 7	Woodland Type B All upslopes and flat land	31-<43 metres	BAL 19	AS3959-2009 to apply
Lot 5, 7	Woodland Type B All upslopes and flat land	43-<100 metres	BAL 12.5	AS3959-2009 to apply
Lot 6, 21 -23	Woodland Type B Downslope 0 - 5 degrees	17-<25 metres	BAL 29	AS3959-2009 to apply
Lot 6, 21 -23	Woodland Type B Downslope 0 - 5 degrees	25-<35 metres	BAL 19	AS3959-2009 to apply
Lot 6, 21 -23	Woodland Type B Downslope 0 - 5 degrees	35-<100 metres	BAL 12.5	AS3959-2009 to apply
No lots	All Vegetation	>100 metres	No BAL rating required	No construction standards required

(as per AS3959-2009)

Notes on BAL Assessment:

- ***Sites will be subject to detailed feature survey and the mapping depicted in the BAL Contour Plan Appendix E is a guide, with accuracy to within 5m.***
- ***Any BE's where two BAL allocations intercept across the dwelling, the higher BAL is to apply.***
- ***BAL setback distances are measured from the edge of existing vegetation at time of feature survey and building construction approvals stages.***
- ***Detailed assessment for BAL Construction as described in this document can be undertaken at building construction stage by an accredited Level 1 BAL Assessor with approval from the City of Albany.***

The BAL mapping Appendix E is a guide based on current vegetation standings, and is not reflective of post construction of roads, firebreaks, weed management and infrastructure installation. These works may alter the landscape and the final placement of dwellings therefore BAL allocation may be subject to change. An updated BAL Contour Map should be provided prior to the release of lots to document any changes to the vegetation after subdivision construction.

The developer will be responsible for the implementation of a notification on title under Section 70A of the Transfer of Land Act 1983 to read:

'Registered proprietors and prospective purchasers of the land described above are notified that the use of the land is subject to an approved Bushfire Management Plan'.

6.3. Element 3: Vehicle Access - Performance Criteria

Intent: To ensure that the vehicular access serving a subdivision/development is available during a bushfire event.

Assessment to the Acceptable Solutions.

The internal layout of the Subdivision's public roads and private access allows vehicles and other emergency vehicles to move through the subdivision at all times, meeting the Acceptable Solutions. Vehicle access technical standards as outlined in Table 4 are the minimum requirements from Guidelines for Planning in Bushfire Prone Areas (WAPC, 2015). Refer to Table 4 and Bushfire Management Plan Appendix G.

Table 4 – Vehicular Access Technical Standards

Technical requirements	Public Roads	Cul-de-sacs	Private Driveways	Emergency Access Ways	Fire Service Routes
Minimum trafficable surface (m)	6*	6	4	6*	6*
Horizontal clearance (m)	6	6	6	6	6
Vertical clearance (m)	4.5	N/a	4.5	4.5	4.5
Minimum weight capacity(t)	15	15	15	15	15
Maximum crossfall	1 in 33	1 in 33	1 in 33	1 in 33	1 in 33
Curves minimum inner radius(m)	8.5	8.5	8.5	8.5	8.5
Signs				To DFES & CoA standards	To DFES & CoA standards
Gates				To DFES & CoA standards	To DFES & CoA standards
* Refer to E3.2 Public roads: trafficable surface, whereby 6m can include 4m pavement and 1m wide constructed road shoulders.					

(WAPC, 2015)

6.3.1. Two access routes (A3.1)

The subdivision meets the Performance Principle, there is the main entry/exit point off Nanarup Road via the newly formed road reserve and two Emergency Access Ways to Swan Pont Road (south) and off the existing Affleck Road to Nanarup Road (north west). This gives the subdivision 3 access routes.

The SGP meets the Performance Principle, if the subdivision is staged then the Acceptable Solutions (A3.6 and A3.7) will apply as outlined in Section 6.2.6 and 6.2.7.

6.3.2. Public roads (A3.2)

All internal public roads shall be constructed with 13-20m road reserves meeting Performance Principle. The Vehicular Access Standards (Refer to Table 4 – Column 1) and relevant technical information shall be detailed in Civil Engineering Designs.

6.3.3. Cul de Sacs (A3.3)

Cul-de-sacs will be no longer than 200m and shall comply with Table 4 – Column 2 and relevant technical information shall be detailed in Civil Engineering Designs.

6.3.4. Battle Axes (A3.4)

Battle Axes will be no longer than 200m and shall comply with Guidelines for Planning in Bushfire Prone areas (WAPC, 2015) and the relevant technical information shall be detailed in Civil Engineering Designs.

6.3.5. Private Driveways (A3.5)

Private driveways will conform to the minimum technical standards as outlined in Table 4 – Column 3 and will be the responsibility of the new lot owner to install to the required standards.

6.3.6. Emergency Access Ways (A3.6)

Emergency Access Ways (EAW) will be along two proposed EAW's to Swan Point Road (south) and along Affleck Road (north west). This will give three entry/exit points in an emergency meeting the Performance Principle. The standards for EAW's are outlined in Table 4, Column 4 and relevant technical information shall be detailed in Civil Engineering Designs.

If the subdivision is staged, the EAW to the south to Swan Point road is to be constructed during the first stage giving residents emergency access at all times. The EAW along Affleck Road is the existing access and so will remain in perpetuity.

6.3.7. Fire Service Access Routes (A3.7)

A dedicated Fire Service Access (FSA) will be along the southern boundary linking lot 14 and 10 to the southern EAW. This will be gated but not locked along the boundary of the lots. This is not an EAW and is recommended for fire fighting and bushfire control reasons only. This FSA will enable access to fire crews to the thick remnant woodland vegetation south of the subdivision in a bushfire emergency. The standards for EAW's will be as per Table 4, column 5 and will meet the Performance Principle.

If the subdivision is staged, the FSA along the southern boundary to Swan Point road is to be constructed during the first stage giving fire crews access at all times.

6.3.8. Individual Fire breaks (A3.8)

Firebreaks are required by the CoA for rural size properties (>4000m²). A fire break is defined in the CoA annual Fire Break Notice as:

"..a strip of land 3 metres wide and 4 metres high that is ploughed, cultivated, scarified or slashed to a maximum height of 50mm for the purpose of preventing the outbreak of or spread of a fire. This includes the trimming back of all overhanging trees, bushes, shrubs and any other objects over the firebreak area. A boundary fire break is a firebreak which is placed within 20m of the property boundary. Fire breaks must be installed and maintained from December 1 to 30 April inclusive."

(CoA, 2014)

It is the responsibility of the owner to maintain firebreaks prior to the fire season (October each year). The CoA firebreak order requires a 3m trafficable internal firebreak (CoA, 2014) for lots >4000m². These are shown on the Bushfire Management Plan Appendix E. Where there is a public road/driveway adjacent, a firebreak has not been shown as is not required. Where there are vegetation protection zones, a firebreak is shown on the edge of the protection area.

Please refer to the CoA Annual fire Break order, this is updated annually, or as gazetted and the current versions should be obtained from the City of Albany website:

<http://www.albany.wa.gov.au>

6.3.9. Gates

Gates are proposed for this development and are to be placed at the north western and southern end of the two EAW's and at the FSA. The gates will not be locked but will be sign posted (see Section 6.3.9).

Gate standards will be as follows:

- Minimum width 3.6 metres;
- Have appropriate signage (as per section 6.3.9);
- Approved by the CoA; and
- Not locked.

Refer to Bushfire Management Plan Appendix G for location of gates.

6.3.10. Signage

Signs are proposed at entry/exit points of the EAW's and FSA and are shown in the Bushfire Management Plan Appendix F. Any new signage shall be to the DFES and CoA recommended wording for signage as appropriate:

- 'Fire Service Access'; or
- 'Emergency Access Only'.

The signage shall meet the following standards:

- Minimum height above ground level 0.9 metres;
- Design and construction to be approved by relevant local government; and
- Lettering height 100mm.

Refer to Bushfire Management Plan Appendix G for location of signs.

6.4. Element 4 Water – Performance Criteria

Intent: To ensure that water is available to the subdivision, development or land use to enable people, property and infrastructure to be defended from bushfire.

Assessment to the Acceptable Solutions

6.4.1. Reticulated areas (A4.1)

Scheme water will be provided to Lot 7 only via the existing connection.

6.4.2. Non-reticulated areas (A4.2)

All other lots (excepting Lot 7) will not be connected to Reticulated Scheme Water and will require individual houses to provide a minimum of 92,000 litres tank capacity, of which 10,000L is to be held in reserve **for fire fighting purposes** only (i.e. not for domestic use). Each dwelling tank should be fitted with an outlet at the base of the tank (75mm Storz Fitting with gate valve).

There is an existing fire hydrant located along Nanarup Road, refer to BMP Appendix G for the location. This is within 0.5km of the site and deemed suitable for fire fighting crews to access. There are numerous dams on the property which are full year round on the property which could be accessed in an emergency situation for fire fighting purposes.

This will ensure that the subdivision meets compliance with A4.2.

6.5. Other Fire Mitigation measures

6.5.1. Evaporative Air Conditioners

Evaporative air conditioning units can catch fire as a result of embers from bushfire getting into the unit. These embers can then spread quickly through the home causing destruction. It can be difficult for fire-fighters to put out a fire in the roof spaces of homes. Information on Evaporative air conditioners is supplied in Appendix G of this document.

It is also recommended that home owners:

- Ensure that suitable external ember screens are placed on roof top mounted evaporative air conditioners compliant with AS3959-2009 (current and endorsed standards) and that the screens are checked annually.

6.5.2. Barrier fencing

In November 2010 the Australian Bushfire CRC issued a "Fire Note" (Issue 70, Bushfire CRC, 2010) which outlined the potential for residential fencing systems to act a barrier against radiant heat, burning debris and flame impingement during bushfire. The research aimed to observe, record, measure and compare the performance of commercial fencing of Colourbond steel and timber (treated softwood and hardwood).

The findings of the research found that:

".. Colourbond steel fencing panels do not ignite and contribute significant heat release during cone calorimeter exposure" (exposure to heat)

.."Colourbond steel (fencing) had the best performance as a non-combustible material. It maintained structural integrity as a heat barrier under all experimental exposure conditions, and it did not spread flame laterally and contribute to fire intensity during exposure"

Residents will be encouraged to build Colourbond or non combustible fences in bushfire prone areas through dissemination of the CRC information "Fire Note" (Issue 70, Bushfire CRC, 2010).

6.5.3. Landscaping/Streetscaping Areas

Landscaping and Streetscaping areas subject to similar standards that apply to the HSZ and the following minimum standards shall apply:

- Trees (crowns) a minimum of 5m apart (no continuous crowns);
- Trees should have no dead material within the plant's crown or on the bole;
- Fuel reduced to <8t/ha; and
- Shrubs should be no higher than 0.5 m.

Site inspection revealed a large amount of declared woody weeds which contribute to the bushfire fuels/hazards on the subject site. Selective removal of the following species as per the Department of Food and Agriculture WA recommended methods should occur and this will assist in bushfire fuel reduction:

- Coastal Teatree *Leptospermum laevigatum*, and
- Sydney Golden Wattle *Acacia linearifolia*

Both of these species are declared under the previous *Agricultural Protection Board Act 1950* (repealed) and now the *Biosecurity and Agriculture Management Act 2007 (BAM Act)* and are listed in the CoA as "Pest Plants".

This plan is not reliant on the above weed removal recommendations with hazard ratings/calculations made to existing vegetation as at March 2015.

6.5.4. Staging

If the proposed development will be staged, staged development will incorporate the following:

- Reduction of bushfire fuels to 100m from adjacent housing or in HSZ areas as specified in Table 4;
- Implementation of 20m APZ to any adjacent dwellings for each stage of construction of the subdivision and during maintenance periods (where appropriate);
- Construction of 2-way Emergency Access Way/Fire Service Access Ways linking to the south Swan Point Road;
- Maintenance of fire protection measures in public areas (gates, access, landscaped areas etc) until the developer has relinquished construction/maintenance responsibility of public use areas to the CoA; and
- Slashing of grasslands should occur to maintain low fuel areas (i.e. HSZ) around housing and dwellings.

6.5.5. Fuel Hazard Reduction – Prescribed Burning

The following parameters/strategies are recommended for the property. (Sampling and fuel calculation should be as approved by Fire & Emergency Services Authority procedures)

- Forest fuels are maintained to maximum of 15 T/ha in Forest (Type A) vegetation types.
- Woodland fuels are maintained to maximum of 8 T/ha in Woodland (Type B) vegetation types.
- Fuel reduction can be achieved through slashing or prescribed burning.
- Prescribed burning should be carried out in consultation with DFES and the CoA in accordance with the *Bushfires Act 1954*. This will be the responsibility of the lot owner as deemed appropriate from the CoA.
- Possible cells for hazard reduction/prescribed burning is outlined in the Bushfire Management Plan Appendix G. A maximum of 8 years in a rotation is a recommended prescribed burning regime, but could be subject to further investigation during prescription preparations.

The three cells proposed for prescribed burning are shown in the BMP Appendix G, Table 5 below outlines the lots which will be responsible for long term maintenance of HSZ and prescribed burning operations. It is recommended that the lot owners jointly contact the CoA, Kalgan Brigade and if required DPaW n(for conservation matters) and prescribed burning operations are carried out in accordance with the *Bushfires Act 1954*.

Table 5 – Prescribed burning regime and lots affected

Lot Numbers	Prescribed Burning Cell	Vegetation type	Maximum fuel loading in HSZ	Recommended rotation (time till burning)
10 to 17	Cell 1	Jarrah/Marri Woodland Forest	8T/ha 15T/ha	4-6 years 8-10 years
9	Cell 2	Jarrah/Marri Forest	15T/ha	8-10 years
1, 2 & 3	Cell 3	Jarrah/Marri Forest	15T/ha	8-10 years

It is recommended that the developer undertake the initial prescribed burning operations of the 3 cells (in consultation with CoA and BFB) during subdivision construction and prior to relinquish of lots so that all lots a fuel reduced prior to point of sale.

7. City of Albany Fire Protection Plan

The City of Albany manages and maintains Volunteer Bush Fire Brigades strategically located throughout the district, with a membership of over 100 trained volunteers. Training and induction courses are held regularly and land owners are encouraged to attend these. For more information refer to the City of Albany.

The City of Albany publishes annually a 'Fire Regulations Notice' (Bush Fire Notice) pursuant to Section 33 of the *Bush Fires Act 1954*. This document guides land owners on management of fire on their property. This should be accessed online from:

www.albany.wa.gov.au

7.1. Fire Fighting Facilities

The Kalgan Bushfire Brigade (BFB) is the closest emergency services and is less than 2km from the subject site. The BFB services and maintain a 2.4 fire truck and a fast attack vehicle at the Upper Kalgan Shed and a 2 x 2.4 at the lower Kalgan shed, this is also backed up with a modern communication system for call outs as well as communication on the fire ground. These are typical of bush fire brigades for fire fighting services within Western Australia.

The Kalgan BFB has the following:

- Fully equipped fire station;
- Volunteer trained members;
- A communications and call out system;
- Protective clothing issue to volunteers; and
- DFES approved fire appliances.

Response times can vary depending on commitments of volunteers, fire events current at time and priority of the fire services in the south west of Western Australia during summer periods. DFES recommends that homeowners take care to prepare their individual dwellings for fire season and take precautions against fire as per the **'Bushfire Preparedness – Prepare. Act. Survive.'**

It is generally acknowledged that during large wildfire events, local resources may not be able to respond to every lot due to strategic deployments of services, priorities within the area or state and/or present commitments of volunteers and resources. It is therefore recommended that land owners implement strategies as recommended by DFES to protect life and property during the fire season.

7.2. Fire Suppression Actions CoA

The following protocols/actions for the subject site are recommended:

- Local Government (City of Albany) through their Bush Fire Brigade Organisation is the Controlling Authority for fire suppression operations on the area.
- Bushfire in or threatening the area will be contained to the smallest possible area, either by direct attack or by back burning from established buffers or fire lines taking into consideration the likely threats to life and property as well as the impact of suppression activity on the water quality and conservation objectives of the reserve.
- Irrespective of fire weather forecasts, whenever reserve vegetation will burn and whenever burns on adjoining lands are imminent, a high level of vigilance and preparedness will be maintained.

7.3. Homeowner Protection

It is the responsibility of homeowners to protect their property from bushfire. DFES have readily available information online which can assist homeowners in their preparedness during fire season (October to May). The DFES website **"Bushfire Preparedness – Prepare. Act. Survive."** should be accessed by all owners in bushfire prone areas. A hard copy of the A4 book "Prepare. Act.

Survive” can be found at local City of Albany Offices or DFES offices, or downloaded off the above web address:

<http://www.dfes.wa.gov.au>

7.4. Bushfire Plan

It is recommended that the individual lot owner prepares an individual bushfire survival plan detailing preparations and actions to take if a bushfire threatens.

When developing a bushfire survival plan, the following generic information should be considered:

- If you plan to leave for a safer place - where will you go and how will you get there? Your safer place could be with friends and family, and may not be far away. Know where you will go and never ‘wait and see’. Relocating at the last minute can be deadly
- Does your household include elderly relatives, young children, people with disabilities or illness? When, where and how will they be relocated? Who will care for them?
- What will you do with your pets and livestock?
- Can your home be defended? Is it in a location that makes it difficult or dangerous to actively defend? (refer to DFES’s Homeowners Bushfire Survival Manual - PDF)
- Will your home provide shelter if you have to or decide to stay?
- Are you capable of defending your home without the support of fire fighters?
- Do you have the skills, knowledge and capacity to check for and put out spot fires for up to ten hours after the fire front has passed?
- Do you have the right equipment and resources to actively defend? (e.g. sufficient independent water supply of at least 20,000 litres and a petrol, diesel or generator powered pump capable of pumping 400 litres per minute)
- Will you cope with the noise and stress of a bushfire if you decide to actively defend? Being in a bushfire may be the most traumatic experience of your life.

(from DFES website, 2013)

By compiling information as outlined above, the individual lot owner can be prepared for their response in a bushfire emergency. Home owners should not rely on emergency personnel to attend their home and thus it is stressed to **prepare an individual bushfire emergency plan** regarding their intentions and property. This Bushfire Management Plan is **not** an individual bushfire emergency plan.

Information is also available on the ABC Radio and the website to guide homeowners in the event of a fire emergency, such information includes:

Planning for an Emergency Bushfire:

- Survival Kit
- Fire Emergency Services
- Before a Bushfire
- During a Bushfire
- After a Bushfire

Refer to the following link for more information on how to prepare a bushfire plan:

<http://www.abc.net.au/news/emergency/?ref=front-page-slider-v2--emergencies>

*“Before summer starts you need to decide what you will do if a bushfire threatens. If you live or work in a bushland area you need to **prepare** your home, family or business and have a plan so you can **act** to make sure you **survive**.” (DFES 2010)*

8. Summary

8.1. Overall Fire Threat

Harley Dykstra commissioned Bio Diverse Solutions (Bushfire Consultants) to undertake a fire hazard assessment and prepare a Bushfire Management Plan to guide all future fire management for the subdivision development of Lot 422 Swan Point Road Lower Kalgan. The development at the subject site contemplates rural residential development with 23 new lots being created. The lot sizes range from 1.01 to 3.44ha with designated building envelopes on each lot utilising existing cleared and/or degraded areas. The BMP has been prepared as part of the planning process to prescribe bushfire management measures for the proposed development as per Guidelines for Planning in Bushfire Prone Areas (WAPC, 2015) and State Planning Policy 3.7 (WAPC, 2015).

The subject site has remnant forest and woodland vegetation in the north east and central areas. There are existing paddocks from past farming practises and these areas are either parkland cleared or current land management practises entails slashing of the entire property to 50mm biannually. Adjacent to the site in private property to the north and south is woodland and forest vegetation. To the west is the Kalgan River and Oyster Harbour Foreshore.

The subdivision area has been rated as having a **Moderate – Extreme** bushfire hazard as defined by Guidelines for Planning in Bushfire Prone Areas (WAPC, 2015) (Appendix three) due to internal and adjacent Forest and Woodland bushfire risks. There are low effective slopes across the site. The development requires “Performance Principle” and/or “Acceptable Solutions” to be met.

The Elements which are met either through the objectives of the “Performance Principle” and/or “Acceptable Solutions” for the Subject site include:

- Element 1 - Location;
- Element 2 - Siting and design of development.
- Element 3 - Vehicular access; and
- Element 4 – Water.

This BMP has identified a number of ways fire risk can be mitigated and managed across the lots to ensure there is protection to life and property and biodiversity assets. To mitigate fire risks and meet the Performance Principles this report outlines:

- **Element 1 – Location:** The subdivision is located in an appropriate landscape with a Moderate- Extreme Bushfire Hazard Rating. No building greater than BAL 29, HSZ and building to BAL and AS3959-2009 as outlined in Table 3, meeting Acceptable Solutions.
- **Element 2 - Siting and design of development:** The design of the subdivision allows for bushfire hazard mitigation measures to be incorporated to reduce threat to people, property and infrastructure. A 20m APZ can be achieved on the individual lots. Building to BAL and AS3959-2009 where 100m HSZ cannot be achieved to the woodlands and forests, meeting Acceptable Solutions.
- **Element 3 - Vehicular access:** The newly created road reserves from Nanarup Road, EAW and FSA proposed to enable quick emergency egress or access for lot owners or fire services, meeting Acceptable Solutions.
- **Element 4 – Water:** reticulated water will go to existing houses and all new dwellings will be required to have 92,000L with 10,000L in reserve for fire fighting purposes. A water hydrant exists on Nanarup Road near the entry/exit point, meeting Acceptable Solutions.

Most of the building envelopes utilise the existing cleared paddock areas with Grassland/Low Fuel Areas (as classified by AS3959-2009) to achieve a 20m APZ. Some building envelopes in the central area utilise cleared Woodland/ very degraded vegetation, which with selective removal of trees can achieve APZ standards in the proposed building envelopes.

This BMP report provides details of the fire management strategies proposed to be implemented across the site as it is subdivided and developed to ensure adequate protection of life, property

and biodiversity assets. To ensure the mitigation measures are implemented responsibilities are outlined in the following sections for the Future Lot Owner, Developer and CoA.

A possible works program to guide the developer is also provided to guide the developer in Appendix H.

8.2. Future Lot Owners Responsibility

It is recommended the Future Property Owners shall be responsible for the following:

- To take measures to protect their own assets on their property, home owners should not rely on emergency personnel to attend their home and thus it is stressed to **prepare a individual bushfire emergency plan**, this Bushfire Management Plan is **not** an individual bushfire emergency plan;
- Implement this document, Bushfire Management Plan as it applies to their individual property;
- Ensure that APZ's are maintained to a minimum of 20 metres around all buildings as per DFES and Planning for Bushfire Protection Guidelines (see Appendix F);
- Ensure that HSZ's are maintained from the vegetation (fire) risks as per AS3959-2009 and DFES guidelines as it applies to their property;
- Where a lot has been identified as requiring an increased construction standard (i.e. BAL) ensure that the design and construction of any building is compliant with the requirements of AS3959-2009 (current and endorsed standards);
- Maintaining the property as per this BMP to minimise bushfire fuels and mitigate the risk of bushfire;
- Maintain firebreaks in accordance with CoA Annual Fire Control Order;
- Ensuring that suitable external ember screens are placed on roof top mounted evaporative air conditioners compliant with AS3959-2009 (current and endorsed standards) and that the screens are checked annually;
- Ensure driveways are constructed as per Table 4, column 1 (see below);
- Ensure Fire Service Access Routes as the traverses their property are maintained as per Table 4, Column 2 (see below);

Table 4 – Vehicular Access Technical Standards

Technical requirements	Private Driveways	Fire Service Routes
Minimum trafficable surface (m)	4	6
Horizontal clearance (m)	6	6
Vertical clearance (m)	4	4
Maximum grades	1 in 8	1 in 8
Maximum grades >50m	1 in 5	1 in 5
Maximum average grade	1 in 7	1 in 7
Minimum weight capacity(t)	15	15
Maximum crossfall	1 in 33	1 in 33
Curves minimum inner radius(m)	12	12
Signs		As per DFES standards & CoA approval
Gates		As per DFES standards & CoA approval

(WAPC, 2014)

- Ensure gates and signs are maintained along the FSA if it traverses their property;
- Maintain existing "Low Fuel Areas" (grasslands) in the balance of the lot excepting where vegetation protection zones occur;
- Undertake prescribed burning as per Table 5 in conjunction with other land owners in cell (if applicable);

- Install 92,000L water tank with 10,000L in reserve for fire fighting purposes only, ensure appropriate fittings (camlock valve) attached to base of tank for fire access; and
- It is the responsibility of the individual property owner to maintain in good order and condition APZ, HSZ and driveway standards. Future modifications other than requirements as set out in this Bushfire Management Plan can only be done with written agreement from the CoA.

8.3. Developers Responsibility

Prior to development being given final approval by the City of Albany, the Developer shall be required to carry out works that include the following but in respect to individual stages of development. Subsequent to the issue of final approval, the Developer shall have no further responsibilities to the provision of fire fighting facilities and fire management on individual lots that pass from their ownership.

It is recommended that the Property Developer shall be responsible for the following:

- Implement this document, Bushfire Management Plan as it applies to their development;
- Comply with standards as outlined by the CoA and WAPC conditions of subdivision;
- Comply with minimum construction standards as outlined by this Bushfire Management Plan;
- Maintain any APZ and/or HSZ as per DFES and Planning for Bushfire Protection Guidelines (as outlined in this plan) until the lots are relinquished by the developer;
- Maintain fire protection measures in public areas until the Developer has relinquished the title to new lot owners;
- Maintain fire breaks in accordance with the CoA Fire Control Order (yearly advise brochure updated annually) the Developer has relinquished the title to new lot owners;
- Undertake initial prescribed burning of Cells 1-3 prior to relinquish of lots to new owners;
- Implement a notification on title pursuant to section 70A of Land Act 1893 to make future lot owners aware of the BMP;
- Construct Emergency Access Routes Fire Service Access to the following standards as outlined in Table (4) column 3 (see below);

Table 4 – Vehicular Access Technical Standards

Technical requirements	Public Roads	Cul-de-sacs	Battle Axes	Private Driveways	Emergency Access Ways	Fire Service Routes
Minimum trafficable surface (m)	6	6	6	4	6	6
Horizontal clearance (m)	6	6	6	6	6	6
Vertical clearance (m)	4	N/a	4	4	4	4
Maximum grades	1 in 8	1 in 8	1 in 8	1 in 8	1 in 8	1 in 8
Maximum grades >50m	1 in 5	1 in 5	1 in 5	1 in 5	1 in 5	1 in 5
Maximum average grade	1 in 7	1 in 7	1 in 7	1 in 7	1 in 7	1 in 7
Minimum weight capacity(t)	15	15	15	15	15	15
Maximum crossfall	1 in 33	1 in 33	1 in 33	1 in 33	1 in 33	1 in 33
Curves minimum inner radius(m)	12	12	12	12	12	12
Signs					To DFES & CoA standards	To DFES & CoA standards
Gates					To DFES & CoA standards	To DFES & CoA standards

(WAPC, 2014)

- Provide an updated BAL Contour Map prior to release of titles detailing any changes in BAL due to subdivisional site works; and
- Provide each prospective owner with:
 - Bushfire Management Plan,
 - A map outlining BAL ratings applicable to individual lots.
 - A hard copy of the A4 book “*Prepare. Act. Survive*”; and
 - Fire Control Information supplied by the CoA (yearly advice brochure updated annually, example provided Appendix E).

A works program has been developed to guide the Developer outlining responsibilities, completion times and standards. Please refer to Appendix H.

8.4. City of Albany Responsibility

At approval and endorsement of this Fire Management Plan, the City of Albany has statutory control and responsibility to ensure that aspects of the Plan and community fire safety are maintained.

It is recommended the City of Albany be responsible for the following:

- Provide advice on standards and methods to achieve community fire protection to owners/occupiers of land through issue and enforcement of the current CoA Fire control Order (yearly advice brochure updated annually);
- Ensuring compliance with this Bushfire Management Plan with regard to any related conditions of subdivision approval;
- Enforcing AS3959-2009 Construction of buildings in bushfire prone areas (current and endorsed standards) for all dwellings affected by a BAL rating;
- Ensure individual Property Owners maintain in good order and condition Emergency Access/Fire Access Ways, Building Protection Zones, Hazard Reduction Zone and driveway standards.
- Developing and maintaining district fire fighting facilities and related infrastructure;
- Maintaining roads and access consistent with the standards this Bushfire Management Plan and in the Planning for Bushfire Protection Guidelines; and
- Periodical review of the Bushfire Management Plan.

9. Conclusions

This Bushfire Management Plan has outlined how the subdivision will meet the “Acceptable Solutions” as per Guidelines for Planning in Bushfire Prone Areas (WAPC, 2015) with specific recommendations for:

- The layout of the subdivision and the facilities proposed have been designed to reduce the fire threat to persons and property within the development (i.e. achieve APZ and HSZ, Low Fuel Areas);
- Building to **BAL** and AS3959-2009 where setbacks of 100m from external remnant vegetation areas cannot be achieved;
- Allocation of BAL does not exceed BAL 29;
- Accessible “Fire Service Access” to Nanarup Road and Swan Point Road for emergency and fire service access along the southern boundary;
- Water to be captured on site with 92,000L tanks installed with 10,000L in reserve for fire fighting purposes only; and
- All bushfire mitigation measures contained within the property.

A copy of DFES’s Compliance Checklist for the “Acceptable Solutions” is provided in Appendix I.

In summary it is recommended to the Developers that in building the proposed subdivision at Lot 422 Swan Point Road Lower Kalgan, the Developer:

- Implements the fire protection standards as outlined in this document and by Guidelines for Planning in Bushfire Prone Areas (WAPC, 2015);
- Adheres to WAPC and CoA subdivision conditions;
- If any changes to structure plan designs occur, that this Bushfire Management Plan is updated to reflect these changes, with approval from the CoA and DFES; and
- Implement this document, Bushfire Management Plan at Lot 422 Swan Point Road Lower Kalgan, standards of construction and recommendations.

10. References

AS 3959-2009 Australian Standard, *Construction of buildings in bushfire-prone areas*, Building Code of Australia, Primary Referenced Standard, Australian Building Codes Board and Standards Australia.

Bureau of Meteorology Climate Data Albany Station accessed January 2015 and August 2014 from:

<http://www.bom.gov.au/climate/data/>

City of Albany, Fire Management Notice 2014-2015. Annual Brochure published by the City of Albany and the Bushfire Service WA.

City of Albany (2014) Strategic Bushfire Plan 2014-2019 Council Management Plan. Accessed via website January 2015:

www.coa.wa.gov.au

Department of Environment and Conservation "*Biodiversity and Climate Change in Western Australia*" accessed from website February 2012:

<http://www.dec.wa.gov.au/content/view/2870/2288/>

Department of Fire and Emergency Services WA (DFES) (2004) The Homeowners Bush Fire Survival Manual, Fourth Edition, Community Safety Division, Perth WA

Department of Fire and Emergency Services website accessed August 2014:

<http://www.dfes.wa.gov.au>

Department of Planning Western Australia *Planning and Development (Bushfire Risk Management) Regulations 2014 and Development (Bushfire Risk Management) Regulations 2014* accessed from website February 2015 from:

http://www.planning.wa.gov.au/dop_pub_pdf/bushfire_risk_mgt.pdf

Hearn, H., Williams, K., Comer, S. and Beecham, B. (2002) Jarrah Forest 2 (JF2 – Southern Jarrah Forest subregion). Department Conservation and Land Management. Government of Western Australia.

Keighrey, B. (1994) *Bushland Plant Survey, A Guide to Community Survey for the Community*, Wildflower Society of WA.

Sandiford, E.M. and Barrett, S. (2010). *Albany Regional Vegetation Survey, Extent Type and Status, A project funded by the Western Australian Planning Commission (EnviroPlanning "Integrating NRM into Land Use Planning" and State NRM Program), South Coast Natural Resource Management Inc. and City of Albany for the Department of Environment and Conservation*. Unpublished report. Department of Environment and Conservation, Western Australia.

Stephens, L. (2010) Land Capability – Geotechnical Assessment and Water Management Strategy Lot 422 Swan Point Road, Lower Kalgan. Unpublished report prepared for unknown client.

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

Western Australian Planning Commission (WAPC) (2010) *Planning for Bushfire Protection Edition 2* Fire and Emergency Services Authority of Western Australia and Department for Planning and Infrastructure Western Australia.

Western Australian Planning Commission (WAPC) *Planning Bulletin 111/2013 Planning for Bushfire*.

Western Australian Planning Commission (WAPC) (2014) Draft Planning for Bushfire Risk Management Guidelines. Western Australian Planning Commission and Department of Planning WA, Government of Western Australia.

Western Australian Planning Commission (WAPC) (2015) Guidelines for Planning in Bushfire Prone Areas. Western Australian Planning Commission and Department of Planning WA, Government of Western Australia.

Western Australian Planning Commission (WAPC) State Planning Policy 3.2 Planning in Bushfire Prone Areas. Department of Planning WA and Western Australian Planning Commission.

State Land Information Portal (SLIP) (2015) map of Bushfire Prone Areas. Office of Bushfire Risk management (OBRM) data retrieved from:
<https://mapsengine.google.com>

Appendices

Appendix A – Location

Appendix B – Local Structure Plan

Appendix C - Vegetation Mapping

Appendix D – Bushfire Hazard Mapping

Appendix E- BAL Contour Plan

Appendix F – DFES Information for Homeowners

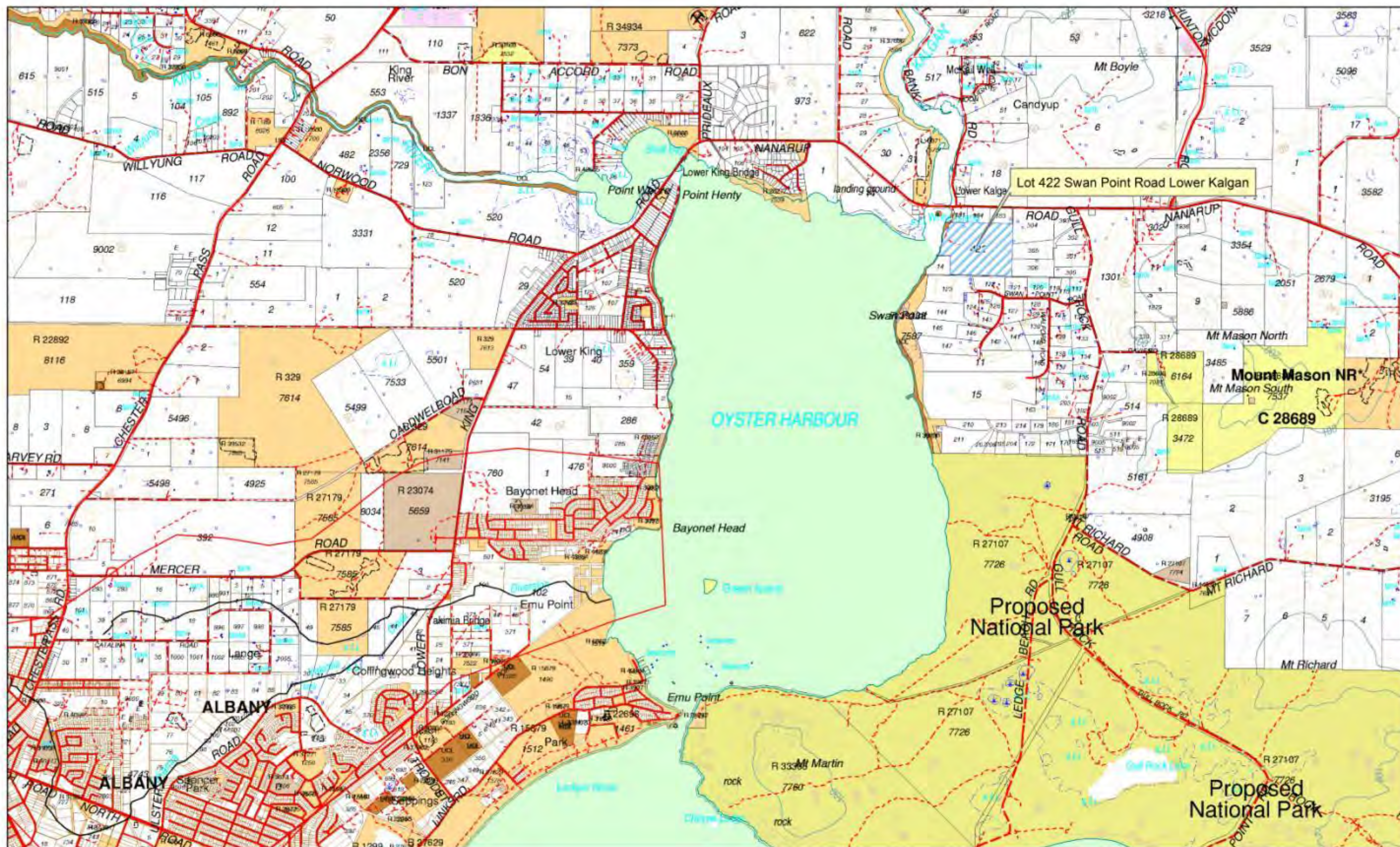
Appendix G-Bushfire Management Plan

Appendix H –Works program


Appendix I - DFES Checklist

Appendix A

Location Mapping



Legend

 Subject site

Scale
1:5,400 @ A3
GDA 94 MGA Zone 50

0 0.5 1 2 3 4 Kilometers



55 Peppermint Drive
Albany, WA 6330
Australia
Tel: 08 9841 3936
Fax: 08 9841 3936
Mob: 0447 555 516

CLIENT Lot 422 Swan Point Road
Lower Kalgan
Albany WA 6330

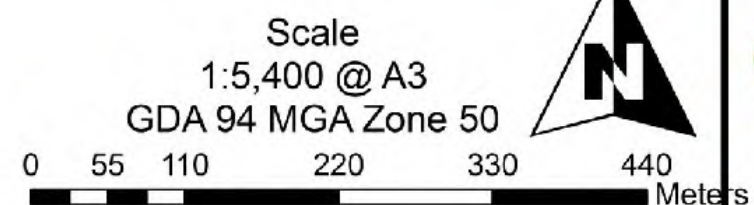
Regional Location

STATUS	FILE	DATE
FINAL	HD025	23/02/2015



Legend

- Subject site
- Cadastre



**BIO
DIVERSE
SOLUTIONS**

55 Peppermint Drive
Albany, WA 6330
Australia
Tel: 08 9841 3936
Fax: 08 9841 3936
Mob: 0447 555 516

CLIENT Lot 422 Swan Point Road
Lower Kalgan
Albany WA 6330

Location

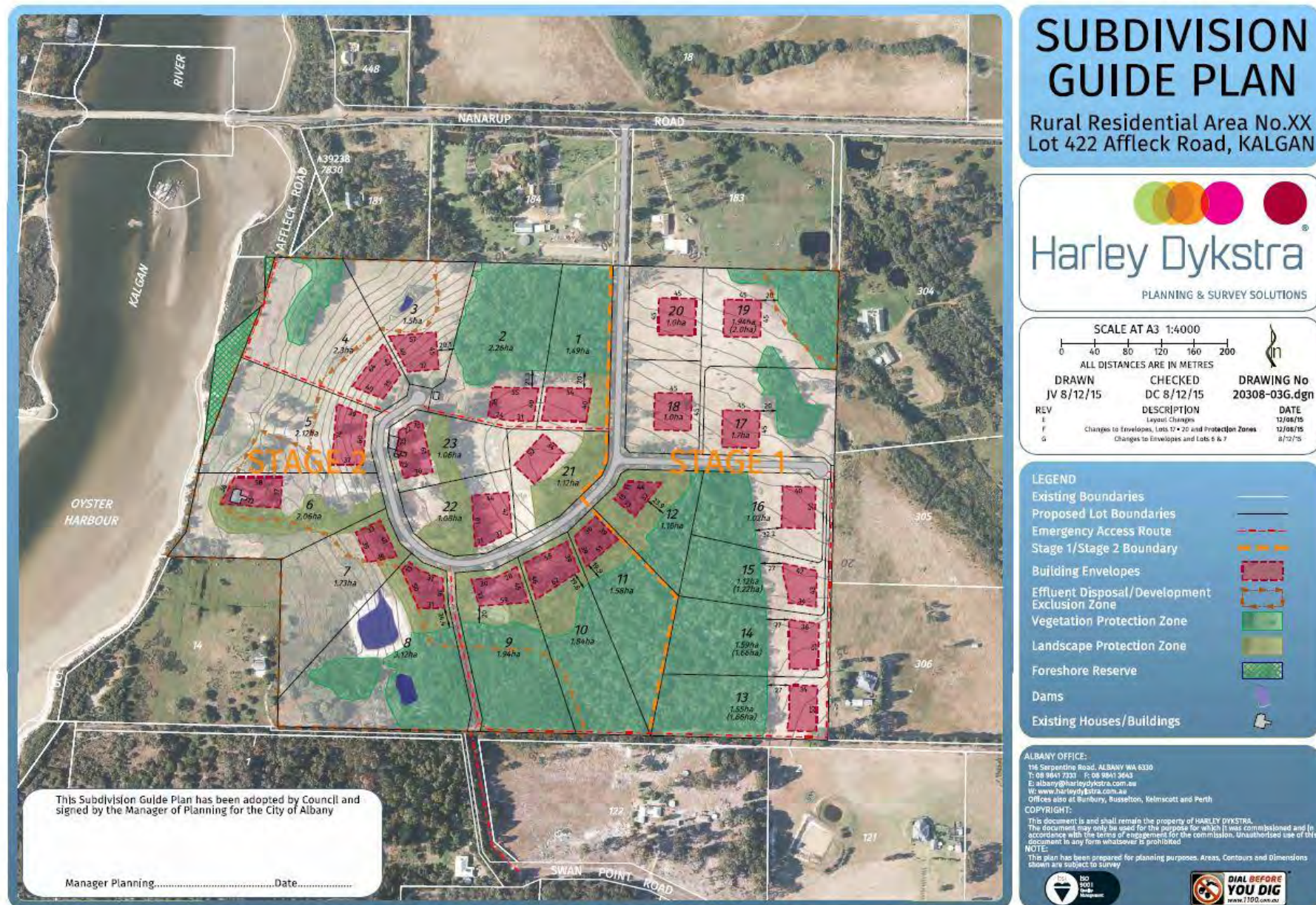
STATUS	FILE	DATE
FINAL	HD025	23/02/2015

OBRM BUSHFIRE PRONE MAPPING 7/12/15



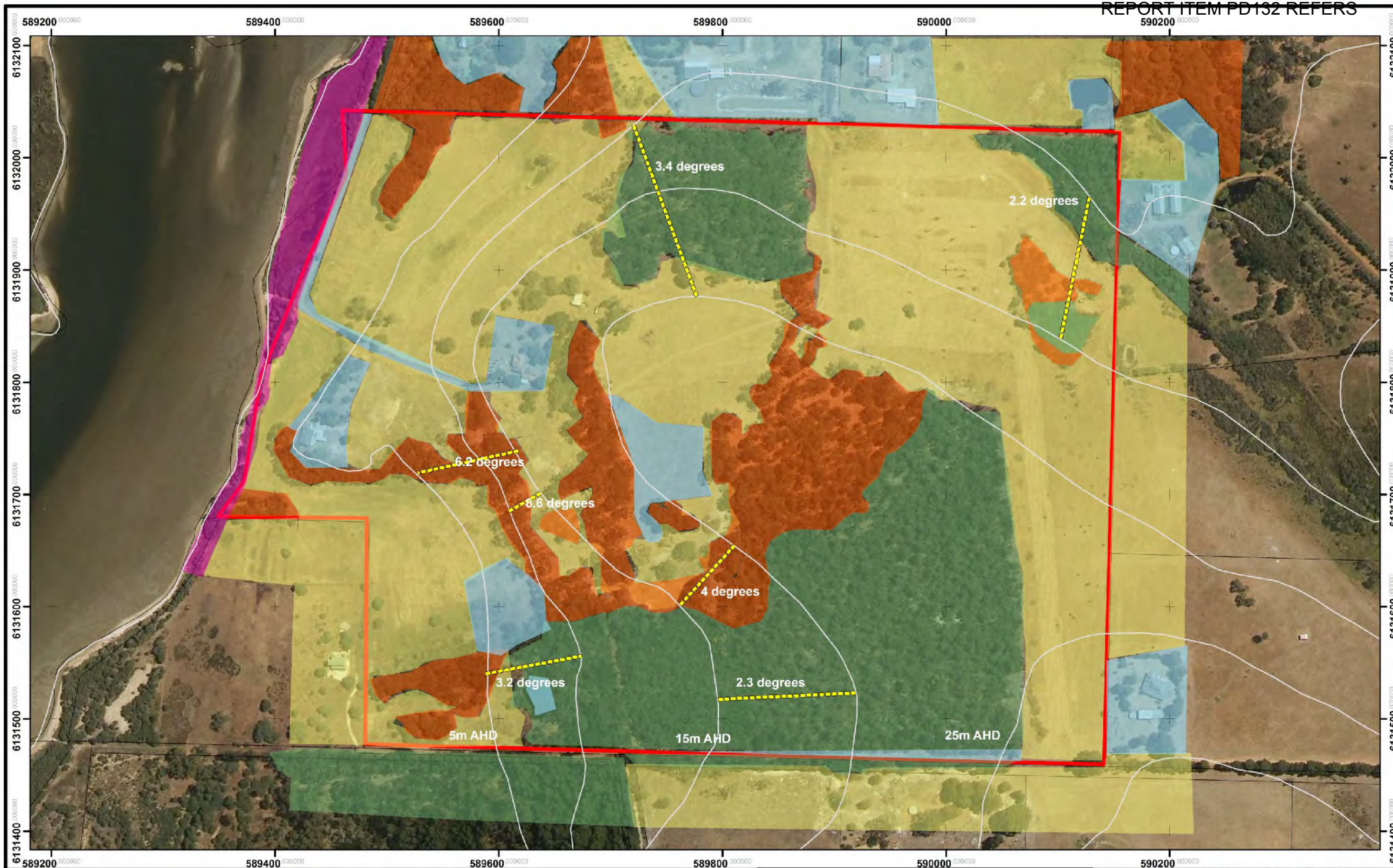
Appendix B

Subdivision Guide Plan



Appendix C

Vegetation Mapping

**Legend**

- | | | |
|---------------|------------------|-----------------------|
| Cadastre | Forest Type A | Low Threat Vegetation |
| Slope degrees | Woodland Type B | |
| 5m Contours | Shrubland Type D | |
| Subject site | Grassland Type G | |

Scale
1:3,200 @ A3
GDA 94 MGA Zone 50

0 25 50 100 150 200 Meters



**BIO
DIVERSE
SOLUTIONS**

55 Peppermint Drive
Albany, WA 6330
Australia
Tel: 08 9841 3936
Fax: 08 9841 3936
Mob: 0447 555 516

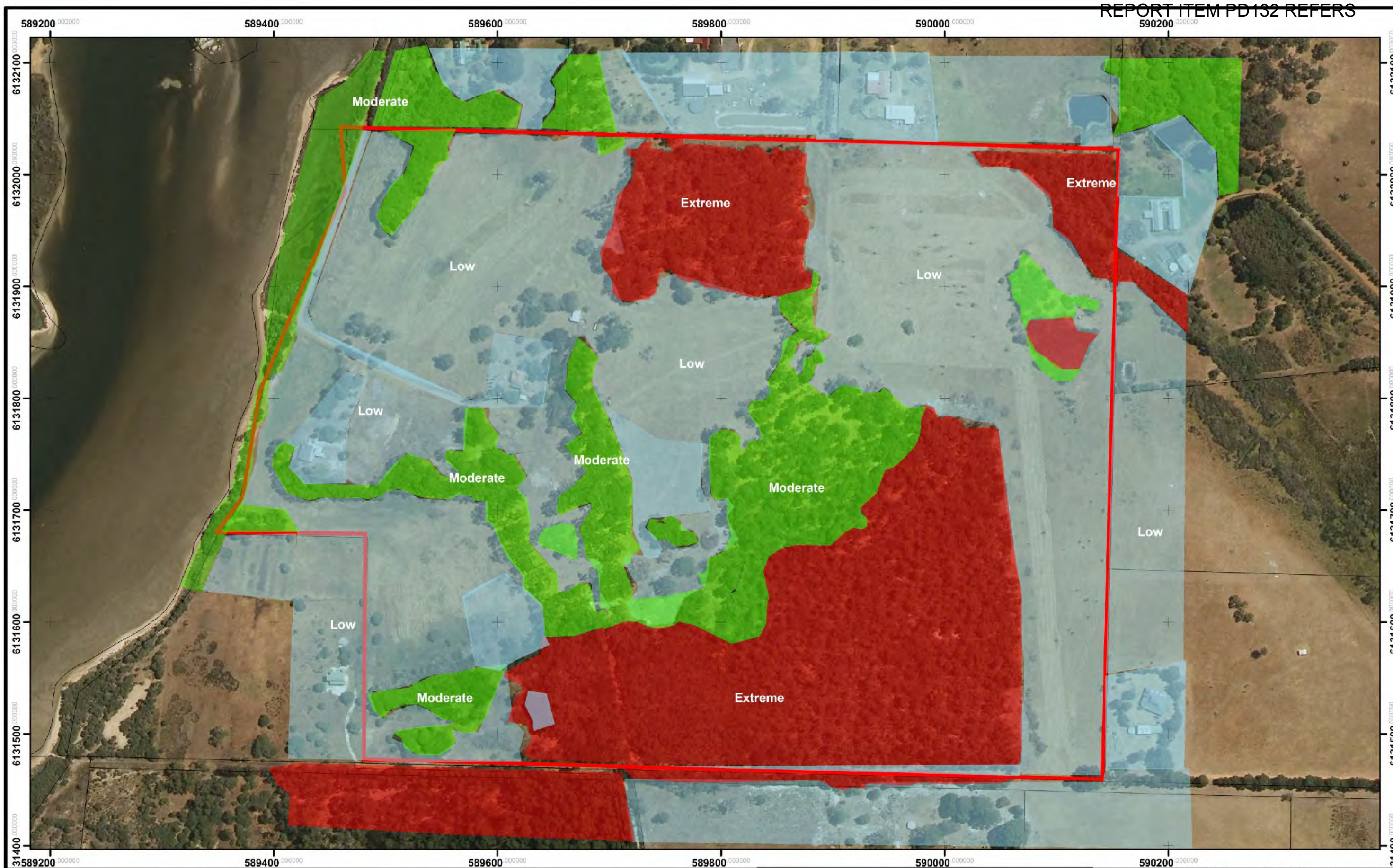
CLIENT Lot 422 Swan Point Road
Lower Kalgan
Albany WA 6330

Vegetation Mapping

STATUS	FILE	DATE
FINAL	HD025	23/02/2015

Appendix D

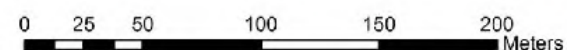
Bushfire Hazard Mapping



Legend



Scale
1:5,400 @ A3
GDA 94 MGA Zone 50



**BIO
DIVERSE
SOLUTIONS**

55 Peppermint Drive
Albany, WA 6330
Australia
Tel: 08 9841 3936
Fax: 08 9841 3936
Mob: 0447 555 516

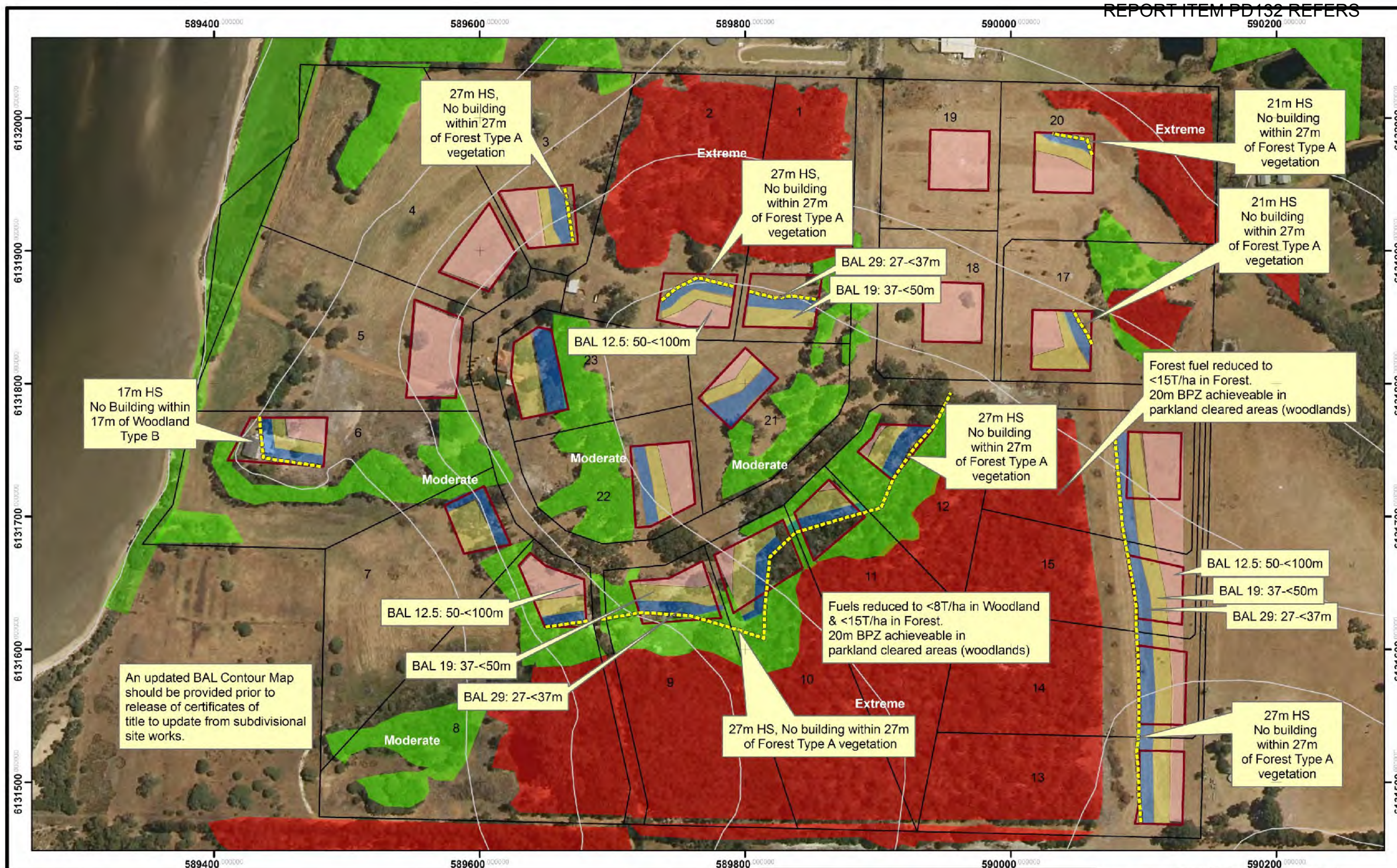
CLIENT Lot 422 Swan Point Road
Lower Kalgan
Albany WA 6330

Bushfire Hazard Mapping

STATUS	FILE	DATE
FINAL	HD025	23/02/2015

Appendix E

BAL Contour Plan



Legend

--- Hazard Separation	BAL 19	Moderate
--- 5m contours	BAL 29	Extreme
BAL 12.5	SGP	

Scale
1:2,700 @ A3
GDA 94 MGA Zone 50

0 25 50 100 150 200 Meters



**BIO
DIVERSE
SOLUTIONS**

55 Peppermint Drive
Albany, WA 6330
Australia
Tel: 08 9841 3936
Fax: 08 9841 3936
Mob: 0447 555 516

CLIENT Lot 422 Swan Point Road
Lower Kalgan
Albany WA 6330

BAL Contour Plan

STATUS	FILE	DATE
FINAL	HD025	22/12/2015

Appendix F

DFES Information to the homeowner



DFES
Department of Fire & Emergency Services

Information Note

September 2014

What is a Building Protection Zone?

Key Points

- Fuel loads influence bushfire intensity.
- The lower the fire's intensity the less impact on the building.
- Creating a minimum 20-metre reduced fuel load area (building protection zone) will increase the protection of the building.
- Ember protection is important to protect the building.
- Constructing or retrofitting your home to meet the Australian Standard 3959 — *Construction of buildings in bushfire-prone areas*, and addressing bushfire risks in accordance with the *Planning for Bushfire Risk Management Guidelines* will ensure your house has the best bushfire protection.

Definitions

- **Scrub crown** is the green, leaf material on the scrub plants.
- **Surface fire** is the fire burning the leaves and scrub on the top of the ground.
- **Mineral earth firebreak** is a firebreak without vegetation.
- **Ember attack** is where the bark and fine vegetation material is set alight, becomes airborne and is carried toward of the fire.

Managing and reducing fuel loads

Managing and reducing fuel loads for a minimum of 20 metres around a building will increase its likely survival from a bushfire.

Known as the Building Protection Zone (BPZ), the aim of this area is to ensure that there will be no direct flame contact on the building from a bushfire. By utilising fuel management options it will also be possible to reduce the potential radiant heat impact on the building.



Above: Well prepared Building Protection Zone with reduced fuel.

If there is little or nothing to burn then the fire's impact will be reduced. This can be achieved by:

- Maintaining a minimum 2 metre gap between trees and the building. Make sure that no trees overhang the house.
- Ensuring tree crowns are a minimum of 10 metres apart.
- Ensuring there is a gap between shrubs and buildings of three times their mature height.
- Ensuring shrubs aren't planted in clumps.
- Keeping the grass short and prune the scrub so that it is not dense, nor does it have fine, dead aerated material in the crown of the scrub.
- Raking up leaf litter and twigs under trees and remove trailing bark.
- Pruning lower branches (up to 2 metres off the ground) to stop a surface fire spreading to the canopy of the trees.
- Creating a mineral earth firebreak.
- Having your paths adjacent to the building and have your driveway placed so that it maximises the protection to the house.

Version 5, September 2014

For more information contact the Environmental Protection Branch on 9395 9300 • email: environment@dfes.wa.gov.au or visit www.dfes.wa.gov.au

- Storing firewood away from the building.
- Ensuring fences and sheds are constructed using non-combustible materials, but preferably not located in the BPZ.
- Keeping your gutters free of leaves and other combustible material.
- Ensuring gas bottles are secured and positioned so that they will vent away from the building, if subject to flame contact or radiant heat.

Ember attack

In a bushfire, most homes that are damaged or destroyed are from ember attack. These burning embers get into gaps within the building, such as into the roof cavity, and ignite the material within the cavity. It can take a number of hours before the burning becomes apparent and by that time the building may not be able to be saved.



Above: Reduced fuel in the Building Protection Zone contributed to the survival of this home in a bushfire.

Right: Home destroyed by bushfire, note the tree branches overhanging the house.

It is recommended that all homes that may be affected by embers be made ember proof. If a bushfire occurs in the general area, then the roof cavity and other crevices should be inspected to ensure that no embers have caused a fire. Be aware that there are electricity cables in the roof area and the introduction of water will be a safety issue.



i For more information contact the Environmental Protection Branch on 9395 9300, email: environment@dfes.wa.gov.au or visit www.dfes.wa.gov.au

BUSHFIRE**Building Protection Zones**

FACTSHEET

02**ARE YOU
BUSHFIRE
READY?**

areyouready.wa.gov.au

**PREPARING YOUR HOME AND
PROPERTY FOR A BUSHFIRE**

You should prepare your home to survive the passage of a bushfire, even if your plan is to leave. A well prepared and constructed house is more likely to survive a bushfire than an unprepared one. **Firefighters cannot defend every property and are unlikely to defend a poorly prepared property; remember their lives are at risk too.**

**DID YOU KNOW?****Firebreaks have a number of purposes.**

They are used to stop the spread of a bushfire and are also used by firefighters to gain access around all areas of your property and as a place from which to fight a fire.

Remember that firebreaks must be wide enough and have enough vertical clearance to let a firefighting truck pass.

Maintain your firebreaks to ensure your property can be defended during a fire.

- ☐ **Create a minimum 20 metre building protection zone** around your home and other buildings. This area needs to be cleared of all rubbish, long dry grass, bark and material that may catch fire.
- ☐ **Prune lower branches** (up to two metres off the ground) to stop a ground fire spreading into the canopy of the trees.
- ☐ **Clear vegetation** around your property to create a fire break, particularly the overhanging branches. Make sure you meet your local government's firebreak requirements.
- ☐ **Cut grass** to less than 10 centimetres high and prune shrubs to remove dead material.

For more information visit www.dfes.wa.gov.au or contact **DFES Community Engagement** 9395 9816



Government of Western Australia
Department of Fire & Emergency Services



PREPARE ACT SURVIVE



Information Note

19/5/08 – Version Control I

Why do we need to manage fuel loads in the urban/forest interface zone?

Key Points

- ⇒ Fuel loads influence bush fire intensity.
- ⇒ The lower the intensity the more options are available to firefighters to suppress a fire.
- ⇒ Managing the fuel load will assist firefighters to suppress bush fires that may threaten homes.
- ⇒ A destructive fire does not need extreme weather conditions.

Definitions

- ⇒ Bush fire intensity is determined by the rate of spread of the fire, the fuel consumed and the heat yield of the burning vegetation.
- ⇒ Fire intensity is calculated by

$$\text{Rate of spread} \times \text{fuel burnt} / 2$$

By managing and reducing fuel loads fire-fighters are able to put bush fires out more quickly. This also reduces the impact a fire has on property and lives of the owners and surrounding neighbours.

With the correct weather conditions and planning, property owners can undertake their own prescribed burning during winter months to reduce the risk of bush fires.

This will reduce the impact a bush fire may have on the owner's property and assist fire fighters in suppressing a fire.

High fuel loads in a bush fire which will burn quicker and hotter and destroy more bush.

As the intensity of the fire increases, it is harder for fire-fighters to put the fire out as their options become increasingly diminished. This can be seen from the head fire behaviour classes table over the page.

For example a fire which starts in the Perth hills which has 20 tonne per hectare of fuel and travels at 200 metres per hour will have a fire intensity of approximately 2,000 kilowatts per metre. The table over the page shows fire-fighters can put the fire out using fire appliances and machinery to cut fire breaks.

A destructive fire doesn't need extreme weather conditions.

A fire of 2,000 kilowatts per metre in the Perth hills which has 20 tonnes per hectare of fuel only needs a temperature of 30 degrees, relative humidity of 55 percent and a wind speed of 16 kilometres per hour before it directly exceeds the capability of fire-fighters to directly attack the bush fire.

The only way to stop this from occurring and to decrease fire intensity is by reducing and managing the amount of fuel available.

People undertake prescribed burning because it is the least intrusive option compared with slashing or using herbicides.

For more information contact the Bush Fire and Environmental Protection Branch on 9323 9300 or visit www.fesa.wa.gov.au

Why do we need to manage fuel loads in the urban/forest interface zone?

The table below shows the options available to firefighters when suppressing a fire at different levels of intensity and rate of spread (ROS).

HEADFIRE BEHAVIOUR CLASSES
1 Readily suppressed. Intensity < 800 kW/m and/or ROS < 60 m/hr in all fuels
2 Hand tool attack possible Intensity < 800 kW/m and/or ROS < 140 m/hr in forest/woodland and shrubland Intensity < 800 kW/m and/or ROS < 300 m/hr in grassland
3 Direct machine and tanker attack possible Intensity < 2000 kW/m and/or ROS < 400 m/hr in forest/woodland Intensity < 2000* kW/m and/or ROS < 1000 m/hr in shrubland Intensity < 5000 kW/m and/or ROS < 6500 m/hr in grassland
4 Direct attack not possible/unlikely to succeed. Intensity > 2000 kW/m and/or ROS > 400 m/hr in forest/woodland Intensity > 2000* kW/m and/or ROS > 1000 m/hr in shrubland Intensity > 5000 kW/m and/or ROS > 6500 m/hr in grassland
5 Indirect attack likely to fail Intensity > 4000 kW/m and/or ROS > 800 m/hr in forest/woodland Intensity > 8000 kW/m and/or ROS 2000 m/hr in shrubland ROS > 10000 m/hr in grassland

Table from C Muller, 2008, "Bush Fire Threat Analysis" Chris Muller

Key
 kW/m Kilowatts per metre
 m/h Metres per hour
 ROS Rate of spread

Description of fuels

Forest occurs where the tall trees and dense canopies grow in the higher rainfall areas such as the jarrah forest between Mundaring and the karri forest near Walpole.

Woodland is an area covered in trees ranging between the higher rainfall areas to the arid interior of the State or on the Swan Coastal Plain. As the trees are spaced further apart than in a forest there is little leaf litter. These areas can also be very floristically diverse.

Shrubland is dominated by small woody shrubs such as in mallee and mulga areas and are primarily in the low rainfall interior. These areas can also be very floristically diverse.

Grassland is an area dominated by grasses, with varying levels of over storey.

For more information contact the Bush Fire and Environmental Protection Branch on 9323 9300 or visit www.fesa.wa.gov.au

BUSHFIRE**Evaporative Air Conditioners**

FACTSHEET

08**ARE YOU
BUSHFIRE
READY?**

areyouready.wa.gov.au

DID YOU KNOW?

Your evaporative air conditioning unit can catch fire as a result of embers from bushfires, or even small back yard fires, getting into your unit. If a fire starts in your air conditioner, it can spread quickly throughout your home.

**If there is smoke nearby
you should:**

- ☐ Run the air conditioner to wet the filter pads
- ☐ When smoke is over your home or ash starts to drop around your house, switch the air conditioner off
- ☐ If possible, continue to run water over the filter with the fan turned off
- ☐ If the water can't be run on its own, or if there is a power failure at the time, wet the air conditioner filter pads using a garden hose
- ☐ Keep checking your air conditioner and the area around your home for spot fires from embers until the danger has passed

It can be difficult for firefighters to put out a fire caused by embers getting into the roof space of your home. Knowing what to do to keep your evaporative air conditioner safe from fire can help save your property.

For more information on evaporative air conditioners see DFES Information Note on Ember Protection Screens.

DID YOU KNOW?

If you live within 500 metres of bushland and have a roof mounted evaporative air conditioning unit, your home may be at increased risk of ember attack.



**If your home does
catch fire, leave your
home and call 000
immediately**

WHAT IS EMBER ATTACK?

Embers are pieces of burning bark, leaves or twigs that are carried by the wind around the main fire creating spot fires.

For more information visit www.dfes.wa.gov.au or contact DFES Community Engagement 9395 9816

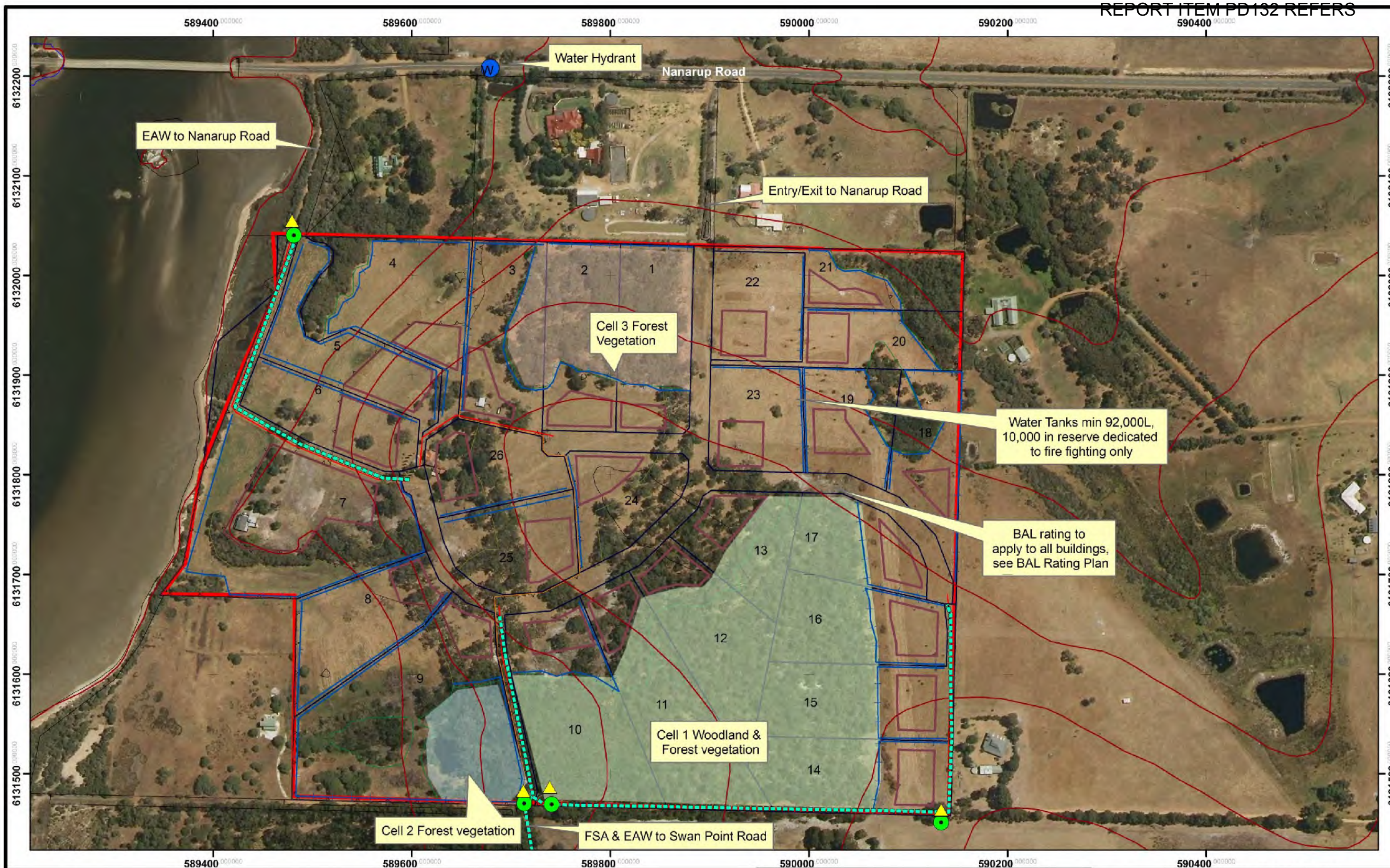


Government of Western Australia
Department of Fire & Emergency Services

**PREPARE ACT SURVIVE**

Appendix G

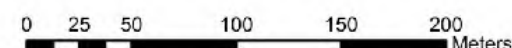
Bushfire Management Plan



Legend

- Water hydrant --- FSA --- EAW
- ▲ Sign Cell 1
- Gate Cell 2
- + Firebreak Cell 3

Scale
1:3,600 @ A3
GDA 94 MGA Zone 50



**BIO
DIVERSE
SOLUTIONS**

55 Peppermint Drive
Albany, WA 6330
Australia
Tel: 08 9841 3936
Fax: 08 9841 3936
Mob: 0447 555 516

CLIENT Lot 422 Swan Point Road
Lower Kalgan
Albany WA 6330

Bushfire Management Plan

STATUS	FILE	DATE
FINAL	HD025	09/03/2015

Appendix H

Works Program

Lot 422 Site Development: Developer Responsibilities				
Item	Standard required/Task Description	To be completed by	Person Responsible	Further information
Internal Roads	To Standards in Table 4	During construction	Developer	As outlined in Bushfire Management Plan & Civil Engineers
Fire Service Access	To Standards in Table 4 - access along southern FSA	During construction	Developer	As outlined in Bushfire Management Plan
Building Protection Zones	Ensure maintained to DFES Standard 20m	During construction	Developer	As outlined in Bushfire Management Plan
Hazard Protection Zones	Ensure maintained to AS3959-2009 standard	During construction	Developer	As outlined in Bushfire Management Plan
Water	Hydrants in road reserve	During construction	Developer	As outlined in Bushfire Management Plan & Civil Engineers
Firebreaks	It will be the responsibility of the developer to maintain firebreaks until the site is developed or changes ownership.	During construction	Developer	As outlined in Bushfire Management Plan and CoA Fire break order.
Low Fuel Areas	Low fuel areas, maintain to APZ standards as outlined in as outlined in Section 6.5.1, until lots relinquished to new owners.	Ongoing	Developer	As outlined in Bushfire Management Plan

Lot 422 - Fire Mitigation Works Plan – Ongoing (Post Lot Sale)				
Item	Standard required/Task Description	To be completed by	Person Responsible	Further information
Internal Driveways	As outlined in Table 4 to be implemented by new lot owners.	CoA deadlines	Lot owner	Civil Engineers
Fire Service Access	Maintained as outlined in Table 4 if it traverses their property.	Annually	Lot owner	As outlined in Bushfire Management Plan and as required by the CoA
Building Protection Zones	CoA & DFES standard	Annually	CoA deadlines	DFES and CoA
Hazard Protection Zones	To AS3959-2009	Annually	Lot owner	DFES and CoA
Building to AS3959-2009	To Australian standard as it applies to individual properties and approved at building construction stages.	Annually.	Lot owner	Australian Standard 3959-2009
Water	Maintenance of hydrants after developer relinquished responsibility.	Annually	CoA/BFB	Water Corporation WA
Firebreaks	CoA firebreak order	Annually	Lot owner	As outlined in Bushfire Management Plan and CoA Fire break order.
Low Fuel Areas	As outlined in Section 6.5.1.	Bi-annually	Lot owner	As outlined in Bushfire Management Plan

Appendix I

DFES Checklist

Appendix I Bushfire Management Plan– Compliance Checklist

Element 1: Location

Does the proposal comply with the performance criteria by applying acceptable solution **A1.1?**

Yes ☒ No ☐

Not in an area where the bushfire hazard does not present an unreasonable level of risk to life and property. Requires construction standards to BAL Construction and AS3959-2009 where 100m HSZ cannot be achieved. No building to higher than BAL 29.

Element 2: Siting and Design of Development

Does the proposal comply with the performance criteria by applying acceptable solution **A2.1?**

Yes ☒ No ☐

20m APZ achievable within the individual lots, large lots and >2000m² BE's.

Does the proposal comply with the performance criteria by applying acceptable solution **A2.2?**

Yes ☒ No ☐

HS achieved between 17-27m from woodland and forest fuels (respectively) all dwellings to be built to BAL and AS3959-2009. No higher than BAL 29 applied to subdivision.

Element 3: Vehicular access

Does the proposal comply with the performance criteria by applying acceptable solution **A3.1?**

Yes ☒ No ☐

Access along new road reserves, two EAW's provide three exit/entry points.

Does the proposal comply with the performance criteria by applying acceptable solution **A3.2?**

Yes ☒ No ☐

Public roads to meet minimum grades.

Does the proposal comply with the performance criteria by applying acceptable solution **A3.3?**

Yes ☒ No ☐

N/A

Does the proposal comply with the performance criteria by applying acceptable solution **A3.4?**

Yes ☒ No ☐

To minimum standards

Does the proposal comply with the performance criteria by applying acceptable solution **A3.5?**

Yes ☒ No ☐

Private driveways will be constructed to required DFES standards.

Does the proposal comply with the performance criteria by applying acceptable solution **A3.6?**

Yes ☒ No ☐

Emergency Access Ways to the south and north west.

Does the proposal comply with the performance criteria by applying acceptable solution **A3.7?**

Yes ☒ No ☐

Fire Service Access along southern boundary, will be constructed to required DFES standards.

Does the proposal comply with the performance criteria by applying acceptable solution **A3.8?**

Yes ☒ No ☐

Firebreaks to CoA standards.

Element 4: Water

Does the proposal comply with the performance criteria by applying acceptable solution **A4.1?**

Yes ☒ No ☐

Individual water tanks 92,000L with 10,000L in reserve for fire fighting only.

Application Declaration

I declare that the information provided is true and correct to the best of my knowledge.

Full name: MARTIN SHUTTLEWORTH

Agency/Corporation: N/A. LANDOWNER

Applicant signature:

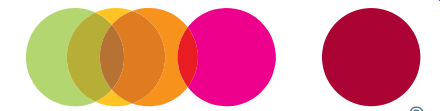


Date: 3RD JUNE 2015

APPENDIX E – SUBDIVISION GUIDE PLAN

SUBDIVISION GUIDE PLAN

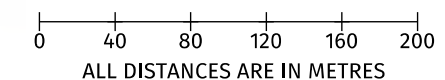
Rural Residential Area No.XX
Lot 422 Affleck Road, KALGAN



Harley Dykstra®

PLANNING & SURVEY SOLUTIONS

SCALE AT A3 1:4000



DRAWN
JV 8/12/15

CHECKED
DC 8/12/15

DRAWING No
20308-03G.dgn

REV	DESCRIPTION	DATE
E	Layout Changes	12/08/15
F	Changes to Envelopes, Lots 17 - 20 and Protection Zones	12/08/15
G	Changes to Envelopes and Lots 6 & 7	8/12/15

LEGEND

Existing Boundaries

Proposed Lot Boundaries

Emergency Access Route

Stage 1/Stage 2 Boundary

Building Envelopes

Effluent Disposal/Development
Exclusion Zone

Vegetation Protection Zone

Landscape Protection Zone

Foreshore Reserve

Dams

Existing Houses/Buildings



ALBANY OFFICE:

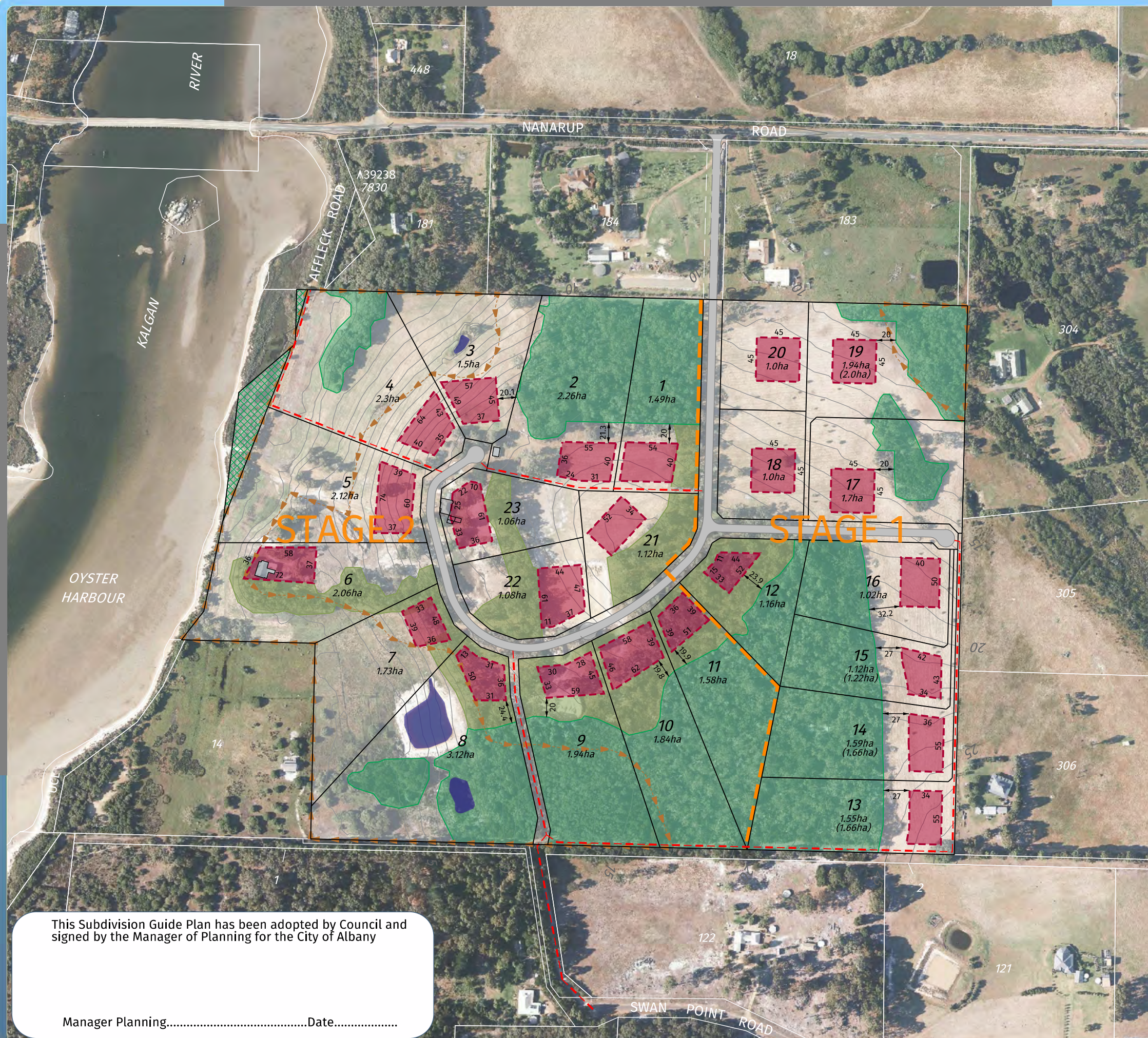
116 Serpentine Road, ALBANY WA 6330
T: 08 9841 7333 F: 08 9841 3643
E: albany@harleydykstra.com.au
W: www.harleydykstra.com.au
Offices also at Bunbury, Busselton, Kelmscott and Perth

COPYRIGHT:

This document is and shall remain the property of HARLEY DYKSTRA. The document may only be used for the purpose for which it was commissioned and in accordance with the terms of engagement for the commission. Unauthorised use of this document in any form whatsoever is prohibited.

NOTE:

This plan has been prepared for planning purposes. Areas, Contours and Dimensions shown are subject to survey



This Subdivision Guide Plan has been adopted by Council and signed by the Manager of Planning for the City of Albany

Manager Planning.....Date.....

APPENDIX F – ADDITIONAL INFORMATION SUPPORTING
SCHEME AMENDMENT TO REZONE LOT 422 AFFLECK ROAD

Our Ref: 20308

22 March 2016

City of Albany
Attn: Jan van der Mescht
PO Box 484
Albany WA 6331

Dear Jan,

RE: Additional information supporting Scheme Amendment to rezone Lot 422 Affleck Road

Introduction

A Scheme Amendment to rezone Lot 422 Affleck Road, Kalgan to Special Residential was initiated by Council at the July 2011 Ordinary Council meeting, but not progressed due to the landowners personal circumstances. The property was later sold and in 2014 Harley Dykstra were engaged by the current landowner to progress an Amendment to rezone the land to Rural Residential.

In July 2015 Councillors resolved to impose a moratorium *"on initiation of significant Local Planning Scheme amendments to rezone agricultural land, or intensify adjacent sensitive land uses, other than those that promote ongoing productive use of the land, effective from 28 July 2015, until the review of the Albany Local Planning Strategy has been completed."*

A letter received from the City of Albany, dated 25 August 2015, notes:

"Council will continue to consider minor planning scheme amendments over, or in the vicinity of agricultural land where it is considered "infill development" or allows for ongoing productive use of the land."

The moratorium imposed to address concerns raised by Councillors, including:

- *the number of Local Planning Scheme amendments that are being presented to them for consideration and the implications that this has in terms of the loss of productive agricultural land, the oversupply of semi-rural 'lifestyle' lots, and the creation of land use conflicts between primary industries and adjacent sensitive land uses.*
- *environmental impacts of such development, ongoing servicing costs, and that the assessment of scheme amendments becoming a drain on staff resources within the Development Services directorate*
- *Increasing number of complaints received from residents of 'Special Residential' and 'Rural Residential' zoned areas (predominantly the latter) about primary industries operating on adjoining lots, whether agricultural enterprises or other industries, such as quarrying.*

This submission provides supporting information to address these concerns and requests the Amendment to rezone lot 422 be reported to the next available Council meeting.

Historical Support for rezoning Lot 422

At its meeting dated 15 June 2010, Council considered the final adoption of the Albany Local Planning Strategy. As part of the adoption of the Strategy the City formally resolved the following in relation to the subject land:

ALBANY

116 Serpentine Road, Albany WA 6332
PO Box 5207, Albany WA 6332

T: 08 9841 7333
F: 08 9841 3643

E: albany@harleydykstra.com.au
www.harleydykstra.com.au

Albany Bunbury Busselton Kelmscott Perth

ACN 009 101 786 ABN 77 503 764 248



“That Council for land at Lower Kalgan agrees to MODIFY the ‘Future Urban designation to ‘Special Residential’ on the north side of Nanarup Road and Lots 181, 184 and Pt Lots 183 and 422 on the south side of Nanarup Road (as per attached plan), and “Rural Residential” on the remainder of land on the south side of Nanarup Road and to the west of the Kalgan River.”

A Scheme Amendment to rezone Lot 422 Affleck Road, Kalgan to Special Residential was initiated by Council at the July 2011 Ordinary Council meeting. However this was not finalised due to personal circumstances of the landowner at the time.

A copy of Council’s earlier decision to initiate rezoning of Lot 422 is available on public records.

The rezoning proposal and supporting Subdivision Guide Plan have been carefully worked up together with Local and State Planners over the past years and all of the required supporting studies and design alterations have been completed so that the rezoning is now ready to be recommended for Council approval.

Council Planning Officers have contributed input throughout the process, which involved modifying the Subdivision Guide Plan, fire management plans, and completion of vegetation assessments to address all the planning requirements and progress the Amendment to a point which now satisfies Council’s requirements.

Environmental impacts and Infill Development

This Amendment has considered environmental impacts of development on the site. A vegetation assessment was completed to assess the condition, quality and location of all vegetation. Ongoing consultation with Council Planning staff has resulted in several revisions to the subdivision layout, lot sizes and building envelope locations to protect and retain quality vegetation.

This Amendment represents a logical completion of the rural residential land use and development pattern of the locality. Given that the proposal completes the surrounding zoning pattern, there is no opportunity for this proposal to set a precedent for new or additional rural residential development in the locality, and supports the proper and responsible creation of a Rural Living area.

Figure A below illustrates the surrounding zoning and support of infill development.

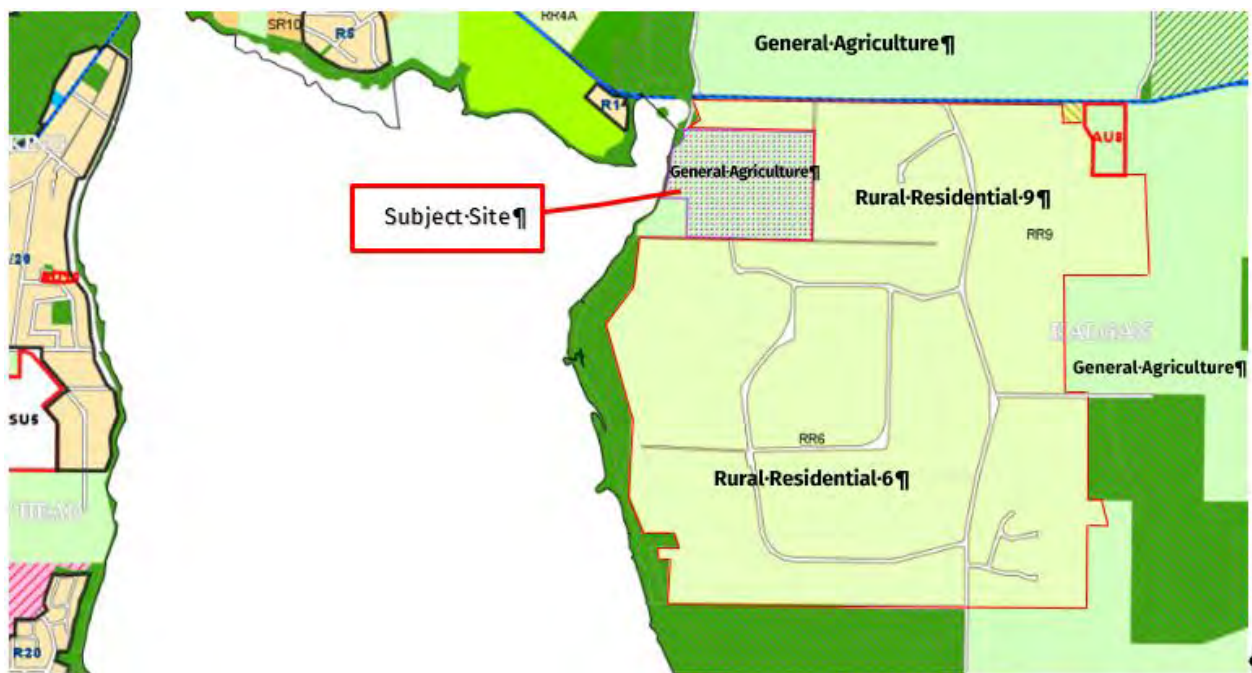


Figure A: Zoning Plan

(Source: City of Albany)

The following points also support this Amendment being classified as infill development:

- Land to the east of Lot 422 and land to the north and south, form part of Rural Residential Zone No. 6 which is comprised of lots of 2ha and above. Refer to **Figure A**.
- The proposal **will not encroach** onto productive agricultural land, but rather complete the residential enclave that currently exists in the locality.
- The Amendment **will not result** in the creation of a new front of residential development, allowing the potential for future residential development to occur in the future.
- The Amendment **will not result** in the creation of a new rural town site, but rather allow rural residential development to occur within an existing rural residential area.
- The Amendment **will not result** in the extension of infrastructure and services which will be unsustainable for Council to maintain. Rather, this will assist to improve the efficiency of existing infrastructure and services including road networks and rubbish collection.
- General agriculture zoning of Lot 422 is inconsistent with the surrounding area, and the future use of the site as identified within the Albany Local Planning Scheme. This amendment seeks to correct this inconsistency in accordance with its intended strategic use.
- The site is located approximately 500 metres, or a 5 minute walk, from the Great Southern Grammar School. This being a leading regional educational establishment with around 770 students enrolled between kindergarten and year 12.

Loss of productive Agricultural land

Physical attributes of the site including topography, soil profile and vegetation result in Lot 422 Affleck Road not being considered productive agricultural land. These factors have also resulted in the land not being actively used for agricultural production, and identified for future residential purposes in ALPS.

As the land does not serve or support productive agricultural production, rezoning this land will not impact on agricultural production.

Supply and demand of semi-rural 'lifestyle' lots

Since its initial development in the 1980's, Swan Point has proven a popular lifestyle choice for many Albany residents. This area created small rural landholdings for residents who wish to enjoy a residential lifestyle with a rural landscape and environment. Its popularity is largely driven by its rural location being in close proximity to existing urban areas including the Albany town centre and Great Southern Grammar School.

Over time, demand for the locality resulted in Swan Point expanding through numerous surrounding landholdings being rezoned Rural Residential. With the western and southern boundaries fronting onto Oyster Harbour and Crown Reserve, Rural Residential expansion has resulted on the eastern and northern fronts. Nanarup Road provides a physical barrier to further northern expansion of Rural Residential subdivision, leaving only the eastern front for continued encroachment into agricultural land.

There are 81 Rural Residential lots in the locality bordered by Nanarup Road to the north, Gull Rock Road to the east, Crown reserve to the south and Oyster Harbour to the west. The popularity of these lots has resulted in development of 71 of the 81 lots, leaving just 10 lots as undeveloped vacant land. As at 21 March 2016, there are just two vacant lots available for sale.* Refer to Figure B.

This rezoning seeks to round off the existing Swan Point Rural Residential zone on the western front, rather than consuming agricultural land or creating a new front of Rural Residential development within a rural area. Further it will provide a well-managed opportunity to provide rural residential supply to meet demand.

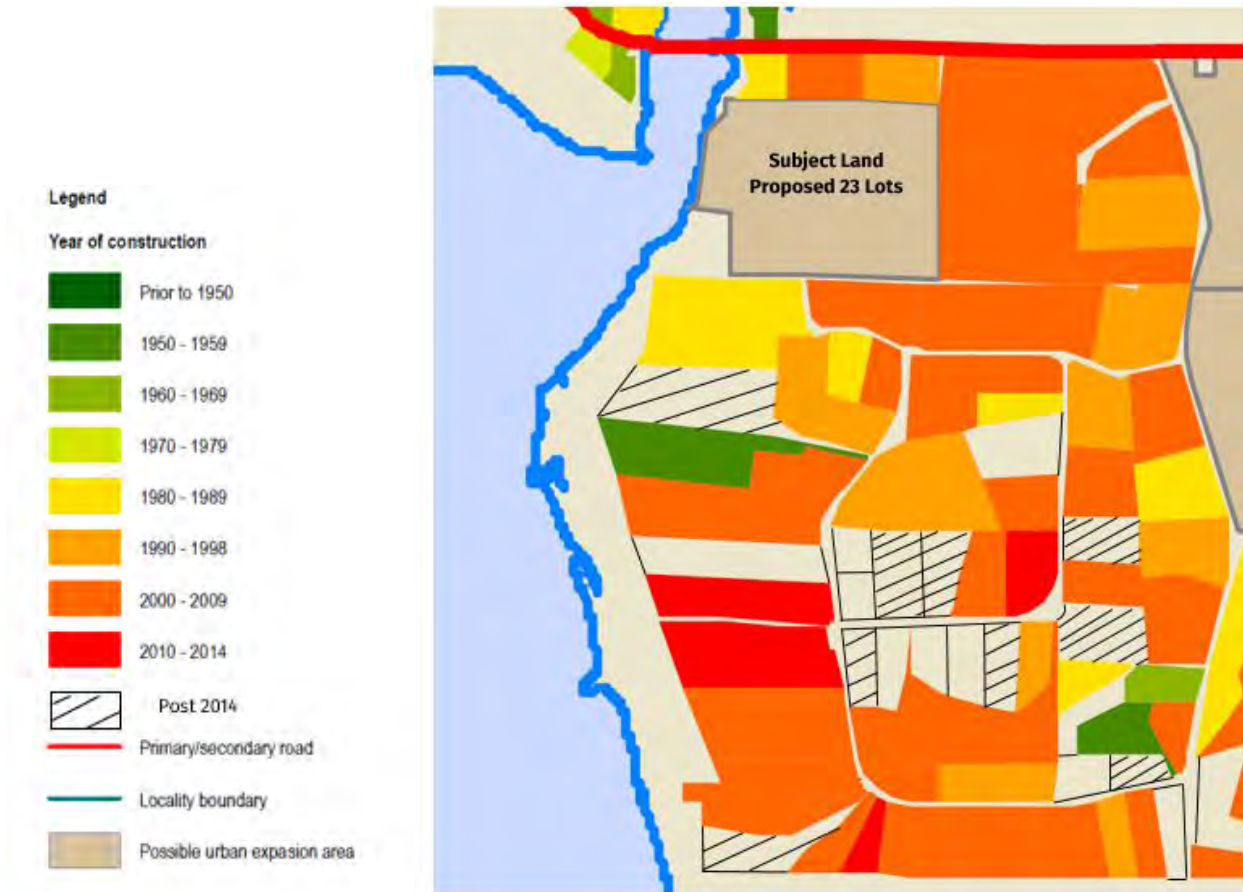


Figure B: Development occurring in Rural Residential locality (note: Post 2014 updated by author and includes development of non-habitable buildings)

(source: WAPC Albany Regional Hotspots Land Supply Update October 2015)

* Realestate.com.au (search 21.3.2016)

Land Use Conflict

This Amendment seeks to correct a zoning anomaly where a 40 hectare site of general agriculture zoned land has been encroached upon by rural residential development over the long term. This has resulted in a zoning of Lot 422 that is inconsistent with the surrounding area. Further this Amendment reduce the current land use conflict associated with agricultural land adjoining existing Rural Residential Area 9.

Current general agriculture zoning of Lot 422 permits the site to be used for intensive and extensive agriculture, including; raising of livestock and crops, development for irrigated fodder production and pastures - as well as agroforestry.

These land uses are not considered compatible with the surrounding rural residential zoning, and can lead to land use conflicts including:

- Odours, dust and noise associated with livestock entering residential areas
- Livestock entering adjoining properties
- Increased bushfire risk to residential areas, associated with tree plantations
- Chemicals from crop spraying entering residential areas

- Noise associated with farming machinery and activities including firearms, occurring within residential areas

Conclusion

The proposal to rezone Lot 422 Affleck Road, Swan Point from “General Agriculture” to “Rural Residential” is consistent with the objectives of ALPS and is also compatible with the existing design and land use of the surrounding Swan Point “Rural Residential” zone. Following on from the direction of ALPS, the owners have spent significant time and resources with progressing the Amendment, which has included extensive consultation with the City Planning department over many months and responding to requests for bushfire management plans and design modifications.

As previously mentioned, Council Planning Officers have contributed input throughout the process, which involved modifying the Subdivision Guide Plan, fire management plans, and completion of vegetation assessments to address all the planning requirements and progress the Amendment to a point which now satisfies Council’s requirements.

This proposal represents a logical long term solution for land that is already surrounded by existing Rural Residential subdivision and completion of the existing “Rural Residential” zone.

In consideration of the details and information provided, it is respectfully requested this Scheme Amendment to be recommended to Council.

Yours sincerely,



David Congdon
Senior Town Planner / Land Development Consultant
Harley Dykstra Pty Ltd

E-mail: davidc@harleyDykstra.com.au
Cc: Landowner