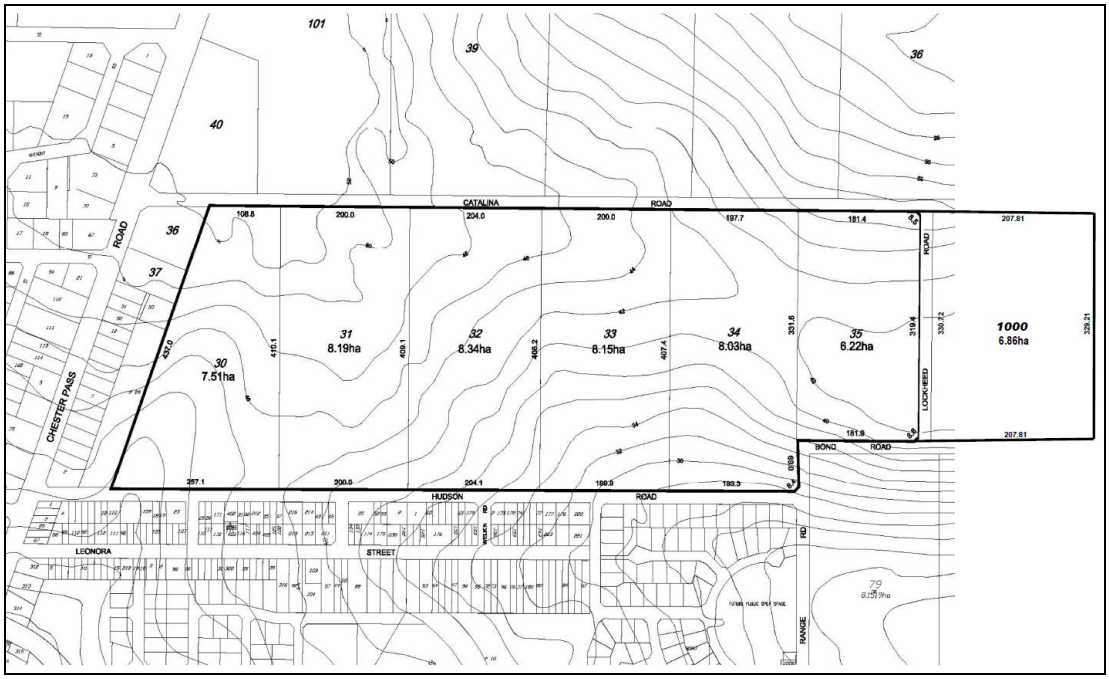
CITY OF ALBANY

TOWN PLANNING SCHEME NO. 3

OUTLINE DEVELOPMENT PLAN
Lots 30 – 35 CATALINA ROAD and Lot 1000 LOCKHEED ROAD, LANGE



July 2010

(Updated March 2012)

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Disclaimer:

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1.0 Introduction

Outline Development Plan
Lots 30 – 35 Catalina Rd and Lot 1000 Lockheed Rd Lange

1.1 Purpose of this document

This report and accompanying plans has been prepared on behalf of the owners of Lots 30, 32, 33, 34 and 35 Catalina Road, Lange for submission to the City of Albany, in support of a request to approve an Outline Development Plan (ODP) over Lots 30 – 35 Catalina Road and Lot 1000 Lockheed Road, Lange. The ODP represents a framework for the future development of this land, and provides a context for subdivision and development applications by establishing urban design principles, land uses, key road systems, open space and infrastructure. This ODP includes an area of approximately 46.5 ha of land that has been rezoned from "Rural" to "Residential Development", under Amendment No. 280 to Town Planning Scheme No. 3. This Scheme Amendment was given final approval by the Hon. Minister for Planning in November 2009, subject to minor modifications. Lot 1000 Catalina Road is also included within the ODP, although this lot is still within the Rural zone.

A multi-disciplinary consultant team addressed the planning, environmental and engineering requirements for the site as a basis for future development. The consultant team includes:-

- Dykstra Planning – town planning and design;
- Opus Consulting (Albany) – environmental, engineering and traffic consultants.

1.2 Background

The land, subject of this ODP lies immediately north of the existing residential development front at Hudson Road. This area has for many years been earmarked for urban development, and has been confirmed for residential expansion in the current Albany Local Planning Strategy.

The subject land is part of a broader precinct that has been addressed by the Yakamia Structure Plan, which is an initiative of the local authority that has been subject to extensive investigation, planning and consultation. Although the Yakamia Structure Plan is a comprehensive study and plan that has been completed, its adoption has been delayed indefinitely due to a number of environmental constraints that occur over other parts of the structure plan area, but that do not affect the land subject of this ODP. Accordingly, although the Yakamia District Structure Plan has yet to be finally adopted, the preferred structure for this precinct has been well studied under the Structure Plan. At its meeting of December 2007, the local authority

resolved to support the rezoning of Lots 30 – 35 Catalina Road from "Rural" to "Residential Development" zone. Subsequently, at its meeting of May 2008, the local authority further considered and supported the request for the "Additional Use" site for a Lifestyle Village over Lots 31, 32 and 33 Catalina Road. The "Residential Development" rezoning of the subject land, and the "Additional Use - Lifestyle Village" proposal over portion of the land, has been progressed under Amendment 280 to Town Planning Scheme No.3.

This ODP and supporting documents have been prepared in order to facilitate the subdivision and development of a high quality and sustainable residential precinct. The primary intent of this ODP is to create a precinct that supports the principles of environmental, social and economic sustainability, whilst respecting the desire for each landowner to develop with a degree of market variety and a degree of independence.

1.3 Key ODP objectives

This report includes the proposed ODP design, and addresses the urban design, planning, environmental, servicing and urban water management issues that are relevant to the site. The primary aim of this ODP is to provide a guide for the cohesive and orderly development of the land, however, a number of key principles and objectives have also guided the ODP preparation, namely:-

- To provide a framework for the progressive subdivision and development of the area by identifying areas for POS, drainage, major road routes, minor roads and residential uses and densities;
- To provide walkable, interconnected and efficient residential areas;
- To provide a variety of housing choice;
- To provide a road network with strong connections and direct access to POS;
- To incorporate best urban water management practices;
- To achieve a robust design that responds to the desire for landowner independence and housing variety; and
- To have regard for the planning context, both in terms of existing development and the broader strategic planning of the surrounding area.

2.0 Subject Land

Outline Development Plan
Lots 30 – 35 Catalina Rd and Lot 1000 Lockheed Rd Lange

2.1 Location

Lots 30 – 35 Catalina Road and Lot 1000 Lockheed Road are located in the Albany suburb of Lange, which is immediately north of Yakamia and on the eastern side of Chester Pass Road. The subject land lies between Catalina Road to the north and Hudson Road to the south, with Lockheed Road forming the eastern boundary of the ODP area. The subject land is located approximately 3.5 kms north of the Albany Town Centre, and is currently accessible from Chester Pass Road as the major regional road to the west. (Refer to Location Plan at **Figure 1**).

2.2 Description of Land

This proposal relates to Lots 30 – 35 Catalina Road and Lot 1000 Lockheed Road, Lange. The land is legally described as follows:-

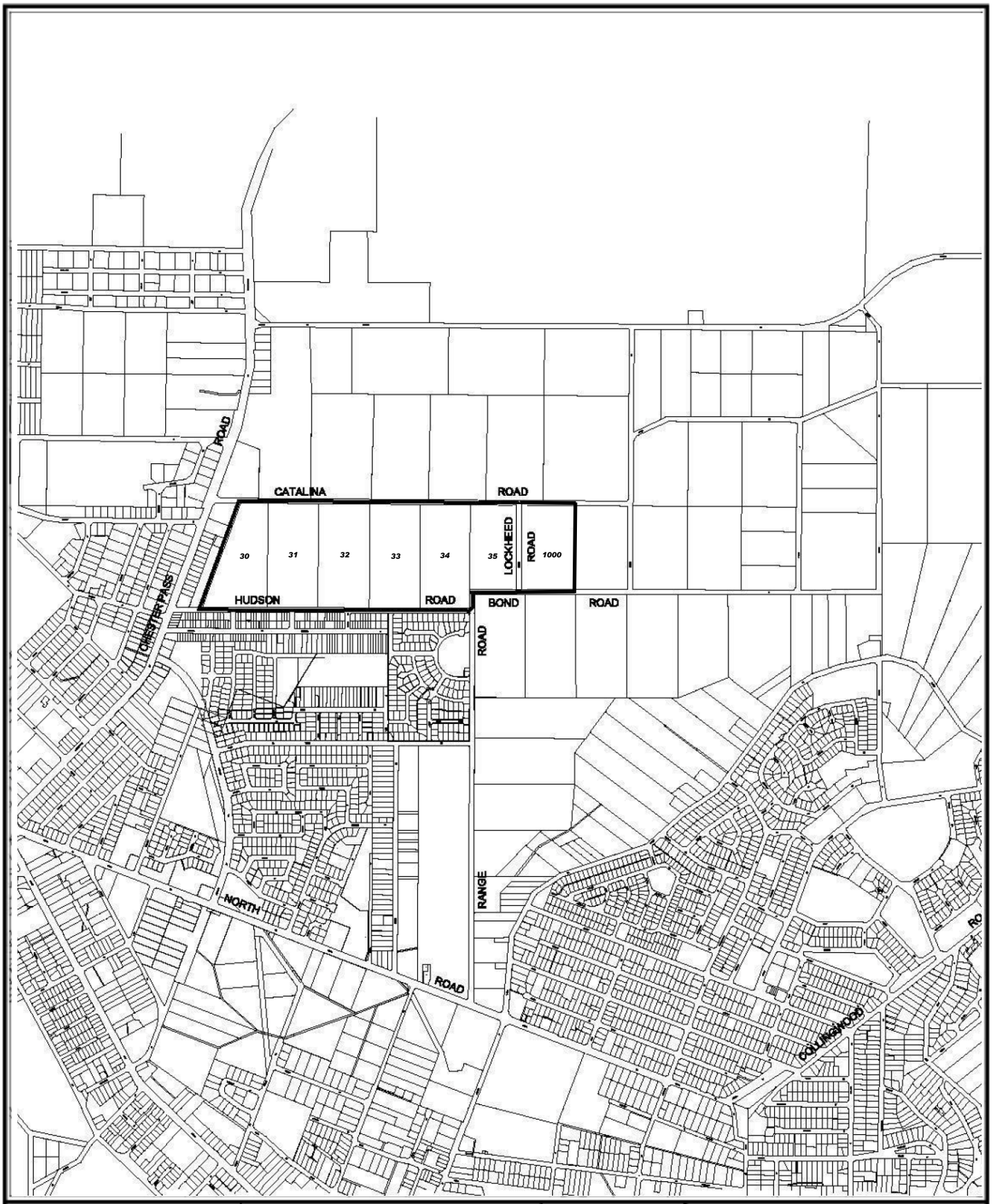
Lot No	Plan No	Volume/Folio	Land Area
30	15774	1763/367	7.5071 ha
31	15774	1765/830	8.1958 ha
32	15774	1765/831	8.3440 ha
33	15774	1765/832	8.1630 ha
34	15774	1765/833	8.0851 ha
35	15774	1765/834	6.1890 ha
1000	230628	1731/269	6.8568 ha

The Cadastral Plans for the subject land are illustrated at **Figure 2**

2.3 Physical and Environmental Attributes

The subject site comprises just over 53 ha in area, and represents a relatively high but sloping ridgeline that is more elevated towards the Catalina Road frontage of the land, and in particular in the north-western corner where an elevation of approximately 55 m is reached. The southernmost portions of Lot 32, 33 and 34, slope down in a southerly direction to an elevation of approximately 30 m, which is still relatively high in contrast to the other surrounding land to the south.

The soil type is generally uniform across the site, comprising sandy gravel over silty clay. Based upon a series of test pits across the entire site, no cap rock or water tables were encountered to a depth of 2.0 m below ground level. The site does not contain any listed wetlands or permanent waterways.



Allerding & Associates

Town Planners, Advocates and Subdivision Designers

0 200 400 600 800 1000m

SCALE 1:20 000
ORIGINAL PLOT SIZE: A4

JOB CODE:	DATE:
NLV YAK GE	27.06.2008

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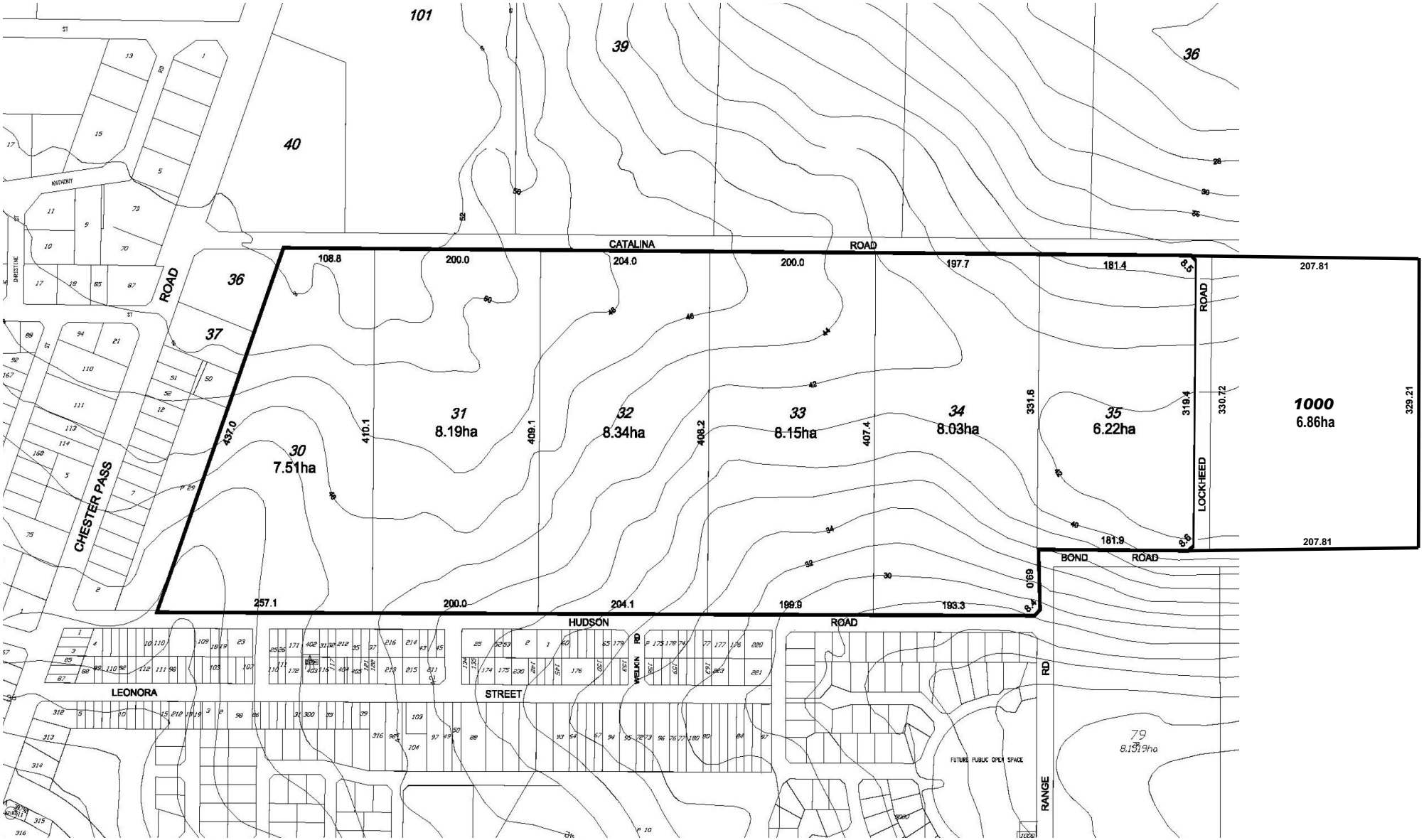
NORTH

Australian Association Of Planning Consultants

Figure 1. Location Plan

Lots 30-35 Catalina Road & Lot 1000 Lockheed Road, Lange



Allerding & Associates
Town Planners, Advocates and Subdivision Designers

0 50 100 150 200 250m
SCALE 1:4000
ORIGINAL PLAN SIZE: A3

DRAWING NUMBER: NLV YAK GE

DATE: 27.05.2008

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NORTH

aapc
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LEGEND:
Subject Land.....

Figure 2. Cadastral Details

Lots 30-35 Catalina Road & Lot 1000 Lockheed Road, Lange

From aerial photography and site survey it can be established that the majority of the subject land has been cleared for pastoral grazing, with the exception of a number of isolated native trees and other introduced eucalypts scattered through some of the cleared areas, and the small plantation area in the south west corner of Lot 35.

For a comprehensive assessment of all the environmental attributes relating to Lots 30, 31 and 35 Catalina Road, refer to the Environmental Report prepared by Opus International Consultants as included at **Appendix A**. A separate environmental assessment was carried out in relation to Lots 32 – 34 Catalina Road, and this is included in the Local Water Management Strategy Report by Opus International Consultants included at **Appendix C**.

2.4 Zoning and Land Use

The subject land is zoned "Residential Development" under the City of Albany Town Planning Scheme No.3, with a "Rural" zoning applying to the land immediately to the north and to the east. Via Scheme Amendment No. 280, lots 30 – 35 were rezoned to "Residential Development" zone, with "Additional Use – Lifestyle Village" over Lots 32 – 34. The land on the southern side of Hudson Road is zoned and developed for residential purposes. The land immediately to the west of Lot 30, fronting Chester Pass Road, is zoned for Light Industrial purposes, whereas the land to the north of Lot 30 on the opposite side of Catalina Road is zoned and developed as a Local Shopping Centre.

Each of the lots that comprise the subject area accommodates a single dwelling and associated outbuildings. Each of the lots is used for Rural Living and grazing purposes.

2.5 Servicing

The subject land is surrounded by utilities that are already in existence. Opus International Consulting has conducted an investigation of the various utilities in the area, and a more comprehensive servicing assessment is included in their report at **Appendix A**. The proposed ODP area can easily gain access to the main sewerage system, water mains, telecommunication cables and the power grid.

3.0 Planning Context

Outline Development Plan
Lots 30 – 35 Catalina Rd and Lot 1000 Lockheed Rd Lange

3.1 Albany Local Planning Strategy

The Albany Local Planning Strategy (ALPS) has designated the subject land as a future urban area for development within the short term. ALPS requires planning and development of such areas in an efficient and coordinated manner as logical extensions of existing settlements, that have retail, service and community infrastructure.

3.2 City of Albany Town Planning Scheme

Lots 30 – 35 Catalina Road, Lange have been rezoned from Rural to Residential Development under the City of Albany Town Planning Scheme No.3. This rezoning was progressed via Scheme Amendment No. 280 to the City of Albany Town Planning Scheme No.3. Succinctly, this rezoning was supported on the basis of the following key rationale:-

a) The rezoning represents a logical frontal expansion of residential development, that builds upon existing urban infrastructure and services adjacent to the subject land;

b) The Albany Local Planning Strategy (ALPS) and the Yakamia Structure Plan have planned for residential expansion in this locality, and identify the subject land as comprising the initial stages of such expansion;

c) The land is unconstrained in terms of the physical and environmental attributes of the subject land, and is therefore capable of development;

d) All the required urban services and infrastructure are available to the subject land;

e) The Residential Development zoning provides a framework for the timely preparation of an Outline Development Plan (ODP), providing a design framework to integrate the existing development areas with the proposals under the Yakamia Structure Plan and the Lifestyle Village Concept;

f) The Additional Use – Lifestyle Village proposal recognises that a Park Home park can be permitted under the current Rural zoning of the land;

g) The proposed Lifestyle Village is compatible with the existing and proposed Residential Development, and the design of the village ensures a layout that ties in with the most recent Structure Plan without unduly prejudicing the development opportunities of adjoining lots;

h) The Lifestyle Village will provide an alternative type and lower cost of housing available for Albany residents;

i) The National Lifestyle Village model is consistent with the State Government's Liveable Neighbourhood's approach to the development of sustainable communities; and

j) The proposal would take advantage of, and consolidate, existing services, road network and infrastructure within the locality, and is strategically placed in reasonable proximity to services and facilities within the City of Albany.

The "Residential Development" zone contains provisions requiring the preparation of an ODP to establish the pattern of development and land use. Clause 5.5.3 of the Town Planning Scheme sets out the minimum principles that need to be shown within an ODP, namely:-

a) the location and width of the distributor road system proposed;

b) the approximate location and quantity of shopping, civil and public facilities proposed together with an analysis of the factors used in determination of such facilities;

c) the distribution of the recreation and open space areas proposed;

d) the population and residential densities proposed; and

e) the physical condition of the land having regard to the need for deep sewerage and/or main drainage.

As part of Scheme Amendment No. 280, Lots 32 – 34 are to be included within the "Additional Use" schedule of the Scheme, as a Lifestyle village. The provisions relating to this "Additional Use" site require that all subdivision and development are to comply with an approved Development Plan. For the purpose of this particular Outline Development Plan (ODP) it is worth noting that National Lifestyle Village (NLV) has now withdrawn from their proposal to develop a lifestyle village within this particular area and accordingly a lifestyle village no longer forms part of the ODP design. This also means that the special requirements under the Scheme relating to the Additional Use that affects Lots 32 – 34 will no longer be applicable.

3.3 Yakamia District Structure Plan

The subject land is part of the broader area that has been addressed by the Yakamia District Structure Plan, an initiative of the local authority that has been subject of extensive investigation, planning and consultation. The Yakamia District Structure Plan, whilst not finally adopted, is effectively used by government planning agencies as a basis for considering planning proposals at a more detailed level. The Yakamia District Structure Plan is widely considered to be the most current and relevant planning instrument to guide ongoing development in this locality.

A copy of the Yakamia District Structure Plan is included at **Appendix B** and shows the extent and key features of the plan. It should be noted that although the key roads and open space areas have been reflected in the ODP for the subject land, a number of other elements have been superseded by the further detailed planning associated with preparation of this ODP. More particularly, the recently drafted Transport Network Plan, compiled as an initiative between the City of Albany, Main Roads and WAPC, has illustrated new alignments for Catalina and Range Roads, and has positioned the primary school beyond this ODP area further to the east along Catalina Road. A draft of the Transport Network Plan is also included at **Appendix B**.

3.4 Site Context

3.4.1 District and Neighbourhood Catchments

The “Farm Fresh” shopping centre at the corner of Catalina Road and Chester Pass Road is the major neighbourhood centre that serves this ODP area. Approximately 50% of the ODP area lies within a 500 m radius from this existing centre, and almost the entire ODP area is within 1.0 km of the centre. Via the future Range Road link into North Road and Lockyer Avenue, the ODP area will have access to the Lockyer Avenue Mixed Business Precinct, some 2.5 kms away.

3.4.2 Transport Network

The transport assessment prepared a part of the Yakamia District Structure Plan identifies a range of transport related issues and opportunities relevant to the site, including the analysis of the existing transport conditions and public transport.

As the area is currently predominantly "Rural", there are no nearby public transport services, however, as the ODP area is developed over time new bus routes will be introduced to service the site. Most significantly, the Range Road and Catalina Road connections will provide a strategic link between Chester Pass Road and Lockyer Avenue. This will represent an important link for both vehicles and buses.

3.4.3 Open Space

District playing fields are located along North Road, near the intersection of the future Range Road connection, less than 2.0 kms from the ODP area. In addition, there are significant areas of nearby proposed open space associated within the vegetated valley system identified under the Yakamia District Structure Plan. An extension of this valley open space system already exists within the recently developed residential subdivision immediately south of Hudson Road.

3.4.4 Design Interface

The southern edge of the ODP interfaces with existing residential subdivision that addresses Hudson Road. The western edge of the ODP interfaces with the side and rear boundaries of existing light industrial lots. Both of these already developed interfaces will need to be respected and reflected in the ODP layout.

The northern and eastern parts of the ODP are dominated by the major roads, Catalina Road and Range Road. Both of these roads were originally shown as realigned on the Yakamia District Structure Plan, but have subsequently been realigned again within the Transport Network Plan. As a consequence, these two major roads have a high function as district distributor roads, and therefore special road widths and interfacing treatments will be necessary.

4.0 Environmental Considerations

Outline Development Plan
Lots 30 – 35 Catalina Rd and Lot 1000 Lockheed Rd Lange

As part of the rezoning of the subject land under Town Planning Scheme Amendment No. 280, Opus International Consultants, undertook a comprehensive environmental assessment dealing with key issues including:-

- Acid sulphate soils;
- Contaminated sites;
- Geotechnical assessment;
- Heritage;
- Soils;
- Vegetation; and
- Wetlands and waterways.

This environmental assessment concluded that the land subject of this ODP does not contain physical or environmental attributes that would constrain it from future residential development. Full details of the Environmental Assessment relating to Lots 30, 31 and 35 are included in the Environmental Assessment by Opus International Consulting at **Appendix A**, whereas the Environmental Assessment relating to Lots 32 – 34 are included as part of the Local Water Management Strategy at **Appendix C**.

Scheme Amendment No. 280, along with the environmental assessment as reported by Opus International Consultants, was referred to the Environmental Protection Authority (EPA). Under Section 48A of the Environmental Protection Act 1986, the EPA set the level of assessment at “Scheme not assessed – advice given”, as the overall environmental impact of the Scheme Amendment’s implication would not be significant to warrant formal assessment under the Environmental Protection Act.

5.0 Existing Service Infrastructure

Outline Development Plan
Lots 30 – 35 Catalina Rd and Lot 1000 Lockheed Rd Lange

Opus International Consulting conducted an investigation into the service utilities within the ODP area, and concluded that the land subject of this ODP can easily gain access to the main sewerage system, water mains, telecommunication cables and power grid. In addition to the obvious availability of local constructed roads to the subject land, Opus International Consulting also identified the principles for stormwater drainage of the subject land. The Servicing Investigation Report by Opus International Consulting formed part of the documentation for Scheme Amendment No. 280 and is included at **Appendix A**.

The drainage capabilities of the subject land, and the possibilities for designing an adequate stormwater drainage system for this ODP area, have been further detailed within a Local Water Management Strategy that is described in Section 6.5 of this ODP report. A detailed Local Water Management Strategy is also included and *attached* at **Appendix C** of this ODP report.

6.0 The Outline Development Plan

Outline Development Plan
Lots 30 – 35 Catalina Rd and Lot 1000 Lockheed Rd Lange

6.1 Overview

The proposed ODP included at **Figure 3**, is considered to be consistent with the principles of Liveable Neighbourhoods whilst also responding to the various opportunities and constraints that face the subject land and surrounding area. The ODP has been prepared through a collaborative design approach, in consultation with relevant stakeholders. Design consultation included referral of a preliminary design to the City of Albany Technical Officers, and obtaining a series of design recommendations from City Staff and incorporating these into the final plan. All of the Technical Officers design recommendations have been incorporated, and the updated design was then tested by the environmental and engineering consultants preparing the Local Water Management Strategy to ensure that the design was compatible with this strategy. The design was also tested by a Traffic Engineer from Opus International Consulting and minor changes were made to the road layout and intersections in response to this Traffic Assessment.

Following the endorsement by the various approving authorities, this ODP will provide a framework to guide future subdivision and development of the subject land, consistent with the "Residential Development" zoning of the land.
Lot 1000 Catalina Road, whilst still zoned as Rural was included as part of the ODP in order to provide a good location and context for the potential School Site. This lot is to be rezoned as "Future Urban" by the city as part of the review of its draft Local Planning Scheme No.1.

6.2 Community Design Principles

The urban design principles applied to the site have been formulated with regard to the site and its relationship to its immediate surrounds and location. These design principles include:-

- Providing walkable interconnected and efficient residential areas;
- Providing a variety of housing types to cater for varying lifestyle choices and budgets;
- Provide a road network with strong connections and direct access to public open space and external major roads;
- Achieve a robust design that is responsive to the desire for landowner independence and housing variety;

ENDORSEMENT OF OUTLINE DEVELOPMENT PLAN

The Western Australian Planning Commission resolved on 28 February 2012 to endorse the Outline Development Plan for Lots 30-35 Catalina Road & Lot 1000 Lockheed Road, Lange dated 7 February 2012 as a guide for subdivision within the locality.

Signed for and on behalf of the Western Australian Planning Commission

_____

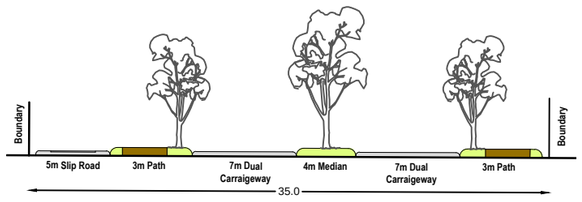
an officer of the Commission duly authorised by the Commission pursuant to section 24 of the *Planning and Development Act 2005* for that purpose in the presence of

_____ Witness

_____ Date

PUBLIC OPEN SPACE SCHEDULE

Lot No	Lot Area	POS/Drainage	Drainage	POS Less than 50% Drainage	Variation POS
30	7.51 Ha	5420m²	2500m²	4170m²	-3340m²
31	8.19 Ha	11268m²	1600m²	10468m²	+2278m²
32	8.34 Ha	11024m²	Nill	11024m²	+2684m²
33	8.15 Ha	6362m²	1100m²	5812m²	-2338m²
34	8.03 Ha	4248m²	2250m²	3123m²	-4907m²
35	6.22 Ha	6950m²	1400m²	6250m²	+30m²
Sub Totals	**46.44 Ha**	**45273m²**	**8850m²**	**40848m² (8.8%)**	**-5592m² (1.2%)**



RANGE ROAD CROSS SECTION
(including service road)

DEVELOPMENT REQUIREMENTS

1. Catalina Road and Hudson Road will need to be constructed to an urban standard at the time of subdivision, including drainage to be piped, road to be kerbed, road surface to be upgraded and traffic calming devices (Hudson Road) to be installed. Treatment of the Hudson Road and Chester Pass Road intersection is to be to the satisfaction of the City of Albany and Main Roads WA.
2. Pathways within the ODP area shall be required as follows:-
   - A 2.5 m shared path along Hudson Road and Catalina Road;
   - A 2.5 m shared path along each of the connector roads between Hudson Road and Catalina Road;
   - 3.0 m pathways on either side of Range Road;
   - 1.5 m pathways where grouped housing lots are situated to connect to the shared paths; and
   - 1.5 m pathways along all other roads.
3. Parallel car parking bays are to be provided on the edge of the larger public open space areas, generally as depicted on the Plan.
4. Range Road will need to be developed as a two lane sealed road between Hudson Road and Catalina Road, as part of the subdivision under this ODP. Contributions to upgrade Range Road from Target Road to Catalina Road to a higher standard in future (ie. 4 lanes) will be required from each subdivider within the ODP area in accordance with an agreed contribution schedule.
5. The 25m width road reserve connecting Catalina to Hudson Roads will need to be designed in a manner that ensures retention of the mature trees along the eastern side
6. All lots interfacing with industrial land to the west will be subject to a detailed area plan requirement, which shall stipulate as a minimum: a 2.0m high masonry wall to the rear boundary; a 15m rear setback requirement for all dwellings; and notifications on titles advising of the adjoining land use. All such measures are to be certified by an acoustic engineer to satisfactorily protect the amenity of future residents.
7. All R30 and R40 areas shall be subject to a Detailed Area Plan requirement, particularly to ensure appropriate interface with road reserves, public open space and pedestrian networks
8. Other than for a 'homestead lot' subdivision in accordance with Appendix E, Public Open Space areas shall be given up as part of the initial stage of subdivision on each lot. Cash-in-lieu shall be paid for any shortfall in Public Open Space, whereas Public Open Space that exceeds the 10% requirement shall be set aside as a separate Public Open Space lot for acquisition. In areas identified as Public Open Space on the ODP, existing mature jarrah and marri trees are to be retained.
9. At the time of subdivision, an Urban Water Management Plan is to be submitted addressing the following requirements:
   i. late winter groundwater testing;
   ii. the use of groundwater and/or stormwater (not scheme water) to irrigate areas of Public Open Space; and
   iii. infiltration at site rather than the standard pipe to detention basin.
10. At the time of subdivision, a dust management plan is to be prepared and implemented to the satisfaction of the City of Albany.
11. Lot 1000 is currently zoned 'Rural' and is to be rezoned in its entirety to Future Urban by the City as part of the review of its Draft Local Planning Scheme No. 1.
12. Interim subdivision to separate the school site from the parent lot in accordance with the ODP being permitted.

OUTLINE DEVELOPMENT PLAN

Lot 30 - 35 Catalina Rd & Lot 1000 Lockheed Rd, LANGE

DYKSTRA PLANNING

Subdivision, Rezoning, Structure Planning, Development Planning, Design, Advocacy

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7 February 2012

N

1:400 @ A3

Figure 3

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.

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- Provide for Best Urban Water Management Practice, in accordance with the Local Water Management Strategy that underpins the ODP; and
- Respect the planning context in terms of existing development and the broader strategic planning of the surrounding area.

6.3 Design Elements

6.3.1 Residential

The proposed base density will be Residential R 20, providing for a range of lot sizes from 440 m^2 through to 700 m^2 and larger. The design also envisages a range of medium density housing options, ranging from a number of single residential housing cottage lots at R30 through to a number of strategically placed R30 and R40 grouped housing sites. These medium density areas have been located in accordance with the criteria of liveable neighbourhoods and in this instance predominantly adjoin and overlook the public open space systems within the ODP area.

The street pattern for the residential development areas is based upon the existing road framework of the area, and also links with the proposed realignment of Catalina Road and extension of Range Road. The predominant road pattern allows for a grid pattern of roads and hence also allows for regular shaped housing lots throughout the ODP area. The exception to this is where a proposed public open space and drainage system diagonally traverses the central area of the ODP, and in this instance a number of irregular shaped grouped housing sites and cottage lots have been designed, which then enables the majority of the single residential lots to retain a regular shape.

6.3.2 Lifestyle Village

Whilst Lots 32 – 34 are the subject of an Additional Use zoning under the Town Planning Scheme, providing for a lifestyle village development, it must be noted that the original proponents of this lifestyle village, NLV, are no longer involved in the land. Accordingly this ODP has been prepared on the basis of the Residential Development zoning only. Given that this ODP does not propose a lifestyle village, the special scheme requirements under the Additional use will not be applicable to this ODP.

6.3.3 Public Open Space Requirement

The design and distribution of public open space and drainage areas across the ODP has been carefully laid out and considered with regard to the following key principles:-

- Provision of extensive POS areas along Hudson Road to provide for an attractive interface between the old and new residential areas, whilst also recognising that this is the lower part of the development where drainage management will be required;
- Provision of two (2) appropriately sized open space areas adjacent to Catalina Road, recognising the need for public open space in the northern part of the ODP area; and
- A central linear diagonal open space swale linking the southern open space system to one of the Catalina Road POS areas, generally following a natural swale in the landform.

The following table provides a breakdown of the provision of public open space within the ODP area. In the absence of any formal City of Albany guiding policy on public open space, the criteria and calculations are based upon the WAPC's adopted Liveable Neighbourhood Edition 4. The criteria for public open space calculations, utilising the Liveable Neighbourhood Edition 4, allows for 100% credit for P.O.S. Areas accommodating above the 1:5 year stormwater event as active open space. It also allows for 2% of the required 10% to be restricted open space, incorporating P.O.S. areas that accommodate stormwater events from the 1:1 year to the 1:5 year event.

Areas of the ODP that will be subject to residential subdivision applications will provide public open space areas generally in accordance with the areas illustrated on the ODP at **Figure 3**, and any shortfall in the 10% public open space requirements will be supplemented by a cash-in-lieu condition as part of the relevant subdivision approval.

Lot No.	Lot Area	POS/Drainage	Drainage	POS – (Less 50% Drainage)	Variation POS
30	7.51 Ha	5420m	2500m^2	4170m^2	-3340m^2
31	8.19 Ha	11268m^2	1600m^2	10468m^2	+2278m^2
32	8.34 Ha	11024m^2	Nil	11024m^2	+2684m^2
33	8.15 Ha	6362m^2	1100m^2	5812m^2	-2338m^2
34	8.03 Ha	4248m^2	2250m^2	3123m^2	-4907m^2
35	6.22 Ha	6950m^2	1400m^2	6250m^2	+30m^2
Sub Totals	**46.44 Ha**	**45273m^2**	**8850m^2**	**40848m^2 (8.8%)**	**-5592m^2 (1.2%)**

There will be no need for a cost contribution schedule or scheme in relation to public open space and drainage areas. Other than for "super lot" subdivision, public open space areas will be given up as part of the initial stage of subdivision on each lot. Cash-in-lieu will be paid for any shortfall in public open space, whereas public open space that exceeds the 10% requirement for any lot will be set aside by the subdivider as a separate POS lot for future acquisition.

6.3.4 School Site

A location for a future primary school site has been negotiated between the landowner of Lot 1000 and the Department of Education and Council. Previous structure planning work undertaken for the Yakamia area included a school site cost of the future Range Road. Given the considerable traffic that is likely to use Catalina Road between Range Road and Chester Pass Road, there is a strong case or the school site to remain east of Range Road. The northern 4.0 Ha portion of Lot 1000 has been illustrated as a potential school site in this ODP. As part of further structure planning to be undertaken for the wider Yakamia area in future, this school site will be subject to further assessment by the Department of Education.

6.4 Movement Network

The proposed design of the road network is based upon a modified grid pattern that builds upon the framework of the existing grid design formed by Catalina Road, Hudson Road, Bond Street and Lockheed Road. The extension of Range Road is a significant component of the plan, and in future will provide direct access into the city centre. Range Road will have a 30 m reserve width and intersects with Catalina Road, with provision for a future roundabout or alternative intersection treatment at this location.

Interfaces in terms of access points with both Range Road and Catalina Road are limited by lot orientation and the use of culs-de-sac where appropriate. The culs-de-sac at these interfaces have been designed to allow the road reserve to continue through, thereby allowing for non-vehicular movement (ie. bicycles and pedestrians) whilst restricting through traffic to these major roads.

Overall the road pattern provides for a legible and interconnected local street system that enables a choice in travel direction and travel modes, and creates a permeable network for both vehicular and pedestrian use. The existing roadways will remain at 20 m wide reserves, the new Range Road will be widened to 30 m (plus a 5 m slip road), whereas any other new internal subdivision road will predominantly be 16 m in width. All the roads will be constructed to the City's engineering standards, and in particular Catalina Road and Hudson Road will need to be constructed to an urban standard at the time of subdivision, including drainage to be piped, road to be kerbed and road surface to be upgraded.

Pathways within the ODP area will be provided as follows:-

- A 2.5 m shared path along Hudson Road and Catalina Road;
- A 2.5 shared path along each of the connector roads between Hudson Road and Catalina Road;
- 3.0 m pathways on either side of Range Road;
- 1.5 pathways where grouped housing lots are situated to connected to the shared paths; and
- 1.5 m pathways along all other roads.

The design has sought to maximise roads interfacing with POS areas, and has also indicated parallel car parking bays to be provided at the edge of the larger POS areas where appropriate.

6.5 Local Water Management Strategy

A Local Water Management Strategy has been developed by Opus International Consultants for the ODP area in order to present the best water management concepts, measures and strategies to be implemented under this development.
The Local Water Management Strategy has been prepared in accordance with the requirements of the Western Australian Planning Commission and City of Albany's requirements, and includes nutrient management and the application of water sensitive urban design principles. (See **Appendix C**).

At the time of subdivision, an Urban Water Management Plan is to be submitted addressing the following requirements:

a) Late winter groundwater testing;
b) The use of groundwater and/or stormwater (not scheme water) to irrigate areas of POS; and
c) Infiltration at site rather than the standard pipe to detention basin.

6.6 Traffic Management and Range Road Construction

6.6.1 Traffic Management

A Traffic Management Assessment has been undertaken by the Traffic Engineer from Opus International Consultants (Albany office), broadly following the WAPC Transport Assessment Guidelines. The initial Traffic Management Assessment recommended a number of modifications to the internal road layout and intersection treatments, and these modifications have now been incorporated into the final Outline Development Plan design that is included in this report. Development Contributions for the construction of the Hudson Road and Chester Pass Road intersection treatments are to be made at the subdivision stage. A final version of the Traffic Management Statement by Opus International Consultants is included at **Appendix D**.

6.6.2 Range Road Construction

The Range Road extension and link back to the Albany City Centre will perform a function well beyond the boundaries of this ODP. Range Road has been planned as an arterial road that will take traffic pressure from Ulster Road and Chester Pass Road, and channel this traffic via a new central link to and from the CBD.

For the purpose of this ODP, Range Road will need to be developed as a two lane sealed road between Hudson Road and Catalina Road, as part of the subdivision under this ODP. Contributions to upgrade Range Road from Target Road to Catalina Road and perhaps beyond, to a higher standard in future (ie. 4 lanes) will be required from each subdivider within the ODP area in accordance with an agreed contribution schedule.

Given that Council desires for this road to perform a function well beyond that demanded by this ODP area, it is entirely appropriate that the construction, staging, timing and contribution schedule for the Range Road upgrading be managed by the Local Authority. Whilst adjacent residential subdividers are certainly stakeholders in this road infrastructure, these landowners will come and go over the many years that this upgrading will be planned for. A suggested contribution schedule is outlined as follows:-

1. The adjoining subdividers construct a standard two lane road to service the local subdivisions;
2. The adjoining subdividers give up additional road reserve width at the time of subdivision, and this extra land area is credited against the overall contribution scheme;
3. Council to cost the full Range Road upgrade from Mercer Road back to Target Road, including road construction, drainage, extra land requirements, interest, and costs of management;
4. Council to determine the proportion of cost to be borne by residential subdividers, in the context of possible partial funding by local and/or state government. This then becomes the developers contribution amount for Range Road, and will be subject to annual CPI increase; and
5. The contribution amount to be calculated on a per m^2 rate across the catchment south of Mercer Road, and payable by all subdividers at the time of subdivision.

7.0 Implementation

Outline Development Plan
Lots 30 – 35 Catalina Rd and Lot 1000 Lockheed Rd Lange

7.1 Adoption of the Outline Development Plan

The ODP would be considered by the local authority in accordance with Clause 5.5 on the Town Planning Scheme, and would require referral to various government agencies and other stakeholders prior to Council adopting the ODP and seeking approval thereto from the Western Australian Planning Commission (WAPC).

7.2 Subdivision

Upon final adoption of the ODP, it will be possible for each of the individual landowners to seek and obtain subdivision and development approval over their respective land generally in accordance with the layout depicted on the ODP. The current resident landowners have expressed a desire to continue living on the land and retaining a homestead lot whilst being able to sell off the larger part of their land to a professional developer. A plan indicating a possible homestead lot subdivision arrangement has been included for information purposes at **Appendix E**.

The creation of the homestead lots as shown on the homestead plan would represent Stage 1 of development, whilst "Residential" subdivision of the balance lot following excision of the homestead lot/s would represent Stage 2. To facilitate orderly future development of Stage 2, any subdivision of existing lots undertaken in Stage 1 to create homestead lots shall require the ceding of half those road reserves which straddle a common boundary with an adjoining lot as shown on the ODP, at the time of creation of the homestead lot. Also to ensure all balance land created following excision of the homestead lot can be developed in accordance with the ODP, the creation of the homestead lot in Lot 33 shall require the ceding of the 16m wide road reservation from the homestead lot north to Catalina Road as shown on the ODP. To facilitate the proposed movement network, any Stage 2 subdivision of existing lots requires the provision of road reserves of sufficient width to accommodate the completed roadways shown on the ODP plan.

In terms of the Stage 2 "Residential" subdivision itself, each subdivider would be responsible for providing the essential urban services of roads and other

infrastructure to all lots within the subdivision, and to meet any requirements associated with upgrading movement network, any Stage 2 subdivision of existing lots requires the provision of road reserves of sufficient width to accommodate the completed roadways shown on the ODP plan. Any cost sharing of infrastructure and drainage land would be minimal, and hence would be able to be resolved by agreements between landowners.

7.3 Development

The development on some of the land parcels within the ODP area will require preparation of further Detailed Area Plan or Development Application Plans. All of the lots interfacing with the industrial land to the west will be subject to a Detailed Area Plan requirement, which will stipulate as a minimum a 2.0 m high masonry wall to the rear boundary; a 15 m rear setback requirement for all dwellings; and notifications on titles advising of the adjoining industrial land uses.

Further, all of the R30 and R40 areas depicted on the ODP will be subject to a Detailed Area Plan requirement, particularly to ensure appropriate interfacing with road reserves, public open space and pedestrian networks. These various Detailed Area Plan requirements will be imposed as a condition on any Subdivision Approval.

7.4 Cost Sharing for Common Infrastructure and Local Open Space

The ODP has been designed in a manner that ensures each individual design parcel can provide for its own public open space and drainage land, with any public open space shortfall then being supplemented by the standard cash-in-lieu contribution.

Any upgrading of infrastructure within existing surrounding road reserves would be required as a condition of subdivision or development approval on the land that adjoins the particular section of road reserve, and accordingly each individual subdivider and developer would need to take responsibility for the relevant portion of road reserve fronting their own lot. This avoids the need for any cost sharing associated with upgrading of existing infrastructure within existing road reserves.

In accordance with the normal WAPC and DET Policies on residential subdivisions, all subdividers will be required to contribute proportionately towards future acquisition of land for a primary school site within the locality.

With respect to other servicing arrangements associated with Water Corporation services and power and telecommunication services, any need for cost sharing would be arranged by separate agreement between the individual landowners within the ODP.

The Local Water Management Strategy prepared by Opus International Consulting, and included at **Appendix C**, illustrates a fairly even distribution of drainage detention areas across all of the "Residential Development" zoned landholdings within the ODP. Predominantly each existing landholding would be able to subdivide and cater for its own drainage, with the exception of Lots 34 and 35 who would need to 1

share two drainage areas on a relatively equal basis, and Lot 32 who may need to reach agreement with Lot 33 regarding construction of additional drainage storage area.

8.0 Conclusion

Outline Development Plan
Lots 30 – 35 Catalina Rd and Lot 1000 Lockheed Rd Lange

This ODP has been prepared in order to facilitate the future subdivision and development of Lots 30 – 35 and Lot 1000 Catalina Road, Lange. The ODP relates closely to Scheme Amendment 280 to Town Planning Scheme No.3, which rezoned most of the land to "Residential Development" zone, and established an "Additional Use" site over Lots 32 – 34 for the purposes of a Lifestyle village.

The ODP and supporting technical documentation demonstrates that the proposed subdivision and development will accord with all environmental, engineering, urban water planning and urban design of State and Local Government requirements. Specifically, the proposal has been prepared with due regard to matters identified as part of the rezoning process, has been designed with respect to the previously prepared Yakamia District Structure Plan, and has been underpinned by the preparation of a Local Water Management Strategy.

This ODP addresses the next logical front of development within an identified urban growth area of the City of Albany, and involves land that is unconstrained from a servicing and environmental perspective, and hence is ready for residential subdivision and development in the short term.

On the basis of the above, and the various details included within the preceding report and associated attachments, it is respectfully requested that the City of Albany adopt this proposed Outline Development Plan for the purposes of advertising and referral to government agencies.

Appendix A:
Opus Environmental and Infrastructure Report

Outline Development Plan
Lots 30 – 35 Catalina Rd and Lot 1000 Lockheed Rd Lange

Preliminary Environmental Assessment

Lots 30, 31 & 35 Catalina Road Albany WA

Alan & Marion Pierce

And

Gerald Bergsma

OPUS

Preliminary Environmental Assessment

Lots 30, 31 & 35 Catalina Road

Albany WA

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Date: May 2008
Reference: G:\Env Projects\Catalina Rd
Status: Final
Reference: Job No: WAENV078

Preliminary Environmental Assessment
Lot 30, 31 and 35 Catalina Road Albany

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Preliminary Environmental Assessment
Lots 30, 31 and 35 Catalina Road Albany

1. Introduction

Alan and Marion Pierce and Gerald Bergsma engaged Opus International Consultants to undertake a Preliminary Environmental Assessment of lots 30, 31 and 35 Catalina Road, Albany, to determine the feasibility of developing the subject lots. This report outlines the field and desktop surveys conducted by Opus International Consultants, with specific reference to acid sulfate soils (ASS), contaminated sites and potential geotechnical issues. The report gives recommendations for any further consultation or assessment required based on the investigation results.

The following agencies and personnel have been consulted during the preparation of this report.

- Department of Environment and Conservation (DEC)
- Department of Indigenous Affairs
- Mr Colin Gough, Albany Soil & Concrete Testing

2. Location

Lots 30, 31 and 35 Catalina Road are located in the Albany suburb of Lange, which is immediately north of Yakamia. The lots are located to the east of Chesterpass Road and are between are Catalina Road and Hudson Road. Lots 30, 31 and 35 are 8.19ha, 7.51ha and 6.19ha respectively. Please refer to Appendix 1 – Locality Map.

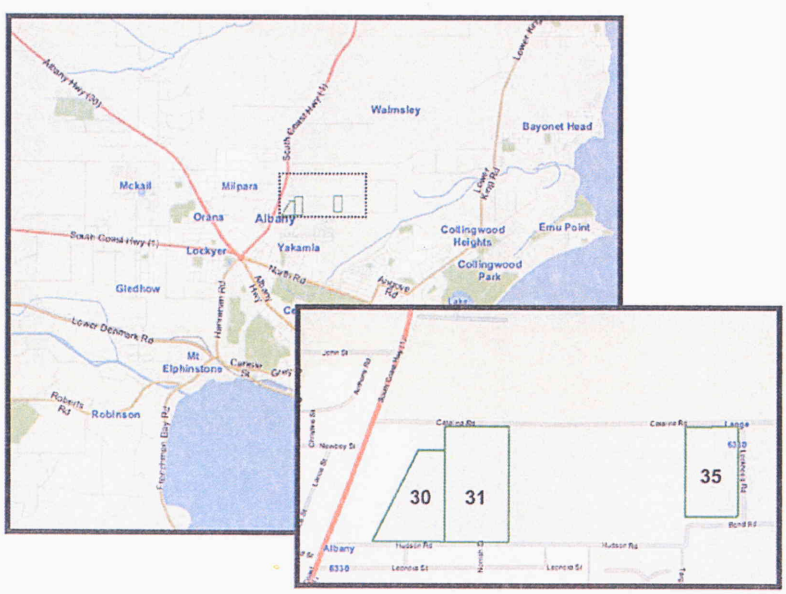

Figure 1: Location of Lots 30, 31 & 35, Catalina Rd

3. Scope

The scope of this report was to undertake Environmental Assessment outlining the conditions contained within lots 30, 31 and 35 Catalina Road. The assessment includes:

- Landscape and geology;
- Wetlands and waterways;
- Flora/Vegetation communities;
- Declared Rare Flora and Priority Flora;
- Environmentally Sensitive Areas and Threatened Ecological Communities;
- Declared and environmental weeds;
- Fauna;
- Erosion and Degradation;
- Soil Assessment;
- Acid sulfate soils;
- Contaminated Site;
- European Heritage Site;
- Aboriginal Heritage Sites; and
- Constructability desktop survey of power, water, sewer and related issues.

4. Development Proposal

Alan and Marion Pierce and Gerald Bergsma propose to progress a rezoning of the subject lands from rural to residential under the city of Albany Town Planning Scheme. This report forms a component of the planning process. At the time of writing it was not known the extent of the intensity of the proposed development.

5. Environmental Assessment

Opus Consultants conducted desktop investigations and government department liaison during the months of April and May 2008. Site investigations were conducted on Monday, 12th May by Opus Environmental Consultant, Vicki Laurie and Colin Gough, of Albany Soil and Concrete Testing.

5.1. Landscape and Geology

The parent material for the area is from recent geological deposits in the tertiary period with dark grey silt top-soils or brown sand containing gravel and silt, commonly containing iron pisoliths and overlying laterite (Australian Geoscience Mapping). In reference to the Soil-Landscape Mapping in South-Western Australia (Schoknecht, *et. al.*, 2004) the project site is located in the Albany Sandplain Zone which is described as a number of south flowing short rivers dissecting a gently undulating plain. The area contains 'eocene marine sediments overlying Proterozoic granitic and metamorphic rocks'. Soils are often alkaline and sodic sandy duplex soils, with some sands, gravels and clays (Schoknecht, *et. al*, 2004).

The height above sea level on lots 30 and 31, which are adjacent to each other, is greatest on the northern boundary at approximately 55m AHD. The lots slope to the south west to the lowest point of approximately 40m AHD. The highest point above sea level on lot 35 is on a ridge which runs east to west and is located in the centre of the lot and at a height of approximately 42m AHD. The lot slopes gently to 40m AHD to the Northern boundary and to 40m AHD on the southern boundary. This information can be found in Appendix 2 – Contours and Land Height. Please refer to plate 1 and 2. A detailed feature survey was not obtained for the purpose of this report. A detailed Soil Assessment Report and findings is located in section 6. of this report.

Plate 1: Lot 30 Facing South West from Southern side of residence

Plate 2: Lot 35 facing north (to Catalina road) from top of ridge.

5.2. Wetlands and waterways

The site does not contain any RAMSAR listed wetlands or any regionally significant wetlands. There are no permanent waterways or wetlands on any of the lots.

There is an artificial dam that has been constructed on Lot 35. The constructed dam, as shown below in Plate 3, was observed to be full during the visit on the 12th May. The water was observed to be a 'dark orange' due to the lateritic soils (gravel, silts and clays) most likely used in the construction of the dam.

Plate 3: The artificial dam constructed on Lot 35.

The three lots are located within the Yakamia catchment and form part of the headwaters for Yakamia Creek. It is important that the natural drainage lines are retained, wetlands are protected and no direct drainage is permitted. Therefore any proposed development should not impact on the natural hydrology and it is recommended that the management of storm water and nutrient loading is done by including urban sensitive design principles in the planning and development stages.

It is therefore recommended to:

- **Implement Water Sensitive Urban Design principles during the planning and construction process;**
- **Control rainfall runoff so that post development run off does not exceed pre-development flows; and**
- **All water (drainage and storm water) run off from the proposed development is nutrient stripped through a reconstructed wetland and/or native sedge bed(s).**

5.3. Flora/Vegetation Communities

Beard's Vegetation Classification dataset classifies the native vegetation prior to clearing on lots 30, 31 and 35 Catalina Road as medium forest;jarrah-marri/low forest;jarrah and casuarina. Such vegetation was observed in the road reserve on the eastern boundary of lot 35. An estimated 85% of the native vegetation has been cleared for pastoral grazing. The classification of the subject sites vegetation complex is made up of three structural categories: Cleared Open Paddocks; Plantation; and Cleared Residential Areas. Please refer to Appendix 3 – Vegetation Mapping.

5.3.1. Cleared Open Padocks

By observation of the remnant vegetation, the three lots have a number of isolated mature trees such as Jarrah (*Eucalyptus marginata*); Marri (*Corymbia callphylla*); and other introduced Eucalypts which can be found scattered throughout most of the cleared areas. Please refer to Plate 5. Weed species such as gorse (*Ulex* europaeus); taylorina (*Psoralea pinnata)*; blackberry (*Rubus spp*); and marshmallow (*Malva parviflora*) were also identified as being prominent in cleared areas. Please refer to more detail in section 4.6. Declared and Environmental Weeds

Plate 5: Isolated Jarrah/Marri on lot 30

5.3.2. Plantation

An established plantation is located in the South West corner of lot 35. Plantation species include *Eucalyptus macrocarpa*, mottlecah; coarse ti-tree (*Taxandria fragrans*) and *Hakea*. Please refer to Plate 6.

The plantation is heavily infested with Sydney Golden wattle (*Acacia longifolia*) and taylorina (*P. pinnata*) and is grazed by horses. Please refer to more detailed information in section 4.6. Declared and Environmental Weeds

Plate 6: Plantation on Lot 35

5.3.3. Cleared Residential Areas

Lot 30 has an established residence and shed on the northern end of the lot (Plate 7). Lot 31 has an existing residence on the north west corner on the lot. There is also a significant area to the south of this residence utilised for the storage of refuse (Plate 8). On lot 35 there is an established residence in the south corner of the lot (Plate 9) and an abandoned house pad in the north west corner of the lot (Plate 10). Each of these residential areas is surrounded by both native and introduced household plants and trees which may act to provide shelter as wind breaks. These are likely to include introduced species which could potentially be listed on the 'Declared and Environmental Weeds' list. Please refer to section 4.6.

Plate 7: House on northern end of Lot 30

Plate 8: Refuse on Lot 31 south of residence

Plate 9: House on Lot 35

Plate 10: House pad northwest of Lot 35

It is therefore recommended that:

- **Re-vegetation and landscaping of verges and medians of the proposed development occurs with endemic native species;**
- **A revegetation plan is produced for potentially seasonally inundated areas (if any);**
- **House hold plants are kept maintained regularly to prevent uncontrolled spread of potential 'declared and environmental weeds'; and**
- **A weed management plan during construction is enforced to prevent any further spread of weeds.**

5.4. Declared Rare Flora and Priority Flora

The Department of Environment and Conservation (DEC) Perth office search of the threatened flora databse indicates there is evidence of Priority or Declared Rare Flora pursuant to Subsection 2 of Section 23F of the *Wildlife Conservation Act 1950* to be known in the vicinity of lots 30, 31 and 35 Catalina Road. However, a site search as requested by the DEC, was undertaken on the 12th of May 2008, this concluded that there are no rare or priority flora on any of the three lots. Please refer to Appendix 4 – DEC Declared and Rare Flora Information.

5.5. Environmentally Sensitive Areas and Threatened Ecological Communities

Based on the current land use of each lot, there are no expected or recorded Environmentally Sensitive Areas or Threatened Ecological Communities within lots 30, 31 and 35 Catalina Road.

5.6. Declared and Environmental Weeds

In 1976 the Agriculture Protection Board introduced legislation to control weeds – the *Agriculture and Related Resources Protection Act 1976.* This legislation sets out "declared" plants and legal obligations to landowners in regards to these species. If a plant is declared then landowners are obliged to control that plant on their properties.

Environmental Weeds are defined by the "Environmental Weeds Strategy for Western Australia" (1999) as *"plants that establish themselves in natural ecosystems and proceed to modify natural processes, usually adversely, resulting in the decline of the communities they invade".* At present there is no legislation governing management of Environmental Weeds, landowners are encouraged to control movement and restrict further spread of these species.

Any plant other than a declared plant can be prescribed as a "Pest Plant", under Section 109 of the *Agriculture and Related Resources Protection Act 1976.* Typically these are prescribed whereby the occurrence of these may adversely affect property values, comfort or convenience of the inhabitants of a particular district.

The Act states that... *The council may serve on the owner or occupier of private land...a duly completed notice...requiring him/her to destroy, eradicate, or otherwise control any pest plant on that land' ((6) (1) Agriculture and Related Resources Protection Act 1976).*

All three of the lots contain blackberry (*Rubus* spp) and gorse (*Ulex europaeus*). Both are listed as a declared weed by the Department of Agriculture and have been classified as P1 and P4 control categories. *P1 is defined as Prevention: Plants which cannot be introduced or spread. Most declared plants are under this category. P4 is defined as Containment: Plants should be prevented from further spread* (City of Albany, 2005). The plantation is heavily infested with Sydney Golden wattle (Acacia longifolia) and taylorina (P. pinnata) and is grazed by horses. It is recommended that the spread of this is also controlled.

As the lots are predominately pasture and are being constantly grazed, there were few weeds noted on site during the site assessment. The main weed that was present on lots 31 and 35 was taylorina (*Psoralea pinnata*). While not a declared weed, it is a common weed in the Albany area, especially along creeklines and roadsides (*Moore, Wheeler*). An example of this weed is visable below in Plate 11. The City of Albany Environmental Weed Strategy 2005 – 2010 states that this environmental weed should be controlled.

The lot adjacent to lot 35 contains a stand of pine trees (*Pinus radiata*) that have been planted along the fence line to provide a windrow for stock protection. Pine trees are considered an environmental weed (City of Albany, 2005) and the area surrounding the pine trees should be monitored for pine tree shoots/saplings to prevent the pine trees from spreading. This is visable below in Plate 12, showing the windrow of *P. radiata* on lot 34 (adjacent to lot 35).

Plate 11: Example of taylorina observed on Lot 31

Plate 12: P. radiata. The windrow of pine trees on the fence line of Lot 35

Plate 13: Gorse on Lot 35

Plate 14: Blackberry on lot 31

Table One outlines the weed species present on Lots 30, 31 and 35 Catalina Road, the current category listing and management requirements.

Table One: List of Weed Species Lots 30, 31 and 35

Species	Declared/Category	Requirements
Rubus spp (Blackberry)	Declared weed (P1, P4)	Prevention and containment
Romulea rosea (Onion Grass/Guilford Grass)	Environmental weed	Recommend control
Pinus radiata (Pine tree)	Environmental weed	Recommend control
Psoralea pinnata (Taylorina)	Environmental weed	Recommend control
Hypochoeris spp. (Flat weed)	Environmental weed	Recommend control
Pennisetum clandestinum (kikuyu)	Environmental weed	Recommend control
Malva parviflora (Marshmallow)	Environmental weed	Recommend control
Ulex europaeus (Gorse)	Declared weed (P1, P3)	Prevention and Control
Acacia Longifolia *(Sydney Golden Wattle)*	Environmental weed	Recommend Control

Due to the lack of remnant vegetation remaining on the project site, and the various species of weeds across the lots, it is recommended that a Weed Management Plan is produced. It should also be noted that some of these species may also be toxic when consumed by animals, thus it is important to monitor the eradication of these weeds and insure no live stock or domesticated animals ingest these plants.

It is therefore recommended that:

- **The blackberry (*Rubus* spp), gorse (*Ulex* europaeus), taylorina (*Psoralea pinnata*) and Golden Wattle (*Acacia Longifolia)* is eradicated or prevented from spreading further. Any areas containing these should be treated prior to soil disturbance;**
- **Machines should be free from soil before entering the site to prevent weed contamination from prior site works;**
- **If it is proposed to retain the pine trees (on the adjacent lot), that the area surrounding them is monitored for seedling growth, and if present, removed by hand; and**
- **The movement of live stock or domestic animals should be monitored around toxic or potentially dangerous weeds to prevent being ingested and spread further.**

5.7. Fauna

Native animal populations have generally been in decline since European settlement. This is mainly due to habitat loss and the introduction of pest animals. Mammals known to the City of Albany area and likely to be present in remnant native vegetation include, the western grey kangaroo (*Macropus fuliginosus*), southern brown bandicoot (*Isoodon obesulus*), bush rats, and brush tailed possums (*Trichosurus vulpecula*).

The Marri/Jarrah open woodlands typical to the Albany area support bird species such as cockatoos (red-tailed black cockatoo, *Calyptorhynchus banksii* and yellow-tail black cockatoo, *Calyptorhynchus funereus*); parrots (red-capped parrot, *Purpureicephalus spurious* and the Western rosella, *Platycercus icterotis*); robins -capped robin, (*Petroica goodenovii*); tawny frog mouth owls (*Podargus strigoides)*; the rufous tree creeper (*Climacteris rufa)* and wrens (splendid fairy wren, *Malurus splendens* and red-winged fairy wren, *Malurus elegans*). During gross observations of the lots, avian fauna sighted were the Australian raven ("crow", *Corvus coronoides*), magpie (*Gymnorhina tibicen*) and a species of Iris (*Threskiornis molucca*).

Reptiles known to the area include: dugite (*Pseudonaja affinis*); tiger snake (*Notechis scutatus*), crowned snake (*Cacophis* spp.), carpet python (*Morelia spilota*); muellers snake (*Typhlops muelleri*); smiths skink (*Egernia napoleonis*); burrowing skink (*Hemiergis peronii*); king skink (*Egernia kingii*) and bobtail lizard (*Tiliqua rugosa*).

Evidence of Kangaroos was observed during the site assessment on the 12th of May, 2008. A full fauna trapping program was not conducted as part of this assessment. Non native fauna observed included horses, cows, sheep and evidence of rabbits was also noted.

6. Erosion and Degradation

As commented on in the geology section of this report, the surface of the three lots is predominantly gently undulating with little or no steep inclines thus mass movement of surface water is unlikely. The observed soil profile contains lenses of clay which has a high water holding capability. Thus, erosion is unlikely in areas where the topsoil is mostly composed of gravel. The mass removal of overlaying vegetation in sandy areas may cause the soil to become 'un-bound' and thus cause erosion during wet conditions and result in the formation of gullies and crevices within the first 500mm to 1000mm of the land surface. To minimise further potential erosion, it is recommended that construction and earthworks should be carried out in dry weather conditions.

Recommendation:

- **Avoid unnecessary soil disturbance and retain, where possible, native vegetation including mature trees to minimise the risk of erosion;**
- **To avoid sedimentation off site, silt and sediment traps should be utilised during construction works; and**
- **Following site works, disturbed areas should be re-vegetated with endemic native species where practical to minimise the risk of erosion.**

7. Soil Assessment

A site assessment was conducted on the 12th May 2008. The scope of the assessment was to determine the soil profile including the amount of rock present on site. The site assessment included recording soil profiles by visual classification to a depth of 2m. Bore pits were drilled by mechanical auger. Eighteen test pits were excavated, with five test pits in lot 30, seven test pits on lot 31 and six test pits in lot 35. Please refer to Test Pit Location Map in Appendix 5. The soils were generally uniform across the site (sandy gravel over sillty clay), with the exception of test pits 15 and 16 recording a soil profile of sand with silt only to 2000mm below ground level. During drilling, none of the 18 test pits hit cap rock or the water table (please refer to Appendix 5 – Soil Profile Description).

At the time of investigation the ground surface was moist. Due to insetting rains, the soils sampled at 2m were also moist. The predominant soil profile on the three locations, with the exception of 15 and 16, was a combination of dark grey sand containing silt at 0 – 150mm (topsoil) over brown sandy gravel to approximately 750mm over red/grey silty clay. These soil profiles were recorded during the investigation and confirmed during a desktop survey, the results of which can be found in section 4.1 Landscape and Geology. Please refer to Plates 17 through to 50 for soil excavation at each test pit across lots 30, 31 and 35.

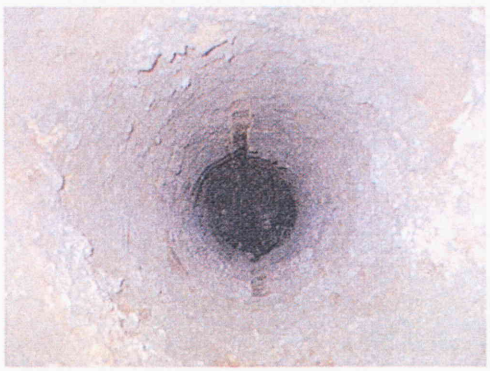

Plate 17: Test pit 1, lot 35

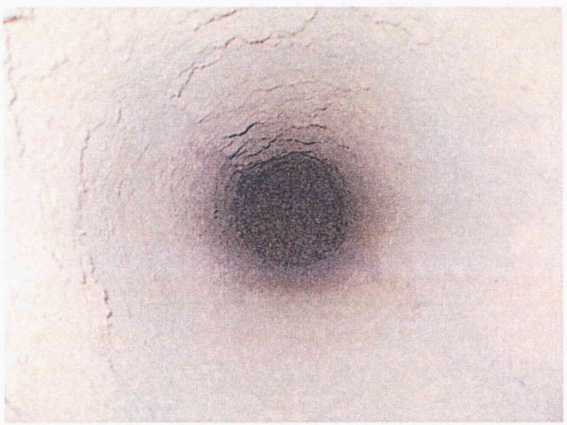

Plate 18: Test pit 2, lot 35

Plate 19: Test pit 2, lot 35, drill

Plate 20: Test pit 3, lot 35

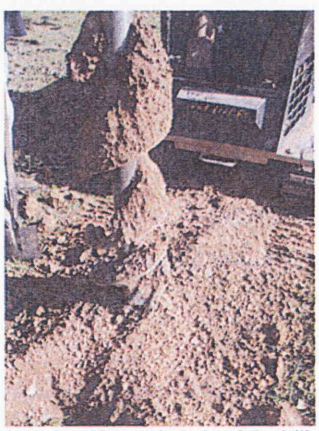

Plate 21: Test pit 3, lot 35, drill

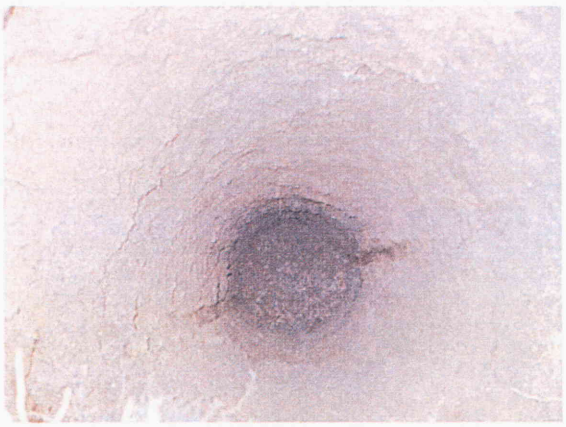

Plate 22: Test pit 4, lot 31

Plate 23: Test pit 12, lot 31, drill

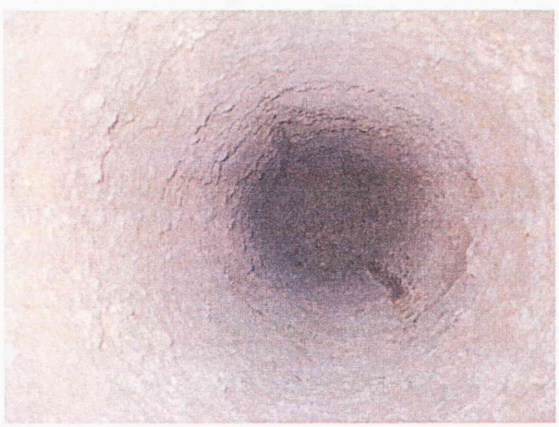

Plate 24: Test pit 5, lot 35

Plate 25: Test pit 5, lot 35, drill

Plate 26: Test pit 6, lot 35

Plate 27: Test pit 6, lot 35, drill

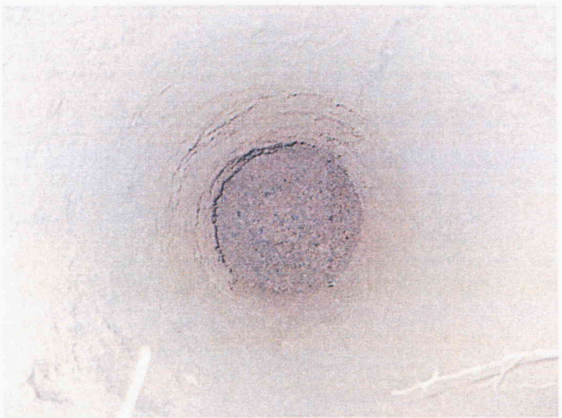

Plate 28: Test pit 7, lot 30

Plate 29: Test pit 7, lot 30, drill

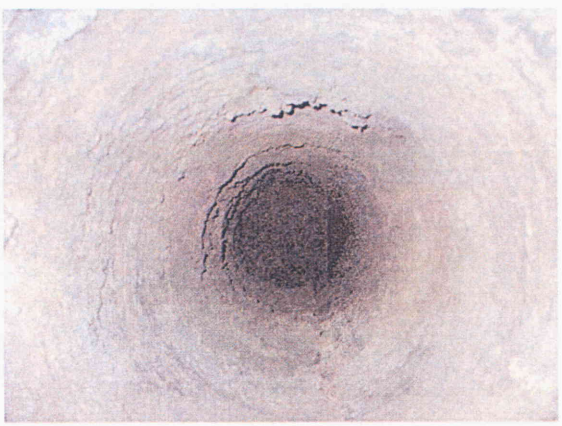

Plate 30: Test pit 8, lot 30

Plate 31: Test pit 8, lot 30, drill

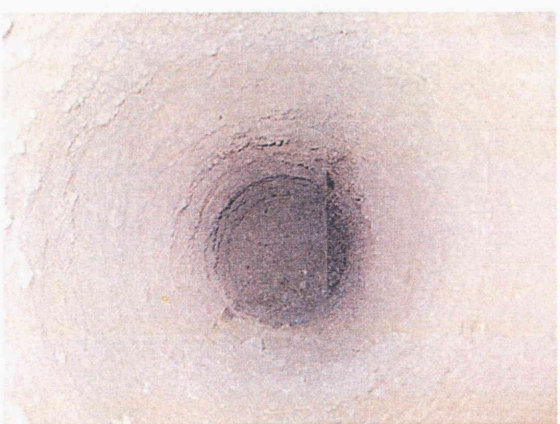

Plate 32: Test pit 9, lot 30

Plate 33: Test pit 9, lot 30, drill

Plate 34: Test pit 10, lot 30

Plate 35: Test pit 10, lot 30, drill

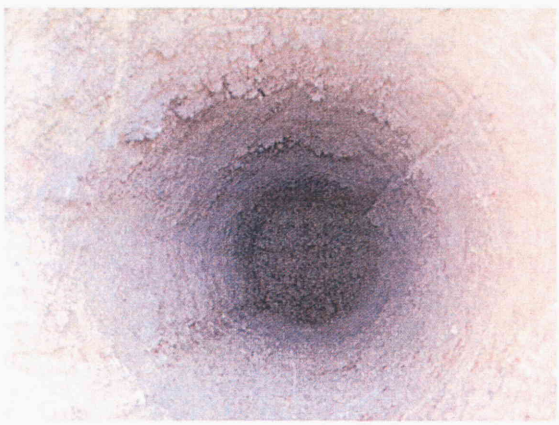

Plate 36: Test pit 11, lot 30

Plate 37: Test pit 12, lot 31

Plate 38: Test pit 12, lot 31, drill

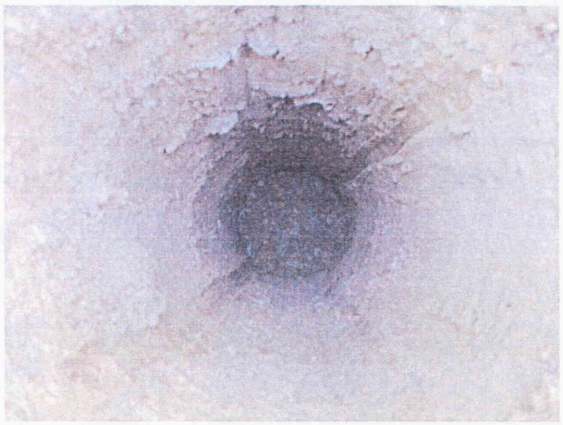

Plate 39: Test pit 13, lot 31

Plate 40: Test pit 13, lot 31, drill

Plate 41: Test pit 14, lot 31

Plate 42: Test pit 14, lot 31, drill

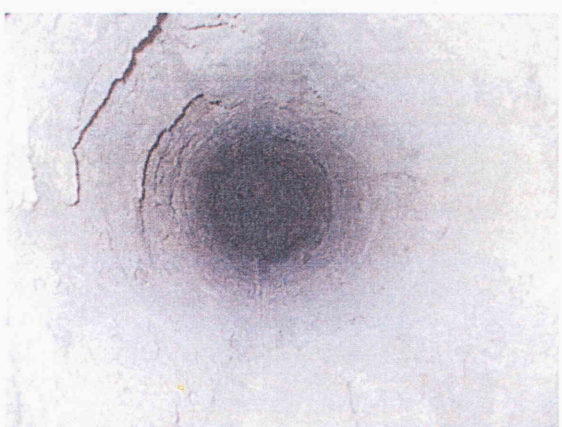

Plate 43: Test pit 15, lot 31

Plate 44: Test pit 15, lot 31, drill

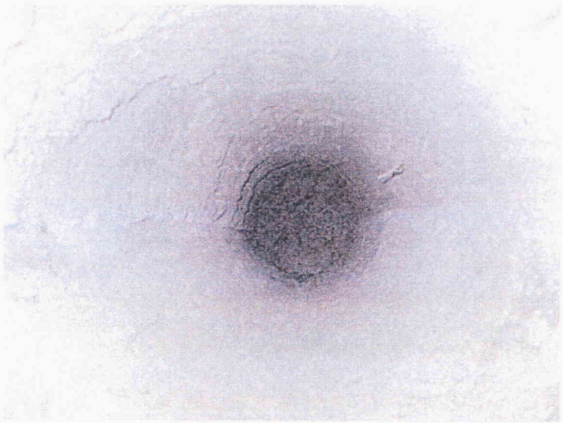

Plate 45: Test pit 16, lot 31

Plate 46: Test pit 16, lot 31, drill

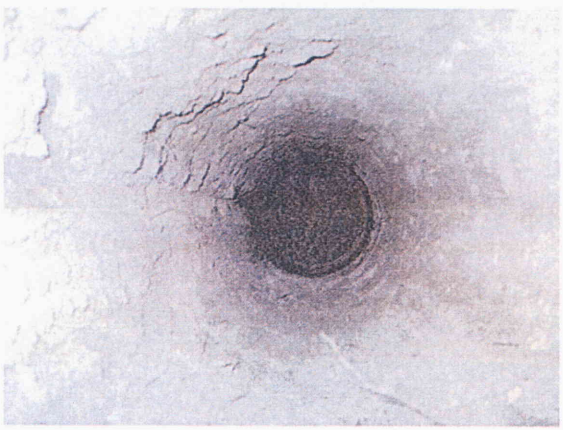

Plate 47: Test pit 17, lot 31

Plate 48: Test pit 17, lot 31, drill

Plate 49: Test pit 18, lot 31

Plate 50: Test pit 18, lot 31, drill

8. Acid Sulphate Soils (ASS) Desktop Assessment

Lots 30, 31 and 35 Catalina Road are located in a "Low to No Risk Acid Sulfate Soil" mapped area. Please refer to the Acid Sulfate Soils Map in Appendix 6. Due to the close proximity of the lots to a "High Risk Acid Sulfate Soil" area to the south (estimated 200m), a condition may be placed to complete an Acid Sulfate Soil (ASS) self assessment form, or to conduct an acid sulfate soil investigation. Please see the comment section for further information below.

Elevation

There were no visible signs of ASS at the time of site investigation in May 2008. The site is relatively elevated with elevation across the site ranging from 55m AHD in the northern area of lot 30 to approximately 43m AHD along the southern boundary. Lot 31 is located in the same contours, thus its height above sea level ranges from 55m AHD in its northern area and 43m AHD in its southern area. Lot 35 has its highest elevation in the centre of the lot (at approximately 45m AHD). The lot slopes from this point to 35m AHD towards the northern and southern boundaries. This information can be found in Appendix 2 – Contours and Land Height.

Visual assessment of surface water and hydrology

There were no surface water bodies at the time of investigation (May 2008). Eighteen test pits were excavated to 2m in depth across the three lots at various elevations and the water table was not reached in any of the pits. Due to the elevation of the site, surface water flows from the north west to the south east across the site.

Surface soils

Site soil assessment was conducted in May 2008. Eighteen test pits were excavated across the three lots to determine the soil profile, which was predominantly silty sand over sandy gravel over clay. Please refer to Appendix 5 – Soil Profile Description.

Vegetation

A large proportion of the remnant vegetation across the project site has been removed. Please refer to the aerial map in Appendix 3 – Vegetation Mapping. The ground cover is predominantly pasture grasses such as kikuyu (*Pennisetum clandestinum*). There are no scald areas or other indicators in the existing vegetation (grasses and planted trees) that indicate the presence of Actual Acid Sulfate Soils or Potential Acid Sulfate Soils.

Comment

It is unlikely that an ASS Preliminary Investigation will be required due to the elevated position of the site. However, a condition may be set to complete an ASS self assessment form or to conduct an investigation in the event of having to undergo deep excavations (greater than 2m below surface) for the construction of water and/or sewage pipes.

9. Contaminated Site Desktop Assessment

A desktop search was conducted on 22nd May, 2008 utilising the Department of Environment (DEC) Contaminated Sites Database and by Opus Consultants, where it was identified that there were no known contaminated sites recorded on lots 30, 31 and 35 Catalina Road. Please note that only sites classified as '*contaminated – restricted use*', '*contaminated – remediation required*' and '*remediated for restricted use*' are recorded on the database.

Rural lots historically may have been subject to rural activity contamination. The potential causes of contamination commonly associated with rural activities that require reporting to the DEC include (Department of Environment and conservation, n.d.):

- *Current or historical arsenic-based sheep or cattle dips – especially if they were unlined or sludge/residue was disposed of on-site.*
- *Uncontrolled landfills and rubbish dumps – particularly sites where unused chemicals were disposed of on-site and leachate from landfills may enter surface water or ground water.*
- *Areas of land where fertilisers, pesticides or herbicides were not applied in accordance with manufacturer recommendations and therefore elevated concentration may be present in soil.*
- *Large spillages of hazardous chemicals or fuels which have impacted soil and may have impacted soil and may impact groundwater and surface water.*
- *Storage of disused chemicals, particularly where these have the potential to leak into the soil, surface water or groundwater."*

It is unlikely that current or historical arsenic-based sheep dips have been located at lots 30, 31 or 35 Catalina Road. The lots are small in size (just over 8ha each) and hold very small numbers of stock. There is no infrastructure present to suggest that a sheep dip has been in existence at these lots.

There is no evidence on site, or in aerial photographs indicating that there have been uncontrolled landfills or rubbish dumps on lots 30, 31 or 35 Catalina Road. An area of refuse is located on Lot 31, however close inspection of this indicated minimal contamination sources. This material would need to be disposed of to approved landfill and inspected during disposal to ensure no hazardous substances.

10. European Heritage Sites

A desktop search of the Heritage Council of Western Australia database conducted on the 23rd of May, 2008, revealed there are no registered Heritage sites located within the project area.

11. Aboriginal Heritage Sites

A desktop search of the Department of Indigenous Affairs "Resisted Aboriginal Heritage Enquiry" system conducted on the 23rd of May, 2008, revealed that there are no Aboriginal sites registered within or directly adjacent to the project area. Please refer to Appendix 7 – Culturally Significant Sites.

12. Constructability desktop survey of power, water, sewer and related issues

The three lots, 30, 31 and 35 Catalina Road are surrounded by utilities that are already in existence. Opus have conducted a desktop investigation for utilities in the area. These are included in Appendix 8 and show that the three lots can easily gain access to the main sewage system, water mains, telecommunication cables and the City of Albany power grid, depending on the existing capacity for each type of infrastructure. Please refer to Appendix 8 for all existing service plans.

12.1. Water

During construction, Opus recommends consultation with the Water Corporation to determine available capacity in the network for this area. They also indicate to which watermain to connect from. The normal design procedure is that Preliminary Engineering design for drinking water reticulation is completed, based on the subdivision lot layout plan, set up by Town Planner and Surveyor and submitted to Water Corporation for comment and approval. Final design is then completed incorporating their comments.

Installation of a watermain to the lots may include thrust boring underneath council roads, to prevent the seal from being damaged, as per council requirements.

12.2. Sewer

Standard gravity sewer connections will be assumed in the preliminary design, diameter varying between 150mm and 225mm, depending on where the lots are in the network. There is an existing gravity sewer along Hudson Street.

The fall in the land is towards Hudson Street, this would serve the design of a gravity sewer for lots 30,31 and 35. However, the north east corner of Lot 35 appears to be behind a crest, with the crest running across lot 35, Catalina Road. There is no existing sewer on Catalina Road, thus if the far northeast corner of lot 35 needs to be connected to sewer in Hudson Road, it will have ramifications on the depth of the sewer within Lot 35. This could possibly mean that excavations to install sewer could reach ASS layers and will need to be treated carefully. Preliminary Engineering design can determine final sewer depth in Lots 30, 31 and 35.

Water Corporation will need to be consulted during preliminary design to check whether they will approve of lots being connected to the gravity sewer along Hudson Road, confirm that the waste water pump station capacity for this area.

The normal design procedure is that Preliminary Engineering design for waste water is completed, based on the subdivision lot layout plans, set up by Town planner and surveyor and submitted to Water Corporation for comment and approval. Final design is then completed incorporating their comments.

12.3. Power

Upon receiving WAPC approval, the electrical design sub-consultant will contact Western Power for a Design

package. Western Power will state their requirements when providing this design package. The following are common requirements for subdivisions in Albany:

- Western Power will require that this development is serviced by underground three phase power. It is understood that the network in the developments vicinity is approaching capacity and network reinforcement will possibly be required to provide for this subdivision;
- The source of High Voltage (HV) will likely be from the main feeder on Chester Pass Road. Low Voltage (LV) network to the development will be supplied by means of a switchgear unit and transformers located within the development, with a number of LV feeders and pillar units servicing each lot. Land will need to be allocated for HV equipment;
- The provision of LV & HV interconnection to the adjoining lots that could be developed in the future will also be catered for within this subdivision;
- Lot 35 may need a separate switchgear and transformer unit separate from lots 30 and 31; and
- Further consultation is required between the electrical consultant and Western Power.

12.4. Telecommunications (Telstra)

Liaison for Telecommunication infrastructure is handled by the electrical sub-consultant in coordination with TELSTRA and Western Power. Availability of connections and broadband internet capacity will depend on the capacity of the nearest switchboard.

There is Optic fibre cable along Catalina Road north of Lots 30 and 31, but does not extend further. Lot 35, if required, would need an Optic fibre cable extension from Lot 31 onward.

12.5. Stormwater Drainage

According to the City of Albany Subdivision guidelines, stormwater runoff needs to be treated before leaving the subdivision. Please refer to section 4.2 Wetlands and Waterways.

The council also requires that a 1 in 10 year storm event (1:10 ARI) post development flow should be held on site before released in the council drainage system. As the lots are being developed, they will likely be less permeable then in its current form and therefore will generate greater storm water runoff.

To hold a 1:10 year storm event volume, several different methods exist and can be done at source (at each house) through rainwater tanks with extra capacity, or inside underground storage units, known as raincells. Storage can also be created collectively in basins or underground storage units. Surface water basins have a disadvantage of attracting mosquitoes if they contain permanent water. Advantages of underground storage units can be rainwater infiltration into the surrounding soil. The top layer of the site is sandy/gravelly material and would facilitate infiltration. The area on top of raincells can be used for POS activities or carparks.

13. Summary

Opus Consultants have assessed the subject site through desktop assessment of the DEC (Land and Water Quality Branch), the DIA and Heritage Council and through site investigations. Considerations and findings have been incorporated into this assessment.

Lots 30, 31 and 35 Catalina Road have been almost entirely cleared of native vegetation. With the exception of a few isolated trees, the only vegetation remaining on the lots are planted windrows, some small stands of trees and household plants and trees, which are a mixture of endemic, native and non-native species.

Due to the lots being almost entirely cleared and utilised for grazing, there are very few weed species present. It is recommended that a weed management plan is not required, although the weeds that are currently located on the lots should be removed and controlled. Some weeds are potentially toxic to domestic animals and thus it is recommended to monitor the movement of animals around weed sites and manage the weed spread or removal.

There are no permanent waterways present on site. However, the subject site is located in the Yakamia Creek Catchment. Opus Consultants recommend the inclusion and application of Water Sensitive Urban Design (WSUD) principles during the planning process for the management of storm water and nutrients so as to maintain pre-development hydrology (i.e. flows) across the site.

The site soil assessment indicates that the lots contain silty sand over gravel over clay.

The site is located in a "Low Risk ASS" mapped area. Therefore it is unlikely that an Acid Sulfate Soil Preliminary Investigation will need to be conducted. A site and desktop assessment of the contaminated sites database revealed little indication of possible site contamination.

13.1. Summary of Recommendations

A summary of recommendations contained in this report are:

- **Implement Water Sensitive Urban Design principles during the planning and construction process;**
- **Control rainfall runoff so that post development run off does not exceed pre-development flows;**
- **All water (drainage and storm water) run off from the proposed development is nutrient stripped through a reconstructed wetland and/or native sedge bed(s);**
- **All water run off post development will be less than predevelopment flows;**
- **Re-vegetation and landscaping of verges and medians of the proposed development occurs with endemic native species;**
- **A revegetation plan is produced for potentially seasonally inundated areas (if any);**
- **House hold plants are kept maintained regularly to prevent uncontrolled spread of potential 'declared and environmental weeds';**
- **A weed management plan during construction is enforced to prevent any further spread of**

weeds;

- The blackberry (*Rubus spp*), gorse (*Ulex europaeus*), taylorina (*Psoralea pinnata*) and Golden Wattle (*Acacia Longifolia*) is eradicated or prevented from spreading further. Any areas containing these should be treated prior to soil disturbance;
- Machines should be free from soil before entering the site to prevent weed contamination from prior site works;
- If it is proposed to retain the pine trees (on the adjacent lot), that the area surrounding them is monitored for seedling growth, and if present, removed by hand;
- The movement of live stock or domestic animals should be monitored around toxic or potentially dangerous weeds to prevent being ingested and spread further;
- Endemic plant species are selected for the areas to be revegetated and for streetscapes/landscaping to support and maintain habitat for native animals;
- Avoid unnecessary soil disturbance and retain, where possible, native vegetation including mature trees to minimise the risk of erosion;
- To avoid sedimentation off site, silt and sediment traps should be utilised during construction works; and
- Following site works, disturbed areas should be re-vegetated with endemic native species where practical to minimise the risk of erosion.

14. References

Australian Geoscience Mapping, Map series S50-11 Part of Sheet S150-15, Mt Barker to Albany.

Beard's Vegetation Classification dataset ,1:3,000,000 digital representation of Beard's vegetation map of the state of Western Australia.

City of Albany. (2005). *Environmental Weeds Strategy for City of Albany Reserves (Including Declared and Pests Plants)*. Works and Services 2005-2010.

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Moore, J, Wheeler, J *Southern Weeds and Their Control*, Department of Agriculture.

Schoknecht, N., Tille, P., Purdie, B., 2004, Soil-Landscape Mapping in South-Western Australia, Resource Management Technical Report 280, Department of Agriculture, Government of Western Australia.

Wheeler, J, Marchant, N. Lewington, M., (2002) *Flora of the South West, Volume 1 & 2,* Australian Biological Resources Study, University of Western Australia".

APPENDICES

Appendix 1 – Locality Map

Locality Map

SCALE AND LEGEND

0 35 70 140 210 280 Meters

1 centimeter equals 50 meters

Legend

Lots 30 31 35

N W E S

	BY	CHECKED	DATE
DESIGN			
DRAWN	S. Glassbrow		22/05/2008
APPROVED			3/6/08

Dykstra Planning

OPUS
Albany Office
PO Box 5236
Albany, WA 6330, Australia
Tel: +61 8 9842 0155
Fax: +61 8 9842 0055

TITLE: Lot 30, 31 and 35 Catalina Road

Locality Map

STATUS	FILE
Final	WAENV078
SCALE: 1:5,000	PLOT DATE: 22 MAY 2008

Appendix 2 – Contours & Land Height

SCALE AND LEGEND

0 25 50 100 Meters

1 centimeter equals 34.136521 meters

Legend

Height (asl) AHD

	BY	CHECKED	DATE
DESIGN			
DRAWN	S. Glasshorow		22/05/2008
APPROVED			21/05/08

Dykstra Planning

OPUS
Albany Office
PO Box 5336
Albany, WA 6330, Australia
Tel: +61 8 9842 0155
Fax: +61 8 9842 0055

TITLE: Lot 30, 31 and 35 Catalina Road

Contour Hights (AHD)

STATUS	FILE
Final	WAENV078
SCALE	PLOT DATE
1:3,414	22 MAY 2008

Appendix 3 – Vegetation Mapping

SCALE AND LEGEND

N
W E
S

0 50 100 200 300 400 Meters

1 centimeter equals 50 meters

Legend

- Cleared Residential Areas
- Plantation
- Cleared open Paddocks
- Lots 30 31 35

	BY	CHECKED	DATE
DESIGN			
DRAWN	S. Glassborow		22/05/2008
APPROVED			2/6/08

Dykstra Planning

Albany Office
PO Box 5230
Albany, WA 6330, Australia
Tel: +61 8 9842 6155
Fax: +61 8 9842 6055

TITLE
Lot 30, 31 and 35 Catalina Road

Vegetation Mapping

STATUS	FILE
Final	WAENV078
SCALE	PLOT DATE
1:5,000	22 MAY 2008

Appendix 4 – DEC Declared Rare Flora Information

Department of
Environment and Conservation

Your reference:
Our reference: 2008/001163-1
Enquiries: Bridgitte Long

Phone: 9334 0123
Fax: 9334 0278
Email: bridgitte.long@dec.wa.gov.au

Opus International Consultants (PCA) Ltd
PO Box 5236
Albany WA

Attention: Vicki Laurie

Dear Ms Laurie

REQUEST FOR RARE FLORA INFORMATION

I refer to your request of 5th May 2008 for information on rare flora in the Albany area. The search co-ordinates used were 34^0 56' - 35^0 02' S and 117^0 49' - 117^0 55' E (GDA94).

A search was undertaken for this area of **(1)** the Department's *Threatened (Declared Rare) Flora* database (for results, *if any*, see "Threatened Flora Data" – coordinates are GDA94), **(2)** the *Western Australian Herbarium Specimen* database for priority species opportunistically collected in the area of interest (for results, *if any*, see "WAHERB"- coordinates are GDA94 – see condition number 9 in the attached 'Conditions in Respect of Supply' and **(3)**, the Department's *Declared Rare and Priority Flora List* [this list is searched using 'place names'. This list which may also be used as a species target list, contains species that are declared rare (Conservation Code R or X for those presumed to be extinct), poorly known (Conservation Codes 1, 2 or 3), or require monitoring (Conservation Code 4) – for results, *if any*, see "Declared Rare and Priority Flora List"]. The results are attached electronically to this email.

Attached also are the conditions under which this information has been supplied. Your attention is specifically drawn to the seventh point, which refers to the requirement to undertake field investigations for the accurate determination of rare flora occurrence at a site. *The information supplied should be regarded as an indication only of the rare flora that may be present and may be used as a target list in any surveys undertaken.*

The information provided does not preclude you from obtaining and complying with, where necessary, land clearing approvals from other agencies.

An invoice for $200 (plus GST) to supply this information will be forwarded.

It would be appreciated if any populations of rare flora encountered by you in the area could be reported to this Department to ensure their ongoing management.

If you require any further details, or wish to discuss rare flora management, please contact Dr Ken Atkins, Manager, Species and Communities Branch, on (08) 9334 0455.

Yours faithfully

B A Long
.....
for Keiran McNamara
DIRECTOR GENERAL
DEPARTMENT OF ENVIRONMENT AND CONSERVATION

5th May, 2008

Please note: Co-ordinates supplied for all data search requests must be provided in latitude/longitude format, 'eastings and northings' are no longer suitable. Thank you.

DEPARTMENT OF ENVIRONMENT AND CONSERVATION

RARE FLORA INFORMATION

CONDITIONS IN RESPECT OF SUPPLY OF INFORMATION

1. All requests for data to be made in writing to the Director General, Department of Environment and Conservation, Attention: Threatened Flora Database Officer, Species and Communities Branch.

2. The data supplied may not be supplied to other organisations, nor be used for any purpose other than for the project for which they have been provided, without the prior written consent of the Director General, Department of Environment and Conservation.

3. Specific locality information for Declared Rare Flora is regarded as confidential, and should be treated as such by receiving organisations. Specific locality information for DRF may not be used in public reports without the written permission of the Director General, Department of Environment and Conservation. Publicly available reports may only show generalised locations or, where necessary, show specific locations without identifying species. The Department is to be contacted for guidance on the presentation of rare flora information.

4. Note that the Department of Environment and Conservation respects the privacy of private landowners who may have rare flora on their property. Rare flora locations identified in the data as being on private property should be treated in confidence, and contact with property owners made through the Department of Environment and Conservation.

5. Receiving organisations should note that while every effort has been made to prevent errors and omissions in the data provided, they may be present. The Department of Environment and Conservation accepts no responsibility for this.

6. Receiving organisations must also recognise that the database is subject to continual updating and amendment, and such considerations should be taken into account by the user.

7. **It should be noted that the supplied data do not necessarily represent a comprehensive listing of the rare flora of the area in question. Its comprehensiveness is dependant on the amount of survey carried out within the specified area. The receiving organisation should employ a botanist, if required, to undertake a survey of the area under consideration.**

8. Acknowledgment of the Department of Environment and Conservation as source of the data is to be made in any published material. Copies of all such publications are to be forwarded to the Department of Environment and Conservation, Attention: The Manager, Species and Communities Branch.

9. The development of the PERTH Herbarium database was not originally intended for electronic mapping (eg. GIS ArcView). The latitude and longitude coordinates for each entry are not verified prior to being databased. It is only in recent times that collections have been submitted to PERTH with GPS recorded in latitude and longitude coordinates. Therefore, be aware when using this data in ArcView that some records may not plot to the locality description given with each collection.

THE DEPARTMENT OF ENVIRONMENT AND CONSERVATION

DECLARED RARE AND PRIORITY FLORA LIST

for Western Australia

CONSERVATION CODES

R: Declared Rare Flora - Extant Taxa

Taxa which have been adequately searched for and are deemed to be in the wild either rare, in danger of extinction, or otherwise in need of special protection, and have been gazetted as such.

X: Declared Rare Flora - Presumed Extinct Taxa

Taxa which have not been collected, or otherwise verified, over the past 50 years despite thorough searching, or of which all known wild populations have been destroyed more recently, and have been gazetted as such.

1: Priority One - Poorly known Taxa

Taxa which are known from one or a few (generally <5) populations which are under threat, either due to small population size, or being on lands under immediate threat, e.g. road verges, urban areas, farmland, active mineral leases, etc., or the plants are under threat, e.g. from disease, grazing by feral animals, etc. May include taxa with threatened populations on protected lands. Such taxa are under consideration for declaration as 'rare flora', but are in urgent need of further survey.

2: Priority Two - Poorly Known Taxa

Taxa which are known from one or a few (generally <5) populations, at least some of which are not believed to be under immediate threat (i.e. not currently endangered). Such taxa are under consideration for declaration as 'rare flora', but are in urgent need of further survey.

3: Priority Three - Poorly Known Taxa

Taxa which are known from several populations, and the taxa are not believed to be under immediate threat (i.e. not currently endangered), either due to the number of known populations (generally >5), or known populations being large, and either widespread or protected. Such taxa are under consideration for declaration as 'rare flora' but are in need of further survey.

4: Priority Four - Rare Taxa

Taxa which are considered to have been adequately surveyed and which, whilst being rare (in Australia), are not currently threatened by any identifiable factors. These taxa require monitoring every 5-10 years.

Note, the need for further survey of poorly known taxa is prioritised into the three categories depending on the perceived urgency for determining the conservation status of those taxa, as indicated by the apparent degree of threat to the taxa based on the current information.

ABBREVIATIONS USED IN THREATENED FLORA DATABASE PRINTOUTS

VESTING

AGR	Chief Exec Dept of Agriculture
ALT	Aboriginal Land Trust
BAP	Baptist Union of WA Inc
BSA	Boy Scouts Association
CC	Conservation Commission – NPNCA - LFC
CGT	Crown Grant in Trust
COM	Commonwealth of Australia
CRO	Crown Freehold-Govt Ownership
DOL	Dept of Land Administration
DPU	Ministry for Planning
EXD	Exec Direc CALM
FRE	Freehold
HOW	Homeswest
ILD	Industrial Lands Develop. Auth
JOI	Joint Vesting-NPNCA & Shire
LAC	LandCorp
LFC	Lands and Forests Commission
MAG	Minister for Agriculture
MED	Ministry of Education
MHE	Minister for Health
MIN	Minister for Mines
MPL	Ministry for Planning
MPR	Minister for Prisons
MRD	Main Roads WA
MTR	Minister for Transport
MWA	Minister for Water Resources
MWO	Minister for Works
NAT	Natural Trust of Australia WA
NON	Not Vested
NPN	NPNCA
OTH	Other
PRI	Private
RAI	Westrail
SEC	Western Power
SHI	Shire
SPC	State Planning Commission
SWA	State of Western Australia
TEL	Telstra
TGR	Timber Govt Requirement
TOW	TOWN
UNK	Unknown
WAT	Water Corporation
WEL	Minister Community Welfare
WRC	Water & Rivers Commission
XPL	Ex-Pastoral Lease

PURPOSES

ABR	Aboriginal Reserve
AER	Aerodrome
AIR	Airport
CAM	Camping
CAR	Caravan park
CEM	Cemetery
CFA	Conservation of Fauna
CFF	Conservation Of Flora & Fauna
CFL	Conservation of Flora
CHU	Church
CPK	Car Park
COM	Common
CON	Conservation Park
DEF	Defence
DRA	Drain
EDE	Educational Endowment
EDU	Educational purposes UWA
ENE	Enjoyment of Natural Environ.
EXC	Excepted from sale
EXL	Exploration Lease
EXP	Experimental Farm
FIR	Firing Range
FOR	State Forest
GHA	Grain Handling
GOL	Golf
GRA	Gravel Pit
GRE	Green Belt
GVT	Government Requirements
HAR	Harbour Purposes
HEP	Heritage Purposes
HER	Heritage trail
HOS	Hospital
KEN	Kennels
MIN	Mining lease
MUN	Municipal Purposes
NPK	National Park
NRE	Nature Reserve
OTH	Other
PAC	Public access
PAR	Parkland (& Recreation)
PAS	Pastoral lease
PFF	Protection of Flora & Fauna
PFL	Protection of Flora
PIC	Picnic ground
PLA	Plantation
POS	Public Open Space
PPA	Public parkland
PRS	Prison site
PUT	Public Utility
QUA	Quarry
RAD	Radio Station
RAC	Racecourse
REC	Recreation
REH	Rehabilitation
RNP	Re-establish Native Plants
RRE	Railway Reserve
RUB	Rubbish
SAN	Sand
SCH	School-site
SET	Settlers requirements
SHI	Shire Requirements
SHO	Showgrounds
SNN	Sanitary
SOI	Soil Conservation
STO	Stopping place
TIM	Timber
TOU	Tourism
TOW	Town-site
TRA	Training Ground
TRI	Trig station
TVT	Television transmitting
UCL	Unallocated Crown Land
UNK	Unknown
UTI	Utilities
VCL	Vacant Crown Land
VER	Road Verge
VPF	Vermin Proof Fence
WAT	Water
WCO	Water & Conservation of F & F
WOO	Firewood

* Please note that LFC now comes under the Conservation Commission.

Total No. of Records = 13

Species Name	Cons. Code	Status	Pop ID	No. Plants	Latitude	Longitude	Purpose	Vest
ustrofestuca littoralis	1		1	1000	35^01'03.8"	117^55'04.0"	Recreation	SHI
aladenia harringtoniae	R		7	0	35^01'31.6"	117^53'37.5"	Public parkland	SHI
aladenia plicata	4		1		35^01'29.6"	117^53'52.5"	Townsite	SHI
rosera fimbriata	4		7A	50	34^58'23.6"	117^55'22.5"	Road Verge	SHI
			7B		34^58'21.8"	117^55'21.5"	Recreation	SHI
opogon uncinatus	R		2	0	34^56'46.6"	117^51'02.5"		PRI
axmannia jamesii	4		5A	1	34^58'25.3"	117^55'22.4"	Road Verge	SHI
			5B	25	34^58'20.6"	117^55'24.5"	Recreation	SHI
			5C	20	34^58'20.6"	117^55'24.5"		PRI
			15		34^58'56.6"	117^54'43.5"	Other	MAG
tylidium plantagineum	4		8	750	34^58'59.6"	117^54'51.5"	Educational purposes UWA	MED
hysanotus tenuis	3		1		34^59'07.6"	117^52'52.5"		PRI
erticordia fimbrilepis subsp. australis	R		1	0	34^56'46.6"	117^51'02.5"		PRI

WAHERB SPECIMEN DATABASE
GENERAL ENQUIRY

Acacia ataxiphylla
Benth. subsp. ataxiphylla (Mimosaceae)
CONSERVATION STATUS:P3
Coll.: W.E. Blackall 1451 Date: 12 1931 (PERTH 721565)
LOCALITY Near Albany WA
LAT 35 Deg 2 Min Sec S LONG 117 Deg 53 Min Sec E
Previous det.: Acacia ataxiphylla Benth.

Acacia prismifolia
E.Pritz. (Mimosaceae)
CONSERVATION STATUS:X
Coll.: A. Meebold 11607 Date: 08 1933 (PERTH 777943)
LOCALITY Albany WA
LAT 35 Deg 0 Min Sec S LONG 117 Deg 52 Min Sec E
Previous det.: Acacia prismifolia E. Pritzel

Adenanthos x cunninghamii
Meisn. (Proteaceae)
CONSERVATION STATUS:P4
Coll.: M. Sherwood 834 Date: 20 02 1986 (PERTH 04150775)
LOCALITY Roberts Road, Robinson Estate, Albany W, WA
LAT 35 Deg 1 Min 53.000 Sec S LONG 117 Deg 52 Min 47.000 Sec E
2 m high, with red flowers. Grey sandy soil.
In association with Eucalyptus sp. and Agonis sp.
Previous det.: Adenanthos cunninghamii Meisn.in Lehm.

Agonis undulata
Benth. (Myrtaceae)
CONSERVATION STATUS:P3 TYPE STATUS: PLE
Coll.: L. Preiss 152 Date: 11 1840 (PERTH 07465661)
LOCALITY Albany (Plantagenet) WA
LAT 35 Deg 1 Min Sec S LONG 117 Deg 53 Min Sec E
In subturfoso - arenosis [...] urbisculam.
Previous det.: Leptospermum

Agrostocrinum scabrum
subsp. littorale Keighery (Anthericaceae)
CONSERVATION STATUS:P2
Coll.: G.J. Keighery 5809 Date: 11 1982 (PERTH 01953567)
LOCALITY Mutton Bird Island, W of Albany WA
LAT 35 Deg 1 Min 53.000 Sec S LONG 117 Deg 52 Min 47.000 Sec E
Perennial rhizomatous herb, to 40 cm. Flowers purple/blue. Large granitic rocks. Granitic loam over granite.
Open granite heath. Abundance: common.
Previous det.: Agrostocrinum scabrum (R.Br.) Baill.

Andersonia auriculata
L.Watson (Epacridaceae)
CONSERVATION STATUS:P3
Coll.: E.M. Sandiford s.n. Date: 22 07 1988 (PERTH 1178385)
LOCALITY Old Quarrum Townsite, c. 2.5 km E of Bow Bridge on South Coast Highway WA
LAT 34 Deg 58 Min 20.000 Sec S LONG 117 Deg 53 Min 50.000 Sec E
Dwarf shrub-spreading. Flowers pale blue and white. Sandy soil, very gentle slope periodically swampy.
Allocasuarina fraseriana open woodland over scrub <1.5m : Kunzea recurva, Melaleuca thymoides, Jacksonia horrida, Adenanthos oboratus, Anarthria scapra, Dasypogon bromliifolius, Leucopogon distans.

Andersonia depressa
R.Br. (Epacridaceae)
CONSERVATION STATUS:P3
Coll.: K. Baker 14 Date: 01 08 2001 (PERTH 06100074)
LOCALITY 20 m from pole No. 257 up firebreak parallel to end N of Memorial trees on Apex Drive, Albany WA
LAT 35 Deg 1 Min 39.600 Sec S LONG 117 Deg 54 Min 17.500 Sec E
Compact perennial 0.15 m high by 0.2 m wide with blue flowers. Grey sand, recently slashed, in a hillside reserve.
Tall trees of Eucalyptus marginata, Corymbia calophylla with Jacksonia horrida, Melaleuca thymoides, Leucopogon capitellatus.
Previous det.: Andersonia caerulea R.Br.
Frequency:one only.

Andersonia depressa
R.Br. (Epacridaceae)
CONSERVATION STATUS:P3
Coll.: E.J. Croxford 1494 Date: 06 05 1981 (PERTH 04358694)
LOCALITY Behind school, Flinders Park, off Lower King Road, WA
LAT 35 Deg 1 Min 53.000 Sec S LONG 117 Deg 52 Min 47.000 Sec E
10 cm high, with blue and white flowers. Gravel pit. In association with Persoonia sp. and Casuarina sp.
Previous det.: Andersonia sp.

Andersonia depressa
R.Br. (Epacridaceae)
CONSERVATION STATUS:P3
Coll.: R. McLaughlin 150 Date: 30 05 1997 (PERTH 05633966)
LOCALITY Mount Clarence, Albany, WA
LAT 35 Deg 1 Min 0.000 Sec S LONG 117 Deg 53 Min 0.000 Sec E
Perennial prostrate shrub with blue flowers and white sepals. Height 0.1m. On hill of white sand over granite/gneiss.
Vegetation a sparse Jarrah-sheoak low woodland.
Previous det.: Andersonia caerulea R.Br.
Frequency:occasional.

Asplenium aethiopicum
(Burm.f.) Bech. (Aspleniaceae)
CONSERVATION STATUS:P4
Coll.: C. Andrews s.n. Date: 03 1906 (PERTH 03249026)
LOCALITY Albany WA
LAT 35 Deg 1 Min 0.000 Sec S LONG 117 Deg 52 Min 47.000 Sec E
Previous det.: Asplenium furcatum Thumb.

Asplenium aethiopicum
(Burm.f.) Bech. (Aspleniaceae)
CONSERVATION STATUS:P4
Coll.: C.J. Robinson 879 Date: 25 08 1992 (PERTH 03131963)
LOCALITY Willyung Hill, N of Albany WA
LAT 34 Deg 56 Min 42.000 Sec S LONG 117 Deg 50 Min 53.000 Sec E
Low herb (fern) 200 mm high. Boulders, shallow loam over granite. Moss and Lichen on boulders.
Abundance: common

Austrofestuca littoralis
(Labill.) E.B.Alexeev (Poaceae)
CONSERVATION STATUS:P1
Coll.: P.C. Heyligers 88127 Date: 08 09 1988 (PERTH 02239035)
LOCALITY Middleton Beach, E of Albany WA
LAT 35 Deg 0 Min Sec S LONG 117 Deg 55 Min Sec E
Tussock grass. Unstable foredunes, including restoration areas.
With Ammophila arenaria (planted), Spinifex hirsutus, Cakile maritima,
Euphorbia paralias, Arctotheca populifolia,
Carpobrotus virescens, Pelargomium capitatum and Senecio elegans.
Previous det.: Austrofestuca pubinervis (Vickery)B.K.Simon

Austrofestuca littoralis
(Labill.) E.B.Alexeev (Poaceae)
CONSERVATION STATUS:P1
Coll.: J.A. Cochrane JAC 3788 Date: 10 12 2000 (PERTH 05814626)
LOCALITY Middleton Beach, on foredune past the caravan park for ca 1 km towards Emu Point, WA
LAT 35 Deg 1 Min 4.600 Sec S LONG 117 Deg 55 Min 0.500 Sec E
Tussock grass to 40 cm with golden fruiting heads to 15 cm tall. Beach dune with white sand.
Dune. Associated species: Arctotheca populifolia, Euphorbia paralias, Cakile maritima, Ammophila arenaria.
Some clumps very large with multiple stems and others small with only a few stems.
Frequency:1000+ plants.

Banksia brownii
R.Br. (Proteaceae)
CONSERVATION STATUS:R
Coll.: A.S. George s.n. Date: (PERTH 05180260)
LOCALITY Willyung WA
LAT 34 Deg 57 Min 0.000 Sec S LONG 117 Deg 51 Min 59.000 Sec E

Banksia goodii
R.Br. (Proteaceae)
CONSERVATION STATUS:R TYPE STATUS: ISO ?
Coll.: W. Baxter s.n. Date: 1829 (PERTH 999075)
LOCALITY King George's Sound. WA
LAT 35 Deg 2 Min Sec S LONG 117 Deg 53 Min Sec E
Previous det.: Banksia goodii R. Br.

Banksia goodii
R.Br. (Proteaceae)
CONSERVATION STATUS:R
Coll.: A.S. George s.n. Date: 19 08 1973 (PERTH 05200040)
LOCALITY Millbrook Reserve, N of Albany WA
LAT 35 Deg 1 Min 53.000 Sec S LONG 117 Deg 52 Min 47.000 Sec E

Banksia serra
(R.Br.) A.R.Mast & K.R.Thiele (Proteaceae)
CONSERVATION STATUS:P4
Coll.: Colonel Goadby B.2181 Date: 09 1899 (PERTH 1100157)
LOCALITY King George Sound WA
LAT 35 Deg 2 Min Sec S LONG 117 Deg 53 Min Sec E
Previous det.: Dryandra serra R.Br.

Banksia serra
(R.Br.) A.R.Mast & K.R.Thiele (Proteaceae)
CONSERVATION STATUS:P4 TYPE STATUS: ISO
Coll.: C.A. Gardner s.n. Date: (PERTH 1066269)
LOCALITY Prope [near] King George Sound WA
LAT 35 Deg 2 Min Sec S LONG 117 Deg 54 Min Sec E
Previous det.: Dryandra serra R.Br.

Banksia serra
(R.Br.) A.R.Mast & K.R.Thiele (Proteaceae)
CONSERVATION STATUS:P4
Coll.: Maxwell s.n. Date: 18 08 1958 (PERTH 1100238)
LOCALITY Western Australia WA
LAT 35 Deg 2 Min Sec S LONG 117 Deg 54 Min Sec E
Flowers, 5-8 feet. On conglomerate dry rocky situations.
Previous det.: Dryandra serra R.Br.

Banksia serra
(R.Br.) A.R.Mast & K.R.Thiele (Proteaceae)
CONSERVATION STATUS:P4
Coll.: C.A. Gardner s.n. Date: 11 1927 (PERTH 1100254)
LOCALITY King George Sound WA
LAT 35 Deg 2 Min Sec S LONG 117 Deg 53 Min Sec E
Previous det.: Dryandra serra R.Br.

Banksia verticillata
R.Br. (Proteaceae)
CONSERVATION STATUS:R
Coll.: H.E. Daniels 4 Date: 05 1964 (PERTH 1000101)
LOCALITY Albany WA
LAT 35 Deg 1 Min 0.000 Sec S LONG 117 Deg 53 Min 0.000 Sec E
Previous det.: Banksia verticillata R. Br.

Banksia verticillata
R.Br. (Proteaceae)
CONSERVATION STATUS:R
Coll.: J. Drummond IV : 304 Date: (PERTH 0999563)
LOCALITY Western Australia [Albany - pers.comm.T.D. Macfarlane, 07/08/2000] WA
LAT 35 Deg 1 Min 53.000 Sec S LONG 117 Deg 52 Min 47.000 Sec E

Banksia verticillata
R.Br. (Proteaceae)
CONSERVATION STATUS:R
Coll.: C.F. Davies s.n. Date: 17 04 1966 (PERTH 05483980)
LOCALITY Albany, WA
LAT 35 Deg 1 Min 53.000 Sec S LONG 117 Deg 52 Min 47.000 Sec E

Banksia verticillata
R.Br. (Proteaceae)
CONSERVATION STATUS:R
Coll.: J.T. Potter s.n. Date: 02 02 1957 (PERTH 1000632)
LOCALITY Albany WA
LAT 35 Deg 1 Min 0.000 Sec S LONG 117 Deg 53 Min 0.000 Sec E
Previous det.: Banksia verticillata R. Br.

Banksia verticillata
R.Br. (Proteaceae)
CONSERVATION STATUS:R

Coll.: R.W. Goodman 54 Date: 25 02 1984 (PERTH 01850156)
LOCALITY Off Blowholes turnoff, Frenchman's Bay road, Albany South WA
LAT 35 Deg 2 Min Sec S LONG 117 Deg 51 Min Sec E
2-3 m high, flowers yellow. Sandy loam in granite. Adenanthos and Borya.

Boronia crassipes
Bartl. (Rutaceae)
CONSERVATION STATUS:P3
Coll.: C.J. Robinson 1129 Date: 03 09 1993 (PERTH 03316270)
LOCALITY Link road, 5 km W of Albany, 0.3 km N of Upper Denmark road WA
LAT 35 Deg 1 Min 54.000 Sec S LONG 117 Deg 49 Min 43.000 Sec E
Erect spindly shrub 1.5 m high, flowers bright pink. Valley, peaty sand.
Homalospermum firmum, Agonis linearifolia, Acacia hastulata, Baumea riparia. Abundance: + 2000 plants

Boronia crassipes
Bartl. (Rutaceae)
CONSERVATION STATUS:P3
Coll.: D. Brearley DB 604-11 Date: 09 06 2005 (PERTH 07437951)
LOCALITY Walmsley Wetland; Albany WA
LAT 35 Deg 0 Min 46.300 Sec S LONG 117 Deg 50 Min 5.000 Sec E
1.5-2 m high. Inundated swamp. White sand. Fire: not known.
Low woodland over open low woodland over scrub over open low sedges. Condition unknown.

Boronia crassipes
Bartl. (Rutaceae)
CONSERVATION STATUS:P3
Coll.: P.J. Collins s.n. Date: 28 09 1993 (PERTH 03316262)
LOCALITY Geldhow Nature Reserve, W side of Albany town WA
LAT 35 Deg 1 Min 53.000 Sec S LONG 117 Deg 52 Min 47.000 Sec E
Erect wispy shrub 1.5 m, flowers bright pink. Flanks of creekline, peaty sand. Wet heath. Abundance: very common in small area.

Boronia crassipes
Bartl. (Rutaceae)
CONSERVATION STATUS:P3
Coll.: E.J. Croxford 1842 Date: 20 09 1982 (PERTH 04369599)
LOCALITY Road behind Superphosphate Works, WA
LAT 35 Deg 1 Min 53.000 Sec S LONG 117 Deg 52 Min 47.000 Sec E
1.5 m high, with pink flowers. Wet peat swamp. In association with Beaufortia sparsa and rushes. This specimen is housed at Albany. ALB. 3437

Boronia crassipes
Bartl. (Rutaceae)
CONSERVATION STATUS:P3
Coll.: Anonymous s.n. Date: 09 1940 (PERTH 993255)
LOCALITY Willyung Hill (Waljenup), Albany. WA
LAT 34 Deg 57 Min 0.000 Sec S LONG 117 Deg 51 Min 0.000 Sec E

Boronia crassipes
Bartl. (Rutaceae)
CONSERVATION STATUS:P3
Coll.: C.J. Robinson 1168 Date: 28 09 1993 (PERTH 03316246)
LOCALITY Warrangoo road - end, off Bayonet Head road, Albany WA
LAT 35 Deg 1 Min 53.000 Sec S LONG 117 Deg 52 Min 47.000 Sec E
Erect wispy shrub 1.5 m, flowers pink. Flat, peaty sand. Agonis juniperina wet heath. Abundance: + 100

Boronia crassipes
Bartl. (Rutaceae)
CONSERVATION STATUS:P3
Coll.: C. Andrews s.n. Date: 12 1902 (PERTH 992836)
LOCALITY Albany. WA
LAT 35 Deg 0 Min 0.000 Sec S LONG 117 Deg 52 Min 0.000 Sec E
Swamp.

Boronia crassipes
Bartl. (Rutaceae)
CONSERVATION STATUS:P3 TYPE STATUS: ISO
Coll.: L. Preiss 2040 Date: 14 10 1840 (PERTH 01636057)
LOCALITY Not far from Mount Wuljenup (Plantagenet)[Willyung Hill], King George's Sound WA
LAT 34 Deg 56 Min 48.000 Sec S LONG 117 Deg 50 Min 17.000 Sec E
Flowers rose. In moist places on plains.
Previous det.: Boronia crassipes Bartling

Caladenia evanescens
Hopper & A.P.Br. (Orchidaceae)
CONSERVATION STATUS:P1
Coll.: R. Oliver s.n. Date: 03 10 1962 (PERTH 00269255)
LOCALITY Albany WA
LAT 35 Deg 1 Min Sec S LONG 117 Deg 53 Min Sec E
Previous det.: Caladenia evanescens Hopper & A.P.Brown

Caladenia harringtoniae
Hopper & A.P.Br. (Orchidaceae)
CONSERVATION STATUS:R
Coll.: R. Herberle s.n. Date: 28 09 1983 (PERTH 0260355)
LOCALITY Mount Clarence, Albany WA
LAT 35 Deg 1 Min 42.000 Sec S LONG 117 Deg 53 Min 42.000 Sec E
Previous det.: Caladenia harringtonae Hopper subsp. harringtonae

Calectasia cyanea
R.Br. (Dasypogonaceae)
CONSERVATION STATUS:R
Coll.: A. Macleay s.n. Date: 1836 (PERTH 01987860)
LOCALITY King George Sound WA
LAT 35 Deg 1 Min Sec S LONG 117 Deg 53 Min Sec E
Previous det.: Calectasia cyanea R.Br.

Chorizema carinatum
(Meisn.) J.M.Taylor & Crisp (Papilionaceae)
CONSERVATION STATUS:P3
Coll.: Webb s.n. Date: 12 1882 (PERTH 02905353)
LOCALITY King George Sound WA
LAT 35 Deg 1 Min Sec S LONG 117 Deg 53 Min Sec E

Previous det.: Oxylobium carinatum

Chorizema reticulatum
Meisn. (Papilionaceae)
CONSERVATION STATUS:P3
Coll.: Col. Goadby s.n. Date: (PERTH 03550435)
LOCALITY King George's Sound WA
LAT 35 Deg 1 Min Sec S LONG 117 Deg 53 Min Sec E
Previous det.: Chorizema reticulatum Meissner

Chorizema reticulatum
Meisn. (Papilionaceae)
CONSERVATION STATUS:P3
Coll.: M.D. Crisp & L.G. Cook MDC 9238 Date: 21 09 2000 (PERTH 06177344)
LOCALITY Darling District. Albany, Henry Street, opposite #55, off Chester Pass Road WA
LAT 34 Deg 59 Min 2.000 Sec S LONG 117 Deg 52 Min 3.000 Sec E
Slender shrub, arching stems, 0.3 m. Petals pastel orange/pastel pink. Standard centre lemon yellow. Flat. Lateritic gravelly clay loam. Jarrah/Casuarina forest.
Previous det.: Chorizema reticulatum Meisn.
Frequency:occasional.

Chorizema reticulatum
Meisn. (Papilionaceae)
CONSERVATION STATUS:P3
Coll.: Col. B.T. Goadby 86 Date: 10 1900 (PERTH 03550427)
LOCALITY King George's Sound WA
LAT 35 Deg 1 Min Sec S LONG 117 Deg 53 Min Sec E
Previous det.: Chorizema reticulatum Meissner

Chorizema reticulatum
Meisn. (Papilionaceae)
CONSERVATION STATUS:P3
Coll.: C. Andrews s.n. Date: 10 1903 (PERTH 03550451)
LOCALITY Near Albany WA
LAT 35 Deg 1 Min Sec S LONG 117 Deg 53 Min Sec E
In ironstone gravel.
Previous det.: Chorizema reticulatum Meissner

Conostylis misera
Endl. (Haemodoraceae)
CONSERVATION STATUS:R TYPE STATUS: HOL
Coll.: J. Drummond s.n. Date: (PERTH 01222031)
LOCALITY King George Sound WA
LAT 35 Deg 1 Min Sec S LONG 117 Deg 53 Min Sec E
Previous det.: Conostylis gladiata Benth.

Corybas limpidus
D.L.Jones (Orchidaceae)
CONSERVATION STATUS:P4 TYPE STATUS: ISO
Coll.: D.L. Jones & T.D. Jones DLJ 2424 Date: 30 08 1986 (PERTH 05724066)
LOCALITY Ledge Beach, Albany, Darling district, WA
LAT 35 Deg 0 Min Sec S LONG 117 Deg 52 Min Sec E
Deciduous terrestrial orchid. Dorsal sepal long, more or less transparent; labellum with reddish-maroon markings.
Stabilised dune. Dense scrub. Under Agonis flexuosa.

Degelia flabellata
P.M.Jorg. & P.James (Pannariaceae)
CONSERVATION STATUS:P2
Coll.: R.J. Cranfield 20496 Date: 30 08 2004 (PERTH 07030541)
LOCALITY Willyung Hill (summit) WA
LAT 34 Deg 57 Min Sec S LONG 117 Deg 51 Min Sec E
Lichen. Foliose. Thallus wet grey blue. Growth phase: active.
Outcrop. Open to closed aspect. Outcrop. Quarry on one face. Bare, moist brown
shallow clay-loam. Granite 70% of area. Litter or organic mats, rocks sheets,
stones, overhangs crevasse. Logs burnt unburnt decaying. Shrubs alive-dead. On sheltered wet. Ground level (0-30cm).
Heath-woodland, Floristic richness 51-100. Life form density classes (LFDC)
3-4. Horizontal View Distance (HVD) 100+ m. Weed abundance: few. Site Area Frequency: occasional.
Frequency:frequent.

Degelia flabellata
P.M.Jorg. & P.James (Pannariaceae)
CONSERVATION STATUS:P2
Coll.: D. Richardson 155 Date: 18 04 1980 (PERTH 03346463)
LOCALITY Gull Rock road, 2 km from the coast, near Albany WA
LAT 35 Deg 1 Min 53.000 Sec S LONG 117 Deg 52 Min 47.000 Sec E
Previous det.: Parmeliella sp.

Degelia flabellata
P.M.Jorg. & P.James (Pannariaceae)
CONSERVATION STATUS:P2
Coll.: R.J. Cranfield 21258 Date: 22 04 2005 (PERTH 07413912)
LOCALITY Northern footslope of Mount Melville; Albany WA
LAT 35 Deg 0 Min 49.000 Sec S LONG 117 Deg 52 Min 7.000 Sec E
Thallus foliose. Active. On sheltered wet stone on ground layer. Hill and outcropping (granite) with bare to littered moist stony, cryptogamic shallow brown sandy clay with 20% exposed granite.
LFDC 1-5, HVD 1-20 m and floristic richness 51-100 species. Shrubland to open
woodland with Eucalyptus marginata and Allocasuarina fraseriana.
Frequency:frequent on site and frequent in area.

Dodonaea trifida
F.Muell. (Sapindaceae)
CONSERVATION STATUS:P3
Coll.: K.R. Newbey 3046 Date: 22 11 1964 (PERTH 02724332)
LOCALITY Mount Melville, Albany townsite WA
LAT 35 Deg 1 Min Sec S LONG 117 Deg 53 Min Sec E
3 ft high. Granite soil.
Previous det.: Dodonaea humifusa var. hirtella Benth.

Dodonaea trifida
F.Muell. (Sapindaceae)
CONSERVATION STATUS:P3
Coll.: K.R. Newbey 3046 Date: 22 11 1964 (PERTH 1106171)
LOCALITY Mount Melville, Albany townsite WA
LAT 35 Deg 1 Min Sec S LONG 117 Deg 53 Min Sec E
3 ft high. In granite soil.
Previous det.: Dodonaea humifusa var. hirtella

Drosera fimbriata
DeBuhr (Droseraceae)
CONSERVATION STATUS:P4
Coll.: R. Erickson s.n. Date: 16 10 1963 (PERTH 05862566)
LOCALITY Albany, WA
LAT 35 Deg 0 Min Sec S LONG 117 Deg 52 Min Sec E
Sand. Open forest.
Previous det.: Drosera stolonifera Endl.

Drosera fimbriata
DeBuhr (Droseraceae)
CONSERVATION STATUS:P4
Coll.: S. Barrett 822 Date: 08 12 1999 (PERTH 05569559)
LOCALITY Lower King Road, W side, N of Bayonet Road, WA
LAT 34 Deg 58 Min 20.600 Sec S LONG 117 Deg 55 Min 24.500 Sec E
Herb to 15 cm. Slope to S. White sand.
Heath/sedgeland with Evandra aristata, Laxmannia jamesii and Agonis parviceps.
Frequency:occasional.

Eucalyptus x erythrandra
Blakely & H.Steedman (Myrtaceae)
CONSERVATION STATUS:P4
Coll.: J. Hyam s.n. Date: 22 09 1961 (PERTH 1126792)
LOCALITY ? Albany WA
LAT 35 Deg 0 Min 0.000 Sec S LONG 117 Deg 52 Min 0.000 Sec E
Previous det.: Eucalyptus x erythrandra Blakely & H. Steedman

Gonocarpus pusillus
(Benth.) Orchard (Haloragaceae)
CONSERVATION STATUS:P3
Coll.: C. Andrews s.n. Date: 12 1902 (PERTH 03494411)
LOCALITY Albany WA
LAT 35 Deg 1 Min Sec S LONG 117 Deg 53 Min Sec E
Swamp.
Previous det.: Haloragis pusilla

Goodenia filiformis
R.Br. (Goodeniaceae)
CONSERVATION STATUS:P3
Coll.: Col. B.T. Goadby s.n. Date: 01 1900 (PERTH 02604663)
LOCALITY King George Sound WA
LAT 35 Deg 1 Min Sec S LONG 117 Deg 53 Min Sec E
Previous det.: Goodenia filiformis R.Br.

Gyrostemon thesioides
(Hook.f.) A.S.George (Gyrostemonaceae)
CONSERVATION STATUS:P2
Coll.: L. Preiss 1226 Date: 16 10 1840 (PERTH 03295176)
LOCALITY King George's Sound WA
LAT 35 Deg 1 Min 53.000 Sec S LONG 117 Deg 52 Min 47.000 Sec E
Female plant.
Previous det.: Didymotheca thesioides J.D. Hook

Gyrostemon thesioides
(Hook.f.) A.S.George (Gyrostemonaceae)
CONSERVATION STATUS:P2
Coll.: C. Andrews s.n. Date: 12 1902 (PERTH 03295184)
LOCALITY Albany WA
LAT 35 Deg 1 Min 53.000 Sec S LONG 117 Deg 52 Min 47.000 Sec E
Previous det.: Didymotheca thesioides J.D. Hook

Gyrostemon thesioides
(Hook.f.) A.S.George (Gyrostemonaceae)
CONSERVATION STATUS:P2
Coll.: F. Mueller s.n. Date: 10 1867 (PERTH 03295192)
LOCALITY King George's Sound WA
LAT 35 Deg 1 Min 53.000 Sec S LONG 117 Deg 52 Min 47.000 Sec E
Male plant.
Previous det.: Gyrostemon thesioides (J.D. Hook) A.S. George

Hakea tuberculata
R.Br. (Proteaceae)
CONSERVATION STATUS:P3
Coll.: F.M.C. Schock 165 Date: 12 04 1917 (PERTH 06564410)
LOCALITY Near Albany WA
LAT 35 Deg 1 Min Sec S LONG 117 Deg 53 Min Sec E
Previous det.: Hakea attenuata R.Br.

Hakea tuberculata
R.Br. (Proteaceae)
CONSERVATION STATUS:P3
Coll.: [A. Morrison] s.n. Date: 18 04 1904 (PERTH 06564429)
LOCALITY King Rier Road, Albany WA
LAT 35 Deg 1 Min Sec S LONG 117 Deg 53 Min Sec E
Previous det.: Hakea attenuata R.Br.

Isopogon uncinatus
R.Br. (Proteaceae)
CONSERVATION STATUS:R
Coll.: A.S. George 9692 Date: 11 10 1969 (PERTH 03430065)
LOCALITY Mount Willyung, N of Albany WA
LAT 34 Deg 57 Min Sec S LONG 117 Deg 51 Min Sec E
Low, tufted shrub; flowers cream. In clay soil.
Among scrub with stunted Jarrah.
Previous det.: Isopogon uncinatus R. Br.

Isopogon uncinatus
R.Br. (Proteaceae)
CONSERVATION STATUS:R TYPE STATUS: SYN
Coll.: W. Baxter s.n. Date: 1828 (PERTH 04228103)
LOCALITY South West Coast, King George's Sound WA
LAT 35 Deg 1 Min 53.000 Sec S LONG 117 Deg 52 Min 47.000 Sec E
Previous det.: Isopogon uncinatus R. Br.

Laxmannia jamesii
Keighery (Anthericaceae)
CONSERVATION STATUS:P4
Coll.: G.J. Keighery 2824 Date: 20 05 1972 (PERTH 1041231)
LOCALITY 6 miles E of Albany on Borden Road (Chester Pass Road) at turnoff to Two Peoples Bay. WA
LAT 34 Deg 57 Min Sec S LONG 117 Deg 54 Min Sec E
Rambling perennial herb, flowers under tepals white, outer striped red. Grey sand swamp.
Melaleuca/Nuytsia/Banksia.
Common.
Previous det.: Laxmannia sp. nov.

Lepidium pseudotasmanicum
Thell. (Brassicaceae)
CONSERVATION STATUS:P4
Coll.: C.A. Gardner s.n. Date: 06 1940 (PERTH 03418456)
LOCALITY Albany WA
LAT 35 Deg 1 Min Sec S LONG 117 Deg 53 Min Sec E
Previous det.: Lepidium hyssopifolium Desv.

Lysinema lasianthum
R.Br. (Epacridaceae)
CONSERVATION STATUS:P4
Coll.: C.A. Gardner s.n. Date: 01 1936 (PERTH 1018272)
LOCALITY N of Albany WA
LAT 35 Deg 0 Min 0.000 Sec S LONG 117 Deg 52 Min 0.000 Sec E
12-18 inches, erect. Flowers white. Swampy places.
Previous det.: Lysinema lasianthum R. Br.

Lysinema lasianthum
R.Br. (Epacridaceae)
CONSERVATION STATUS:P4
Coll.: Col. B.T. Goadby s.n. Date: 08 1900 (PERTH 1017802)
LOCALITY King George's Sound WA
LAT 35 Deg 0 Min Sec S LONG 117 Deg 52 Min Sec E

Lysinema lasianthum
R.Br. (Epacridaceae)
CONSERVATION STATUS:P4
Coll.: Col. Goadby s.n. Date: 08 1900 (PERTH 1018213)
LOCALITY King George's Sound WA
LAT 35 Deg 0 Min Sec S LONG 117 Deg 52 Min Sec E
B.2639.

Melaleuca diosmifolia
Andrews (Myrtaceae)
CONSERVATION STATUS:P3
Coll.: A. Cunningham 243.95 Date: 1818 (PERTH 01313312)
LOCALITY King George Sound WA
LAT 35 Deg 2 Min 0.000 Sec S LONG 117 Deg 53 Min Sec E
1st voyage of the Mermaid.

Microtis media
subsp. quadrata R.J.Bates (Orchidaceae)
CONSERVATION STATUS:P4
Coll.: P. Smith s.n. Date: 04 12 1959 (PERTH 00280828)
LOCALITY Spencer Park, Albany WA
LAT 35 Deg 1 Min Sec S LONG 117 Deg 53 Min Sec E
Previous det.: Microtis media R.Br. subsp. quadrata R.J.Bates

Microtis pulchella
R.Br. (Orchidaceae)
CONSERVATION STATUS:P4
Coll.: J. Tonkinson s.n. Date: 30 10 1960 (PERTH 333247)
LOCALITY Albany. WA
LAT 35 Deg 1 Min 0.000 Sec S LONG 117 Deg 53 Min 0.000 Sec E
Previous det.: Microtis pulchella

Microtis pulchella
R.Br. (Orchidaceae)
CONSERVATION STATUS:P4
Coll.: C. Andrews s.n. Date: 12 1902 (PERTH 298166)
LOCALITY 1.5 miles NW of Albany. WA
LAT 34 Deg 59 Min Sec S LONG 117 Deg 50 Min Sec E
Flowers white. Swamp.
Previous det.: Microtis gymnadenoides

Petrophile longifolia
R.Br. (Proteaceae)
CONSERVATION STATUS:P3
Coll.: Col. Goadby B 2374 Date: 10 1898 (PERTH 01767259)
LOCALITY King George Sound WA
LAT 35 Deg 1 Min Sec S LONG 117 Deg 53 Min Sec E
Previous det.: Petrophile longifolia R.Br.

Prasophyllum paulineae
D.L.Jones & M.A.Clem. (Orchidaceae)
CONSERVATION STATUS:P1
Coll.: M. Sherwood 853 Date: 22 10 1988 (PERTH 04514238)
LOCALITY R. Heberle's property, Frederick Street, Gledhow, WA
LAT 35 Deg 0 Min 59.000 Sec S LONG 117 Deg 49 Min 59.000 Sec E
20 cm plant with green flowers. Soil, sand. In association with Eucalyptus sp. and Agonis sp.
This specimen is housed at Albany.
Previous det.: Microtis sp.

Prasophyllum paulineae
D.L.Jones & M.A.Clem. (Orchidaceae)
CONSERVATION STATUS:P1 TYPE STATUS: ISO
Coll.: D.L. Jones & R. Heberle DLJ 12425 Date: 20 10 1993 (PERTH 05724015)
LOCALITY Cuthbert, near Albany, Darling district, WA
LAT 35 Deg 1 Min Sec S LONG 117 Deg 50 Min Sec E
Deciduous terrestrial orchid. Robust species; many flowered, subpyramidal spike. Flower pale green with purple to red suffusions.
Gentle slope. Black, peaty, alkaline soil; degraded swamp. Grasses and herbs.
Frequency:frequent.

Sphenotoma parviflora
F.Muell. (Epacridaceae)
CONSERVATION STATUS:P3
Coll.: M. Sherwood 364 Date: 16 11 1979 (PERTH 04359577)
LOCALITY Robinson Estate, WA
LAT 35 Deg 1 Min Sec S LONG 117 Deg 50 Min Sec E
40 cm high, with white flowers. Sandy soil. In association with Agonis sp. and Banksia sp.
This specimen is housed at Albany.
Previous det.: Sphenotoma parviflorum F.Muell.

Sphenotoma parviflora
F.Muell. (Epacridaceae)
CONSERVATION STATUS:P3
Coll.: C.H. Ostenfeld 912 Date: 20 10 1914 (PERTH 1163612)
LOCALITY Albany WA
LAT 35 Deg 1 Min 0.000 Sec S LONG 117 Deg 53 Min 0.000 Sec E
Previous det.: Dracophyllum parviflorum F. Muell.

Spyridium spadiceum
(Fenzl) Benth. (Rhamnaceae)

CONSERVATION STATUS:P2
Coll.: C.A. Gardner s.n. Date: 06 11 1927 (PERTH 01534947)
LOCALITY Summit of Mount Clarence, King George Sound WA
LAT 35 Deg 1 Min 42.000 Sec S LONG 117 Deg 53 Min 42.000 Sec E
Weak shrub, 1-2 ft. Flowers white. Thickets.

Spyridium spadiceum
(Fenzl) Benth. (Rhamnaceae)
CONSERVATION STATUS:P2
Coll.: C.A. Gardner s.n. Date: 06 11 1927 (PERTH 01534955)
LOCALITY Summit of Mount Clarence WA
LAT 35 Deg 1 Min 42.000 Sec S LONG 117 Deg 53 Min 42.000 Sec E
Weak bushy shrub, 1-2 ft. Flowers white.
Thickets.

Spyridium spadiceum
(Fenzl) Benth. (Rhamnaceae)
CONSERVATION STATUS:P2
Coll.: C.A. Gardner s.n. Date: 06 11 1927 (PERTH 01534939)
LOCALITY Summit of Mount Clarence, King George Sound WA
LAT 35 Deg 1 Min 42.000 Sec S LONG 117 Deg 53 Min 42.000 Sec E
Weak shrub, 1-2 ft. Flowers white. In sand.
Thickets.
Previous det.: Spyridium spadiceum (Fenzl) Benth.

Stylidium articulatum
R.Br. (Stylidiaceae)
CONSERVATION STATUS:P2
Coll.: Col. B.T. Goadby s.n. Date: 12 1901 (PERTH 1039733)
LOCALITY Rocky Shores, King George Sound, Albany WA
LAT 35 Deg 1 Min Sec S LONG 117 Deg 53 Min Sec E
Previous det.: Stylidium articulatum R.Br.

Stylidium plantagineum
Sond. (Stylidiaceae)
CONSERVATION STATUS:P4
Coll.: R. Erickson s.n. Date: 02 11 1954 (PERTH 1031694)
LOCALITY Albany WA
LAT 35 Deg 1 Min Sec S LONG 117 Deg 53 Min Sec E
In sandy soil. In Jarrah forrest.

Stylidium plantagineum
Sond. (Stylidiaceae)
CONSERVATION STATUS:P4
Coll.: R. Helms s.n. Date: 11 1896 (PERTH 1031708)
LOCALITY Albany WA
LAT 35 Deg 1 Min Sec S LONG 117 Deg 53 Min Sec E
Previous det.: Stylidium pilosum Labill.

Stylidium plantagineum
Sond. (Stylidiaceae)
CONSERVATION STATUS:P4
Coll.: A.S. George s.n. Date: 10 03 1970 (PERTH 03172937)
LOCALITY Mount Willyung, N of Albany WA
LAT 34 Deg 56 Min 42.000 Sec S LONG 117 Deg 50 Min 53.000 Sec E
Previous det.: Stylidium sp.

Stylidium plantagineum
Sond. (Stylidiaceae)
CONSERVATION STATUS:P4
Coll.: R. Helms s.n. Date: 12 1898 (PERTH 1031724)
LOCALITY Albany, King George's Sound WA
LAT 35 Deg 1 Min Sec S LONG 117 Deg 53 Min Sec E
Previous det.: Stylidium pilosum Labill.

Stylidium plantagineum
Sond. (Stylidiaceae)
CONSERVATION STATUS:P4
Coll.: M. Sherwood 341 Date: 08 12 1979 (PERTH 04548280)
LOCALITY Henry Street area, off Chester Pass Road, Albany, WA
LAT 34 Deg 59 Min 12.000 Sec S LONG 117 Deg 52 Min 47.000 Sec E
1 m plant with mauve-white flowers. Soil, sandy. In association with Eucalyptus sp.
This specimen is housed at Albany. ALB. 1048

Stylidium plantagineum
Sond. (Stylidiaceae)
CONSERVATION STATUS:P4
Coll.: M. Sherwood 582 Date: 12 11 1979 (PERTH 04548272)
LOCALITY Henry Street, off Chester Pass Road, Albany, WA
LAT 34 Deg 59 Min 12.000 Sec S LONG 117 Deg 52 Min 47.000 Sec E
1 m plant with pale pink flowers. Soil, sandy loam. In association with Eucalyptus sp. and Casuarina sp.
This specimen is housed at Albany. ALB. 2713

Synaphea preissii
Meisn. (Proteaceae)
CONSERVATION STATUS:P3
Coll.: R. McLaughlin 221 Date: 11 08 1997 (PERTH 05529808)
LOCALITY Mount Adelaide, S side in fire cell 3, Albany WA
LAT 35 Deg 1 Min 42.000 Sec S LONG 117 Deg 53 Min 42.000 Sec E
Perennial shrub to 0.2 m with yellow flowers.
On hill of brown loamy sand over granite/gneiss.
Dense coastal heath of shrubs less than 2 m high.
Previous det.: Synaphea obtusata (Meisn.) A.S.George
Frequency:occasional.

Thomasia discolor
Steud. (Sterculiaceae)
CONSERVATION STATUS:P3 TYPE STATUS: UNK
Coll.: L. Preiss 1658 Date: 30 09 1840 (PERTH 01751026)
LOCALITY William's-point, ditionis [district] Plantagenet [This locality is probably Mount Adelaide, Albany] WA
LAT 35 Deg 1 Min Sec S LONG 117 Deg 55 Min Sec E
In rupestribus sub umbrosis chasmatis clivuli [Rock-dwelling under shade {?} slopes].
Previous det.: Thomasia discolor Steudel

Thomasia discolor
Steud. (Sterculiaceae)
CONSERVATION STATUS:P3
Coll.: Goadby s.n. Date: (PERTH 1062379)
LOCALITY King George Sound WA
LAT 35 Deg 1 Min Sec S LONG 117 Deg 53 Min Sec E
Previous det.: Thomasia discolor Steud.

Thomasia discolor
Steud. (Sterculiaceae)
CONSERVATION STATUS:P3
Coll.: C. Andrews s.n. Date: (PERTH 1062816)
LOCALITY Middleton Beach, Albany WA
LAT 35 Deg 0 Min Sec S LONG 117 Deg 55 Min Sec E
Previous det.: Thomasia discolor Steud.

Thomasia discolor
Steud. (Sterculiaceae)
CONSERVATION STATUS:P3 TYPE STATUS: UNK
Coll.: L. Preiss 1658 Date: 30 09 1840 (PERTH 1149946)
LOCALITY William's-point, ditionis [district] Plantagenet [This locality is probably Mount Adelaide, Albany] WA
LAT 35 Deg 1 Min Sec S LONG 117 Deg 55 Min Sec E
In rupestribus sub umbrosis chasmatis clivuli [Rock-dwelling under shade {?} slopes].

Thomasia discolor
Steud. (Sterculiaceae)
CONSERVATION STATUS:P3
Coll.: E.J. Croxford 7541 Date: 13 10 1996 (PERTH 05664918)
LOCALITY Below Rotary Car Park Lookout, Marine Drive, Albany, WA
LAT 35 Deg 1 Min 42.000 Sec S LONG 117 Deg 54 Min 53.000 Sec E
Mauve-pink flowered large spreading shrub growing to 2m high. Soil a coastal grey sand over granite.
In association with Gastrolobium sp. and Agonis sp.
Frequency:plentiful in area.

Thomasia discolor
Steud. (Sterculiaceae)
CONSERVATION STATUS:P3
Coll.: Col. Goadby s.n. Date: 10 1898 (PERTH 1062794)
LOCALITY King George Sound WA
LAT 35 Deg 1 Min Sec S LONG 117 Deg 53 Min Sec E
Previous det.: Thomasia discolor Steud.

Thomasia discolor
Steud. (Sterculiaceae)
CONSERVATION STATUS:P3
Coll.: C. Andrews s.n. Date: (PERTH 1062786)
LOCALITY Middleton Beach, Albany WA
LAT 35 Deg 0 Min Sec S LONG 117 Deg 55 Min Sec E
Previous det.: Thomasia discolor Steud.

Thomasia discolor
Steud. (Sterculiaceae)
CONSERVATION STATUS:P3
Coll.: R. McLaughlin 252 Date: 15 09 1997 (PERTH 05664926)
LOCALITY On eastern side of Mount Adelaide in firecell 2, Albany, WA
LAT 35 Deg 1 Min 42.000 Sec S LONG 117 Deg 54 Min 53.000 Sec E
Perennial shrub growing to 1.5m and with purple flowers.
Associated with granite outcrops on hill of grey sand over granite/gneiss.
Vegetation dense coastal scrubland associated with granite outcrops.
Frequency:occasional.

Thomasia multiflora
E.Pritz. (Sterculiaceae)
CONSERVATION STATUS:P1
Coll.: Diels Dr. s.n. Date: (PERTH 1055682)
LOCALITY Albany. WA
LAT 35 Deg 1 Min 54.000 Sec S LONG 117 Deg 52 Min 48.000 Sec E
Previous det.: Thomasia pauciflora

Thomasia multiflora
E.Pritz. (Sterculiaceae)
CONSERVATION STATUS:P1 TYPE STATUS: ISO
Coll.: L. Diels 5528 Date: 16 11 1901 (PERTH 1011901)
LOCALITY S of Albany WA
LAT 35 Deg 1 Min 54.000 Sec S LONG 117 Deg 52 Min 48.000 Sec E
Previous det.: Thomasia multiflora E. Pritzel

Thomasia solanacea
(Sims) Gay (Sterculiaceae)
CONSERVATION STATUS:P3
Coll.: Dr Diels & Pritzel 499 Date: 11 1901 (PERTH 1132210)
LOCALITY Albany, Plantagenet District. WA
LAT 35 Deg 1 Min 0.000 Sec S LONG 117 Deg 53 Min 0.000 Sec E
Previous det.: Thomasia solanacea Gay

Thomasia solanacea
(Sims) Gay (Sterculiaceae)
CONSERVATION STATUS:P3
Coll.: Col. B.T. Goadby 2616 Date: (PERTH 1131826)
LOCALITY King George's Sound. WA
LAT 35 Deg 0 Min Sec S LONG 117 Deg 52 Min Sec E
Previous det.: Thomasia solanacea Gay

Thomasia solanacea
(Sims) Gay (Sterculiaceae)
CONSERVATION STATUS:P3
Coll.: J.A. Cochrane JAC 4352 Date: 15 12 2002 (PERTH 06242286)
LOCALITY Mount Adelaide, in bush near walk trails on seaward side, Albany WA
LAT 35 Deg 2 Min 2.000 Sec S LONG 117 Deg 55 Min 6.000 Sec E
Shrub spreading to 1.5 m tall and wide. Purple flowers with bracts drying off to brown.
Coastal slopes. Brown sand over granite.
Shrubland. Associated species: Spyridium globulosum, Hakea elliptica, Eucalyptus calophylla, Gastrolobium bilobum, sedges, Leucopogon sp.
Previous det.: Thomasia solanacea (Sims) Gay
Frequency:50+ plants.

Thomasia solanacea
(Sims) Gay (Sterculiaceae)
CONSERVATION STATUS:P3
Coll.: W.V. Fitzgerald s.n. Date: 06 1903 (PERTH 1132288)
LOCALITY Albany WA
LAT 35 Deg 1 Min 0.000 Sec S LONG 117 Deg 53 Min 0.000 Sec E
Previous det.: Thomasia solanacea Gay

Thomasia solanacea
(Sims) Gay (Sterculiaceae)
CONSERVATION STATUS:P3
Coll.: Col. B.T. Goadby 119 Date: 10 1898 (PERTH 1132229)
LOCALITY King George's Sound. WA

LAT 35 Deg 0 Min Sec S LONG 117 Deg 52 Min Sec E
Previous det.: Thomasia solanacea Gay

Thysanotus isantherus
R.Br. (Anthericaceae)
CONSERVATION STATUS:P3
Coll.: P. Foreman 224 Date: 29 10 2000 (PERTH 06102891)
LOCALITY Mount Melville, Albany WA
LAT 35 Deg 1 Min 0.000 Sec S LONG 117 Deg 53 Min 0.000 Sec E
Caespitose perennial herb to 8cm in height, with tuberous root, filiform leaves, 1 to 5 flowered umbels and purple flowers.
West facing hillside with burnt bare brown gravelly loam over granite.
New growth of low heath with Tetraria octandra, Stypandra glauca and Opercularia hispidula.
Frequency:occasional.

Thysanotus isantherus
R.Br. (Anthericaceae)
CONSERVATION STATUS:P3 TYPE STATUS: NEO *
Coll.: N.H. Brittan 77/09 Date: 24 11 1977 (PERTH 1011391)
LOCALITY Near summit of Mount Melville, Albany WA
LAT 35 Deg 1 Min Sec S LONG 117 Deg 53 Min Sec E
On granite. In moss swards.
Previous det.: Thysanotus isantherus R. Br.

Thysanotus isantherus
R.Br. (Anthericaceae)
CONSERVATION STATUS:P3
Coll.: G.J. Keighery 905 Date: 10 11 1976 (PERTH 1053523)
LOCALITY Mount Clarence slopes, Albany WA
LAT 35 Deg 1 Min 42.000 Sec S LONG 117 Deg 53 Min 42.000 Sec E
Perennial herb, flowers purple. Shallow soil over granite.
Previous det.: Thysanotus isantherus R. Br.
Frequency:rare.

Thysanotus isantherus
R.Br. (Anthericaceae)
CONSERVATION STATUS:P3
Coll.: N.H. Brittan 53/20 Date: 28 10 1953 (PERTH 02981041)
LOCALITY N summit Mount Clarence WA
LAT 35 Deg 1 Min 42.000 Sec S LONG 117 Deg 53 Min 41.000 Sec E
In thin humus layer over granite. Low grass etc vegetation.
Previous det.: Thysanotus sp.

Thysanotus isantherus
R.Br. (Anthericaceae)
CONSERVATION STATUS:P3
Coll.: Col. Goadby B 2049 Date: 11 1900 (PERTH 1011421)
LOCALITY King George's Sound. WA
LAT 35 Deg 0 Min Sec S LONG 117 Deg 52 Min Sec E
Previous det.: Thysanotus isantherus R. Br.

Thysanotus isantherus
R.Br. (Anthericaceae)
CONSERVATION STATUS:P3
Coll.: N.H. Brittan 77/09 Date: 24 11 1977 (PERTH 06238858)
LOCALITY Mount Melville WA
LAT 35 Deg 1 Min Sec S LONG 117 Deg 52 Min Sec E
In fruit. In moss sward with Borya.

Thysanotus isantherus
R.Br. (Anthericaceae)
CONSERVATION STATUS:P3
Coll.: K. Baker 77 Date: 17 09 2001 (PERTH 06099769)
LOCALITY Apex Drive carpark, Albany, about 20m down slope below toilet block WA
LAT 35 Deg 1 Min 26.600 Sec S LONG 117 Deg 53 Min 56.500 Sec E
Herb 0.1m high by 0.1m wide. Hillside reserve, burnt Dec.2000 in brown loam.
Medium trees of Corymbia calophylla, Agonis marginata, Gastrolobium bilobium, Calytrix acutifolia, Xanthorroea preissii.
Frequency:over 50 plants.

Usnea pulvinata
Fr. (Usneaceae)
CONSERVATION STATUS:P1
Coll.: R.J. Cranfield 20519 Date: 30 08 2004 (PERTH 07030576)
LOCALITY Willyung Hill (summit) WA
LAT 34 Deg 57 Min Sec S LONG 117 Deg 51 Min Sec E
Lichen. Thallus erect, dry yellow/green. Growth phase: active.
Outcrop. Open to closed aspect. Outcrop. Quarry on one face. Bare, moist brown
shallow clay-loam. Granite 70% of area. Litter or organic mats, rocks sheets,
stones, overhangs crevasse. Logs burnt unburnt decaying. Shrubs alive-dead.
Exposed-shletered, wet bark (alive/dead). Ground level 0-30 cm - shrub layer (31cm-3m).
Heath-woodland, Floristic richness 51-100. Life form density classes (LFDC) 3-4. Horizontal View Distance (HVD) 100+ m.

DEPARTMENT OF ENVIRONMENT AND CONSERVATION
DECLARED RARE AND PRIORITY FLORA LIST
26 February 2008

SPECIES / TAXON	CONS CODE	CALM REGION	DISTRIBUTION	FLOWER PERIOD
Acacia ataxiphylla subsp. ataxiphylla	3	SC,WB	Albany, Cranbrook, Jingalup, Kojonup, Chillerup, Bokal	Dec
Acacia prismifolia	X	SC	Albany, Stirling Range N.P.	Sep
Adenanthos cunninghamii x	4	SC	Albany	Mar,Sep-Oct
Amperea protensa	3	WA,SR,SC	Walpole, Scott River, Albany, Gardner Lake	Jan
Andersonia jamesii	1	SC,WA	Narrikup, Sheepwash, Albany, Porongurup	Jun,Jul
Andersonia setifolia	3	SC,WB	Manypeaks, Gordon River, Albany, Two Peoples Bay, Ongerup	Jul-Aug
Anthotium junciforme	4	SR,SW,SC	Wattle Grove, Midland, Bayswater, Serpentine, Upper Swan, Kenwick, Busselton, Scott River Plain, Albany	Dec-Mar
Asplenium obtusatum subsp. northlandicum	R	SC,WA,*	Albany-Walpole, Chatham Is.	Oct
Astartea arbuscula ms	4	SC,WA	Albany, D'Entrecasteaux, Wilson Inlet, Mt Frankland, Mt Romance, Kordabup	Jan-Dec
Asterolasia sp. Kalgan River (S Barrett 1522)	1	SC	Kalgan River, Albany	Aug
Astroloma sp. Grass Patch (AJG Wilson 110)	2	SC	Grass Patch, Cascade, Albany	May-Sep
Austrofestuca littoralis	1	WA,SC	Warren Beach, Albany	
Banksia brownii	R	SC	Albany-Stirling Range	Jan-Jul
Banksia goodii	R	SC	Albany, Narricup, Redmond	Nov-Dec
Banksia verticillata	R	SC,WA	Albany-Walpole	Jan-Apr
Boronia crassipes	3	SC	Albany, Millbrook	Aug-Dec
Caladenia harringtoniae	R	SC,SR,WA	Nannup-Albany, Lake Muir	Oct-Nov
Calectasia cyanea	R	SC	Albany	Aug-Dec
Chordifex isomorphus	4	SR,SC	Scott River, Waychinicup, Kaloorup, Stirling Range, Albany	Feb-Apr
Chordifex leucoblepharus	2	SC	NE of Albany, Stirling Range area, Wellstead	Oct
Chorizema reticulatum	3	SC,WA,SR	Albany, Mt Barker, Porongurups, Manypeaks, Denbarker, Denmark, Cowaramup, Meelup-Eagle Bay	
Conospermum quadripetalum	2	SR,SC	Scott River, Albany, Torndirrup	Nov
Corybas limpidus	4	SC,WA	Albany-Broke Inlet, Stirling Range, Ledge Point	Sep-Oct
Diuris heberlei	2	SC,WA,SR	Lake Seppings, Albany, Two Peoples Bay, D'Entrecasteaux, Scott Plains	Sep
Dodonaea trifida	3	SC	Albany to Munglinup, Bandalup Hill	-
Drakaea elastica	R	SR,SW,MW,SC	Gingin-Busselton, Lake Guraga, East of Albany, Narrikup, Gull Rock NP	Oct-Nov
Drakaea micrantha	R	SC,SR,WA,SW	Perth-Augusta-Albany, Denmark, Margaret River	Sep-Oct
Drosera fimbriata	4	SC,WA,SR	NE of Manypeaks, Lake William, Albany, Leeuwin Naturaliste NP	Oct
Eucalyptus buprestium x staeri	4	SC	N of Albany	-
Gonocarpus pusillus	3	SR,WA,SC	Albany, Walpole-Nornalup, Mt Frankland, Augusta, Scott River, Yelverton, Scotsdale	Nov-Dec

DEPARTMENT OF ENVIRONMENT AND CONSERVATION
DECLARED RARE AND PRIORITY FLORA LIST
26 February 2008

SPECIES / TAXON	CONS CODE	CALM REGION	DISTRIBUTION	FLOWER PERIOD
Goodenia filiformis	3	SC	Millbrook, Albany, Hassel Hwy, Gingilup Swamp	Oct-Feb
Goodenia sp. South Coast (AR Annels 1846)	3	SC,WA	Albany, Nanarup, Porongurup NP, Kentdale, Mt Lindsay	Jul-Jan
Isopogon uncinatus	R	SC	Albany	
Juncus meianthus	2	WA,SC	West Cape Howe, Porongurup NP, Nornalup, Albany	Nov,Jan
Laxmannia jamesii	4	SC,WA,SR	Albany-Mt Barker, Narrikup, Denmark, Busselton, Yelverton	May-Jul
Lepidium pseudotasmanicum	4	SW,WB,SC,WA	Yanchep, Wongan Hills, Denmark, Albany, Porongurup R, Jerramungup, Munglinup, Stirling Range, Lake Clifton	
Leucopogon bracteolaris	2	SC	Stirling Range N.P., Albany	Jan-May
Leucopogon rotundifolius	3	SC	Albany, Lucky Bay, Recherche Archipelago, Cape Le Grand NP, Mt Ragged, Esperance	Nov-Jan
Lysinema lasianthum	4	SC,WA	Porongurup Range, Albany, Collis Block, Millbrook, Nornalup, Cheyne Beach, West Cape Howe	July-Sep,Jan
Melaleuca diosmifolia	3	SC,WA	Albany, Bald Island, Two Peoples Bay, D'Entrecasteaux, Broke Inlet	Sep,Oct
Meziella trifida	R	SR,WA,(SC)	Scott River Plains, Pingerup Plains, Black Pt Road, Mt Roe, (Albany), D'Entrecasteaux NP, Northcliffe, Windy Harbour	Oct
Microtis globula	R	SC,WA	Walpole-Albany	Dec-Jan
Microtis media subsp. quadrata	4	SC,WA,SR,SW	Albany-Augusta, Pinjarra, Jandakot, Varley	Dec-Jan
Microtis pulchella	4	WA,SC	Northcliffe, Walpole, Albany, Donnelly River	Nov-Dec
Petrophile longifolia	3	SC	Stirling Range, Mt Willyung, Cheyne Beach, Albany, Porongurup	Aug-Nov
Pilostyles collina	4	SC	Fitzgerald peaks, Albany, Bluff Knoll	Jab-Mar
Pleurophascum occidentale	4	SC,WA	Two Peoples Bay, N of Albany, Cape Le Grand NP, Hay River, Walpole, Mt Lindesay, Gull Rock, Mt Frankland NP, Granite Hill NR	-
Prasophyllum paulineae	1	SC	Albany	Sep-Nov
Sphaerolobium pubescens	3	WA,SC	Walpole, Albany, Mt Lindsay, Ledge Beach	Oct-Nov
Sphenotoma parviflora	3	SC,SR,WA	Albany, Millbrook, Scott River, Esperance, Mt Lindesay	-
Spyridium spadiceum	2	SC	Porongurup Range, Albany	Oct-Feb
Stylidium articulatum	2	SC	Albany, Mermaid Point	Dec
Stylidium lepidum	3	WB,SC	Wagin, Albany, Kojonup, Mt Barker	Sep-Nov
Stylidium plantagineum	4	SC	Between Stirling Range, Albany and Two Peoples Bay	Nov-Dec
Synaphea incurva	1	SC	Albany, Denmark, Cheyne Beach	Sep-Oct
Synaphea preissii	3	WB,SC,WA	Torndirrup NP, Albany, Mt Barker, Stirling Range NP, Gnowangerup, Narrikup, Rocky Gully	Aug-Sep
Thomasia discolor	3	SC	Albany area	Oct-Nov
Thomasia multiflora	1	SC	Albany, Warriup Hill	Oct
Thomasia purpurea x solanacea	1	SC	Albany	Nov-Dec

DEPARTMENT OF ENVIRONMENT AND CONSERVATION
DECLARED RARE AND PRIORITY FLORA LIST
26 February 2008

SPECIES / TAXON	CONS CODE	CALM REGION	DISTRIBUTION	FLOWER PERIOD
Thomasia quercifolia	2	SC,WA	Albany, Torndirrup NP, Walpole, Denmark	
Thomasia solanacea	3	SC	Albany, Two Peoples Bay, Cape Riche, Stirling Range	Jun
Thysanotus isantherus	3	SC	Mt Melville, Mt Clarence, Torndirrup NPk, Albany	Nov
Tribonanthes purpurea	R	WB,SW,SC	Pingaring, Hillman T/S, Mt Dale, Albany	Aug
Verticordia fimbrilepis subsp. australis	R	SC,WA	Kent River, Albany	
Xanthorrhoea brevistyla	4	WB,SC	Narrogin, Albany	Oct-Nov

Appendix 5 – Test Pit Locations Map/Soil Profile Description

SCALE AND LEGEND

Legend

Albany Cadastre

	BY	CHKD BY	DATE
DESIGN			
DRAWN			
APPROVED			2/10/08

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Client: Dykstra Planning

OPUS

Albany Office

PO Box 8236
Albany 1142, Auckland

Tel: +64 9 8420 000
Fax: +64 9 8420 000

Title: Actual Test Pit Locations

Test Pits on Lots 30, 31 and 35
Catalina Road

DRAWING STATUS	FILE
SCALE 1:3,500	PLOT DATE Plotted on 22. May. 2008

ALBANY SOIL AND CONCRETE TESTING

39 Hill St, Albany. W.A. 6330
Phone/Fax: 08 98415309 Mobile: 0427 277797
Email: albsoil@omninet.net.au
A.B.N. : 65 229 884 872

REF: 11630

CLIENT: OPUS INTERNATIONAL

PROJECT: LOTS 30, 31 & 35 CATALINA RD

DATE TESTED: 12-05-08 TESTED BY: SCOTT DRAKE-BROCKMAN

APPROVED BY: COLIN GOUGH SIGNATURE:

SITE INVESTIGATION

LOT 35

LOC 1	0- 150mm	DARK GREY SAND WITH SILT (TOPSOIL). MOIST
	150- 600mm	DARK BROWN SANDY GRAVEL WITH SILT. MOIST
	600-1200mm	LIGHT BROWN SILTY CLAY. MOIST
	1200-2000mm	RED/GREY SILTY CLAY. MOIST
		WATER TABLE NOT REACHED
LOC 2	0- 200mm	DARK GREY SAND WITH SILT (TOPSOIL). MOIST
	200- 500mm	BROWN SANDY GRAVEL. MOIST
	500-1500mm	BROWN SILTY SAND MINOR CLAY. MOIST
	1500-2000mm	BROWN SILTY CLAYEY SAND WITH GRAVEL. MOIST
		WATER TABLE NOT REACHED
LOC 3	0- 100mm	DARK GREY SAND WITH SILT (TOPSOIL). MOIST
	100- 700mm	DARK BROWN SANDY GRAVEL WITH SILT. MOIST
	700-1500mm	LIGHT BROWN SILTY CLAY. MOIST
	1500-2000mm	RED/GREY SILTY CLAY WITH MINOR GRAVEL. MOIST
		WATER TABLE NOT REACHED
LOC 4	0- 100mm	DARK GREY SAND WITH SILT (TOPSOIL). MOIST
	100- 750mm	DARK BROWN SANDY GRAVEL WITH SILT. MOIST
	750-1300mm	LIGHT BROWN SILTY CLAY. MOIST
	1300-2000mm	RED/GREY SILTY CLAY
		WATER TABLE NOT REACHED
LOC 5	0- 100mm	DARK GREY SAND WITH SILT (TOPSOIL). MOIST
	100- 750mm	DARK BROWN SANDY GRAVEL WITH SILT. MOIST
	750-1200mm	LIGHT BROWN SILTY CLAY. MOIST
	1200-2000mm	GREY/BROWN SILTY CLAY. MOIST
		WATER TABLE NOT REACHED
LOC 6	0- 100mm	DARK GREY SAND WITH SILT (TOPSOIL). MOIST
	100- 900mm	DARK BROWN SANDY GRAVEL. MOIST
	900-1300mm	LIGHT BROWN SILTY CLAY. MOIST
	1300-2000mm	RED/GREY SILTY CLAY. MOIST
		WATER TABLE NOT REACHED

LOT 30

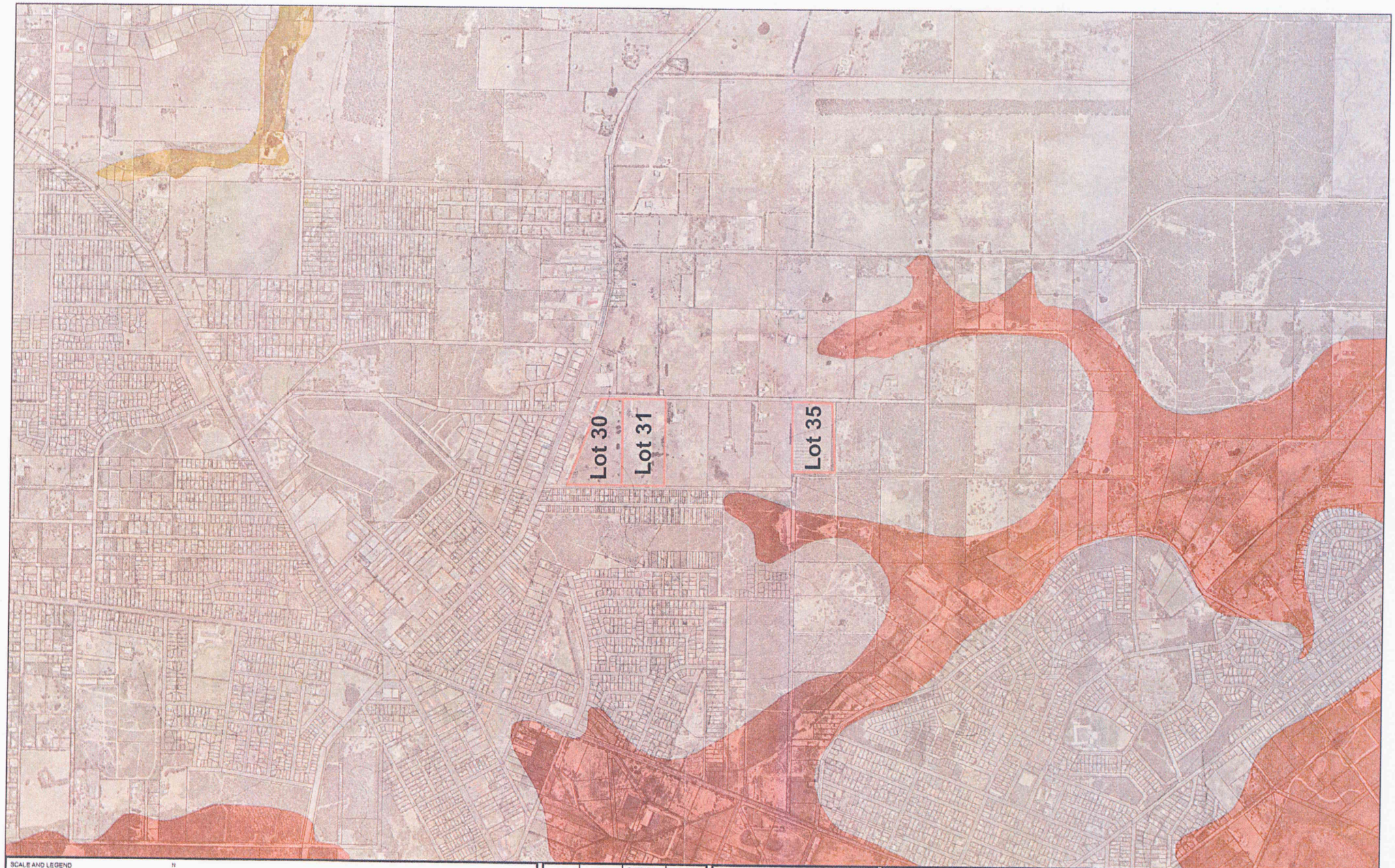
LOC 7	0- 150mm	DARK GREY SAND WITH SILT (TOPSOIL). MOIST
	150- 400mm	DARK GREY SAND WITH SILT. MOIST
	400- 700mm	DARK BROWN GRAVELLY SAND WITH SILT. MOIST
	700-1200mm	BROWN SANDY GRAVEL WITH SILT. DRY
	1200-1800mm	BROWN SANDY CLAY MINOR GRAVEL. MOIST
	1800-2000mm	RED/GREY SILTY CLAY. MOIST
		WATER TABLE NOT REACHED
LOC 8	0- 150mm	DARK GREY SAND WITH SILT (TOPSOIL). MOIST
	150- 400mm	GREY SAND WITH SILT. MOIST
	400- 800mm	DARK BROWN GRAVELLY SAND WITH SILT (CEMENTED). MOIST
	800-1800mm	BROWN SILTY SAND MINOR CLAY. MOIST
	1800-2000mm	BROWN/ORANGE SILTY CLAY. MOIST
		WATER TABLE NOT REACHED

LOC 9	0- 150mm	DARK GREY SAND WITH SILT (TOPSOIL). MOIST
	150- 900mm	BROWN SANDY GRAVEL WITH SILT. MOIST
	900-1200mm	LIGHT BROWN SILTY CLAY. MOIST
	1200-2000mm	RED/GREY SILTY CLAY. MOIST
		WATER TABLE NOT REACHED
LOC 10	0- 200mm	DARK GREY SAND WITH SILT (TOPSOIL). MOIST
	200- 700mm	LIGHT GREY SAND WITH SILT. MOIST
	700- 900mm	LIGHT BROWN CLAYEY SANDY GRAVEL. MOIST
	900-1600mm	LIGHT BROWN/ORANGE SILTY CLAY. MOIST
	1600-2000mm	LIGHT BROWN/ORANGE SILTY CLAY. MOIST
		WATER TABLE NOT REACHED
LOC 11	0- 50mm	DARK GREY SAND WITH SILT (TOPSOIL). MOIST
	50- 900mm	LIGHT BROWN SILTY CLAY. MOIST
	900-1600mm	BROWN/GREY SILTY CLAY. MOIST
	1600-2000mm	RED SILTY CLAY. MOIST
		WATER TABLE NOT REACHED

LOT 31

LOC 12	0- 100mm	DARK GREY AND WITH SILT (TOPSOIL). MOIST
	100- 500mm	LIGHT GREY SAND WITH SILT. MOIST
	500-1200mm	BROWN SANDY GRAVEL WITH SILT. MOIST
	1200-2000mm	LIGHT BROWN SILTY CLAY. MOIST
		WATER TABLE NOT REACHED
LOC 13	0- 100mm	DARK GREY SAND WITH SILT (TOPSOIL). MOIST
	100- 400mm	BROWN SILTY ANDY GRAVEL. MOIST
	400-1500mm	BROWN SILTY CLAY. MOIST
	1500-2000mm	GREY/BROWN SILTY CLAY. MOIST
		WATER TABLE NOT REACHED
LOC 14	0- 100mm	DARK GREY SAND WITH SILT (TOPSOIL). MOIST
	100- 300mm	DARK GREY SAND WITH SILT. MOIST
	300- 700mm	LIGHT GREY SAND WITH SILT. MOIST
	700- 900mm	BROWN CLAYEY SAND. MOIST
	900-1300mm	BROWN SILTY CLAY. MOIST
	1300-1900mm	LIGHT GREY/BROWN SILTY CLAY. MOIST
	1900-2000mm	RED/BROWN SILTY CLAY. MOIST
		WATER TABLE NOT REACHED
LOC 15	0- 100mm	DARK GREY SAND WITH SILT (TOPSOIL). MOIST
	100-2000mm	LIGHT GREY SAND WITH SILT. MOIST
		WATER TABLE NOT REACHED
LOC 16	0- 100mm	DARK GREY SAND WITH SILT (TOPSOIL). MOIST
	100-2000mm	LIGHT GREY SAND WITH SILT. MOIST
		WATER TABLE MOT REACHED
LOC 17	0- 100mm	DARK GREY SAND WITH SILT (TOPSOIL). MOIST
	100-1500mm	GREY/LIGHT GREY SAND WITH SILT. MOIST
	1500-1600mm	BLACK SILTY SAND (CEMENTED). MOIST
	1600-2000mm	LIGHT GREY/LIGHT BROWN SILTY CLAY. MOIST
		WATER TABLE NOT REACHED
LOC 18	0- 100mm	DARK GREY SAND WITH SILT (TOPSOIL). MOIST
	100- 300mm	GREY SAND WITH SILT. MOIST
	300- 500mm	DARK BROWN SAND WITH SILT. MOIST
	500-1000mm	CREAM SAND WITH SILT. MOIST
	1000-1100mm	BROWN SANDY GRAVEL WITH SILT. MOIST
	1100-1500mm	LIGHT BROWN SILTY CLAY. MOIST
	1500-2000mm	LIGHT GREY/BROWN SILTY CLAY. MOIST
		WATER TABLE NOT REACHED

Appendix 6 – Acid Sulphate Soils (ASS) Map



SCALE AND LEGEND

N W E S

0 170 340 680 1,020 1,360

Meters

1 centimeter equals 164.218919 meters

Legend

- High Risk of AASS & PASS
- Moderate to Low Risk of AASS & PASS
- Low to No Risk of AASS & PASS

	BY	CHECKED	DATE
DESIGN			
DRAWN	S. Glassborow		22/05/2008
APPROVED			2/6/08

Dykstra Planning

Albany Office
PO Box 5236
Albany, WA 6330, Australia
Tel: +61 8 9842 8156
Fax: +61 8 9842 6055

TITLE

Lot 30, 31 and 35 Catalina Road

Acid Sulphate Soil Risk SMap

STATUS	FILE
Final	WAENV078
SCALE	PLOT DATE
1:16,422	22 MAY 2008

Appendix 7 – Cultural Significant sites

arch Criteria

e 24418

claimer

original sites exist that are not recorded on the Register of Aboriginal Sites, and some registered sites may no longer exist. Consultation with Aboriginal communities is on-going to identify additional sites. The AHA tects all Aboriginal sites in Western Australia whether or not they are registered.

pyright

gend

striction

- No restriction
- Male access only
- Female access

Access

C	Closed
O	Open
V	Vulnerable

Status

L	Lodged
I	Insufficient Information
P	Permanent register
S	Stored data

Coordinate Accuracy

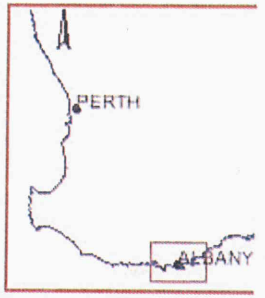
Accuracy is shown as a code in brackets following the site coordinates.

[Reliable]	The spatial information recorded in the site file is deemed to be reliable, due to methods of capture.
[Unreliable]	The spatial information recorded in the site file is deemed to be unreliable due to errors of spatial data capture and/or quality of spatial information reported.

atial Accuracy

lex coordinates are indicative locations and may not necessarily represent the centre of sites, especially for sites with an access code "closed" or "vulnerable". Map coordinates (Lat/Long) and (Easting/Northing) are sed on the GDA 94 datum. The Easting / Northing map grid can be across one or more zones. The zone is indicated for each Easting on the map, i.e. '5000000:Z50' means Easting=5000000, Zone=50.

e ID	Status	Access	Restriction	Site Name	Site Type	Additional Info	Informants	Coordinates	Site
418	L	O	N	Yakamia Creek	Mythological, Historical	Natural Feature, Water Source, [Other: Path of migration between a chain of historical]	*Registered Informant names available from DIA.	582591mE 6126976mN Zone 50 [Reliable]	



Legend

- Highlighted Area
- Town
- Map Area
- Search Area

Appendix 8 – Existing Services Plan

1:2000 A1

GRAPHIC SCALES

AMENDMENT	APP'D	DATE
RA Issued for service locations		

	BY	CHECKED	DATE
DESIGN	J. Gray		05/08
DRAWN	J. Gray		05/08
APPROVED			

DYKSTRA PLANNING

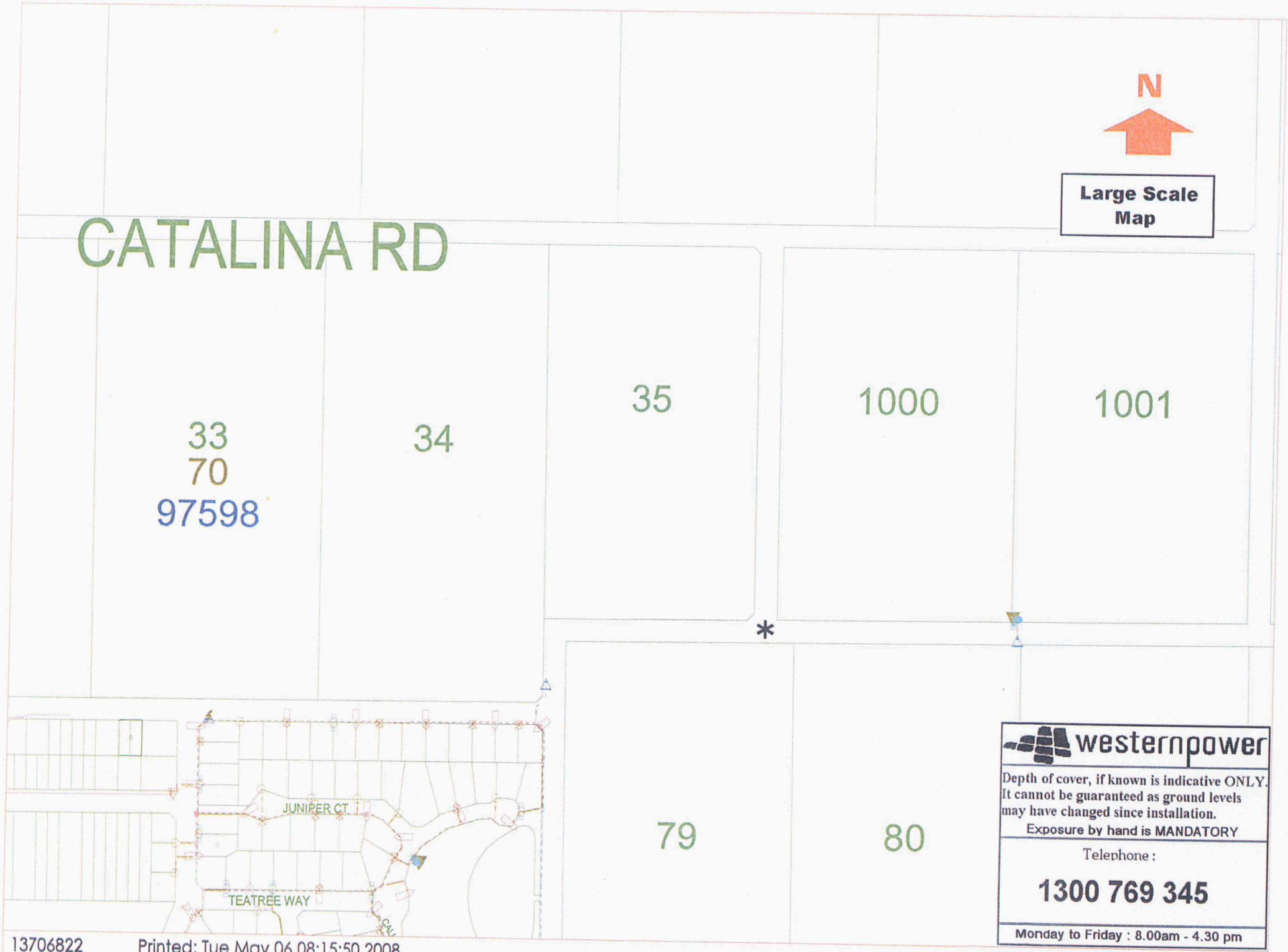
OPUS INTERNATIONAL CONSULTANTS
Albany Office
PO Box 5336
Albany, Western Australia 6331
Tel: +61 8 9842 6155
Fax: +61 8 9842 6055

TITLE: DYKSTRA PLANNING
LOTS 30, 31 & 35 CATALINA ROAD - ALBANY
PRELIMINARY ENVIRONMENTAL ASSESMENT

EXISTING SERVICES PLAN - WATER & SEWER

STATUS	SCALE	PLOT DATE	FILE	CODE	SHEET	REVISION
PRELIMINARY	1:2000 A1 1:4000 A3	13/05/08 @ 14:48	WAENV078 FEATURE IDENTIFIER 13/5037/1	52075	1	A

g:\environmental services\environmental projects\waenv078 lot 35 catalina env & geo investigation\acad\13_5037_1_52075_1-4_ra.dwg - 1 ORIGINAL SHEET SIZE A1 [841x594]



13706822_ Printed: Tue May 06 08:15:50 2008
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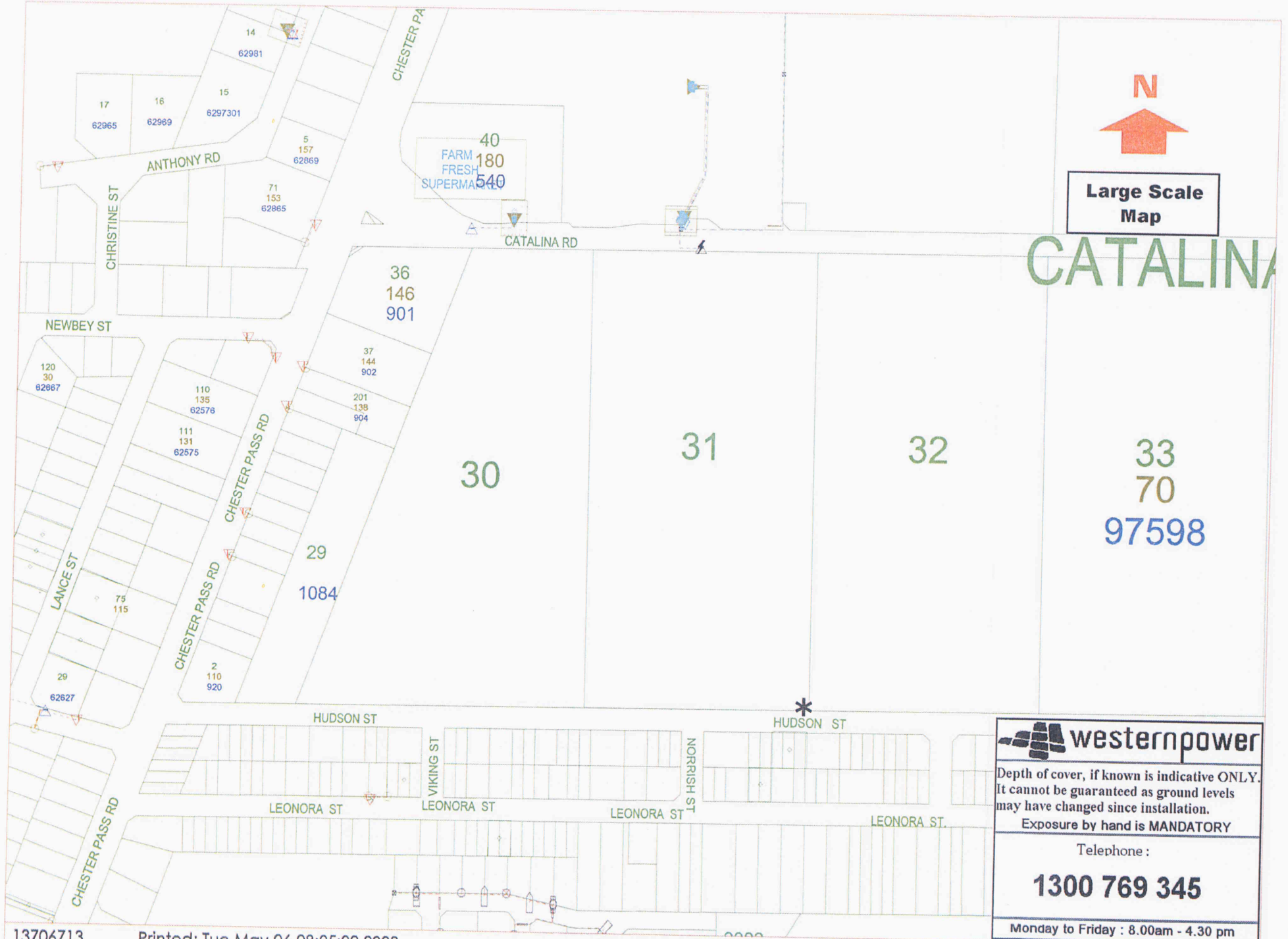
User: edmelvi



13706713_ Printed: Tue May 06 08:25:02 2008
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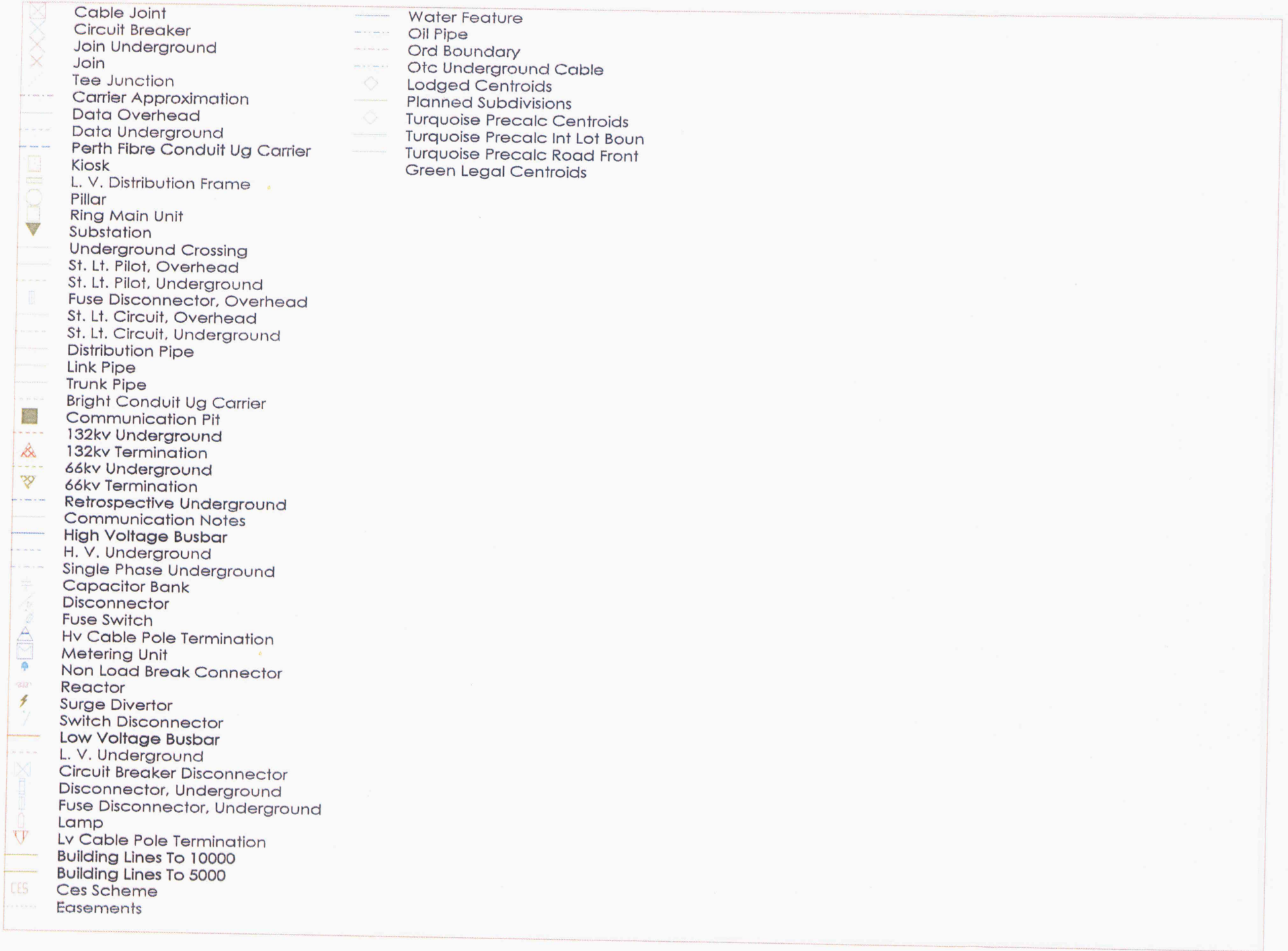
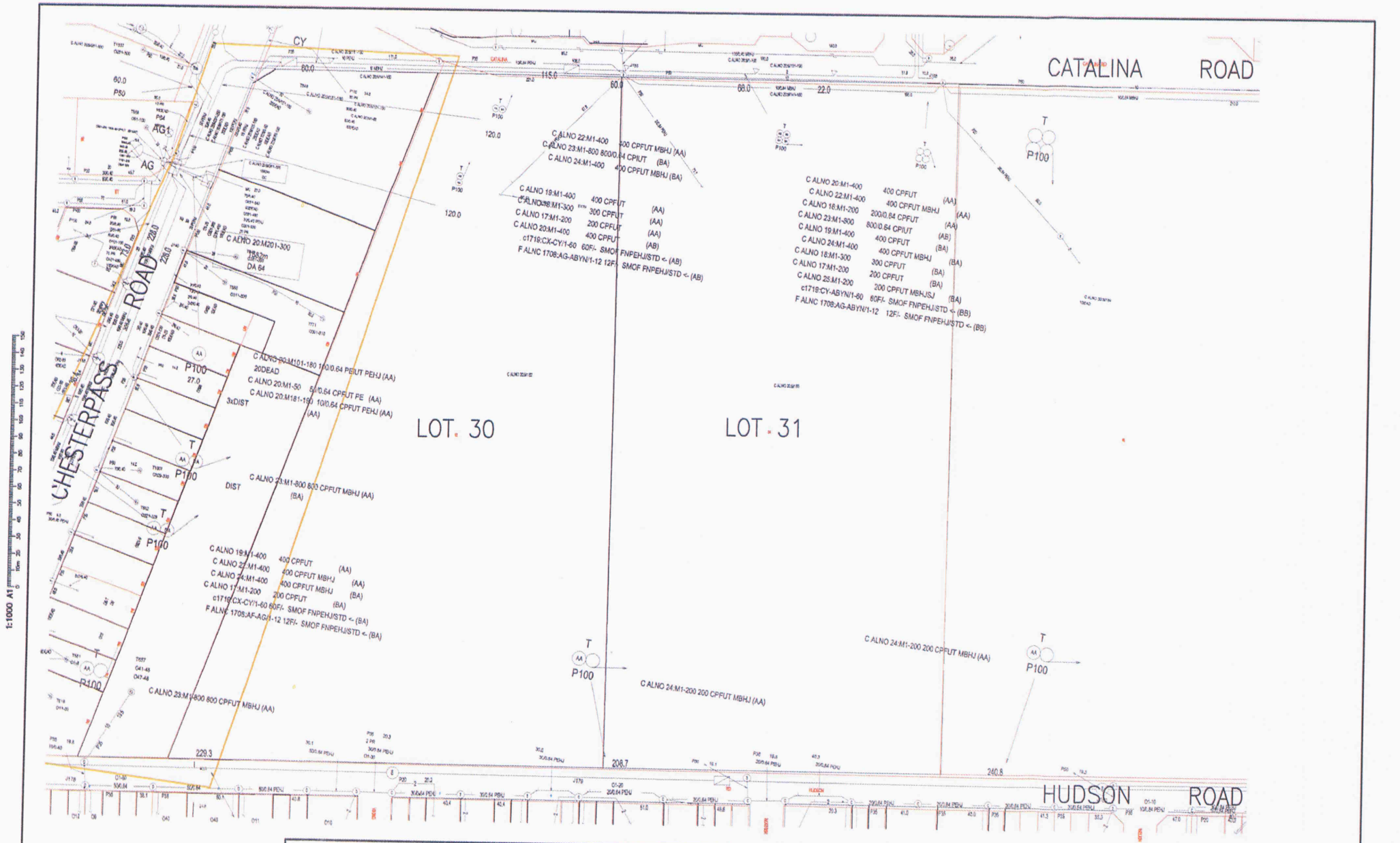
User: edmelvi


Cable Joint
Circuit Breaker
Join Underground
Join
Tee Junction
Carrier Approximation
Data Overhead
Data Underground
Perth Fibre Conduit Ug Carrier
Kiosk
L. V. Distribution Frame
Pillar
Ring Main Unit
Substation
Underground Crossing
St. Lt. Pilot, Overhead
St. Lt. Pilot, Underground
Fuse Disconnector, Overhead
St. Lt. Circuit, Overhead
St. Lt. Circuit, Underground
Distribution Pipe
Link Pipe
Trunk Pipe
Bright Conduit Ug Carrier
Communication Pit
132kv Underground
132kv Termination
66kv Underground
66kv Termination
Retrospective Underground
Communication Notes
High Voltage Busbar
H. V. Underground
Single Phase Underground
Capacitor Bank
Disconnector
Fuse Switch
Hv Cable Pole Termination
Metering Unit
Non Load Break Connector
Reactor
Surge Divertor
Switch Disconnector
Low Voltage Busbar
L. V. Underground
Circuit Breaker Disconnector
Disconnector, Underground
Fuse Disconnector, Underground
Lamp
Lv Cable Pole Termination
Building Lines To 10000
Building Lines To 5000
CES
Ces Scheme
Easements
Water Feature
Oil Pipe
Ord Boundary
Otc Underground Cable
Lodged Centroids
Planned Subdivisions
Turquoise Precalc Centroids
Turquoise Precalc Int Lot Boun
Turquoise Precalc Road Front
Green Legal Centroids



	BY	CHECKED	DATE
DESIGN	J. Gray		05/08
DRAWN	J. Gray		05/08
APPROVED			

RA Issued for service locations

AMENDMENT | APP'D | DATE

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DYKSTRA PLANNING

Albany Office
PO Box 5236
Albany, Western Australia 6331
Tel: +61 8 9842 6155
Fax: +61 8 9842 6055

TITLE: DYKSTRA PLANNING
LOTS 30, 31 & 35 CATALINA ROAD – ALBANY
PRELIMINARY ENVIRONMENTAL ASSESMENT

EXISTING SERVICES PLAN – TELSTRA. LOTS 30 & 31

STATUS		FILE	
PRELIMINARY			WAENV078

SCALE	PLOT DATE	FEATURE IDENTIFIER	CODE	SHEET	REVISION
1:1000 A1 1:2000 A3	13/05/08 @ 14:48	13/5037/1	52075	3	A

GRAPHIC SCALES

g:\environmental services\environmental projects\waenv078 lot 35 catalina env & geo investigation\acad\13_5037_1_52075_1-4_ra.dwg - 3 ORIGINAL SHEET SIZE A1 [840x594]

	BY	CHECKED	DATE
DESIGN	J. Gray		05/08
DRAWN	J. Gray		05/08
APPROVED			

RA Issued for service locations

AMENDMENT | APP'D | DATE

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DYKSTRA PLANNING

Albany Office
PO Box 5236
Albany, Western Australia 6331
Tel: +61 8 9842 6155
Fax: +61 8 9842 6055

TITLE: DYKSTRA PLANNING
LOTS 30, 31 & 35 CATALINA ROAD – ALBANY
PRELIMINARY ENVIRONMENTAL ASSESMENT

EXISTING SERVICES PLAN – TELSTRA. LOT 35

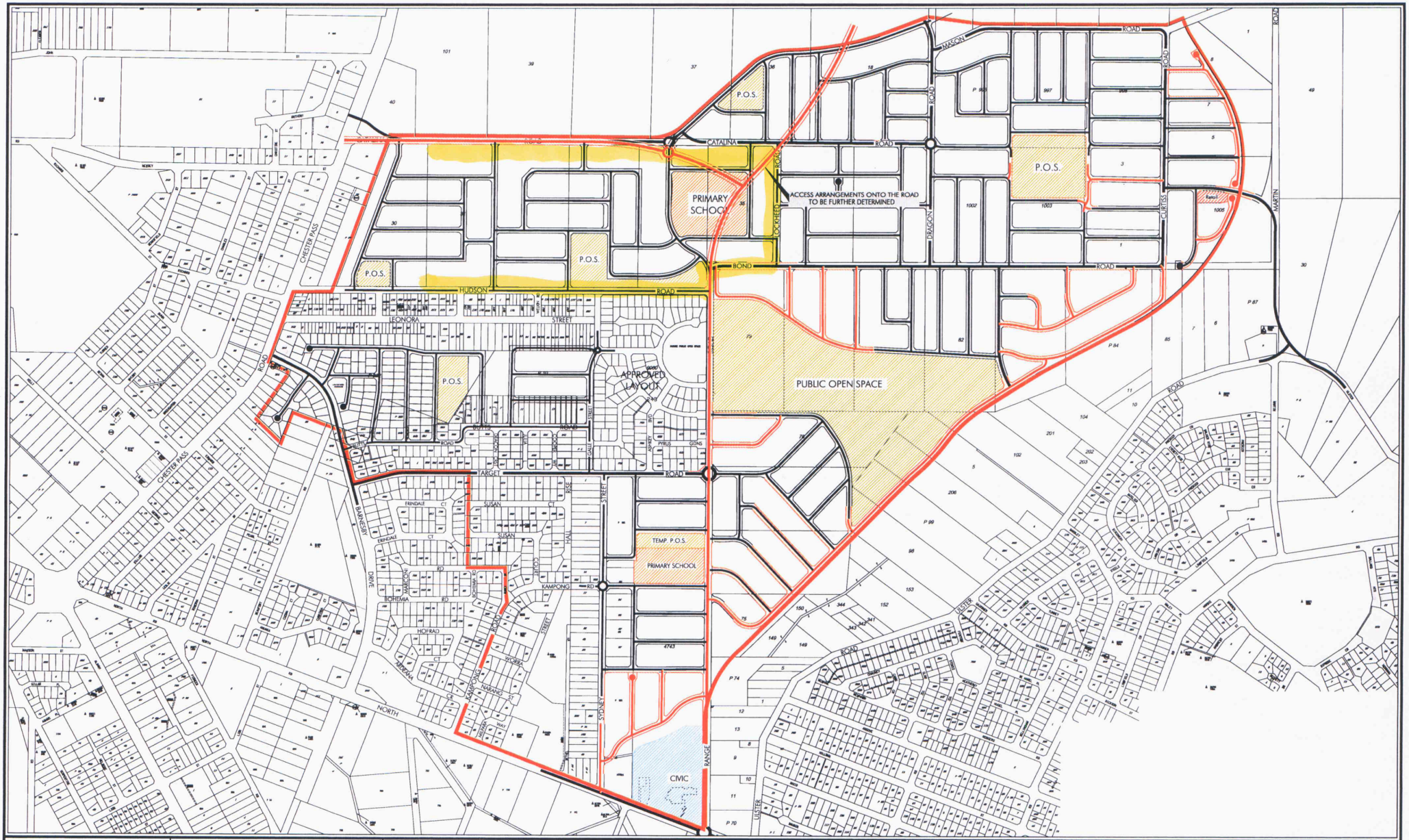
STATUS	FILE				
PRELIMINARY	WAENV078				
SCALE	PLOT DATE	FEATURE IDENTIFIER	CODE	SHEET	REVISION
1:1000 A1 1:2000 A3	13/05/08 @ 14:48	13/5037/1	52075	4	A

GRAPHIC SCALES

g:\environmental services\environmental projects\waenv078 lot 35 catalina env & geo investigation\acad\13_5037_1_52075_1-4_ra.dwg - 4 ORIGINAL SHEET SIZE A1 (840x594)

Appendix B:
Yakamia District Structure Plan and Draft Transport Network (February 2010)

Outline Development Plan
Lots 30 – 35 Catalina Rd and Lot 1000 Lockheed Rd Lange



Allerding & Associates
Town Planners, Advocates and Subdivision Designers

0 100 200 300 400 500m
SCALE 1:10 000
ORIGINAL PLAN SIZE: A3

DRAWING NUMBER:	DATE:
ALB YAK ST	21.04.2005

310A Newcastle Street, Perth W.A. 6000
PH: (08) 9328 5555 FAX: (08) 9328 5559

Figure 3
PROPOSED STRUCTURE PLAN
DRAFT

Subject Land.....

NORTH

YAKAMIA DISTRICT STRUCTURE PLAN CELLS A & B

CITY OF ALBANY

Transport Network Draft (Feb 2010) Full Build Out

Hazzard
Millbrooke
Chester Pass
Hunton
Down
Willyung
Nanarup
Norwood
Esplanade
Gunn
Copal
Menange
Greatrex
Albany
Reddale
Gladville
Henry
Mercer
Bayonet
Lancaster
Timewell
Gregory
Newby
Catalina
South Coast Highway
Bottlebrush
Clydesdale
Cull
Le Grande
Townsend
Barnesby
Target
Ulster
Range
Collingwood
Emu Point
Golf Links
Lockyer
Sanford
Albany
Middleton
Lower Denmark
Princess Royal
Frenchman Bay Road
Bay View

Legend

0 1,200 2,400 4,800 Meters

- Neighbourhood Connector (2 Lanes/60kmh/20-25m)
- Indicative NC
- Integrater Arterials (4 Lanes/60kmh/30-40m)
- Integrater Arterials (4 Lanes/60kmh/60m)
- Ring (4 Lanes/90kmh)
- Interchange (Over/Under Pass)
- Major Intersection
- Tourism Nodes
- Schools
- Mixed Use
- Commercial
- Regional Recreation
- Parks and Recreation
- Residential
- Future Residential
- Special Residential
- Special Rurual
- Eco Living
- Industry

Appendix C:
Local Water Management Strategy - Opus International Consultants

Outline Development Plan
Lots 30 – 35 Catalina Rd and Lot 1000 Lockheed Rd Lange

Local Water Management Strategy

Lots 30 – 35 Catalina Road Lange, Albany

Prepared for Dykstra Planning

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				DoW	City of Albany
DRAFT	July 2010	Local Water Management Strategy	Evan Chadfield Albany Manager		
FINAL	July 2010	Local Water Management Strategy	Evan Chadfield Albany Manager		
1					
2					
3					

After the document is reviewed, any changes that are made shall be forwarded to the City of Albany and Department of Water for review and comment.

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APPENDICES

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1 | Summary

Table 1: Design Elements and Requirements for BMPs and Critical Control Points

The Western Australian Department of Water (DoW) Stormwater Management Objectives have been addressed for this site:

Design Objectives	Compliance with Design Objectives Via Development Design Elements	Section or Appendices
Water Quality: *To maintain or improve the surface and groundwater quality within the development areas relative to pre-development conditions.*	1:1year ARI post development events shall be treated as per Faculty for Advancing Water Biofiltration (FAWB) guideline of a treatment area based on 2% of constructed impervious area within the proposed drainage/POS areas within the development. This is to be calculated at the detailed design stage of the development. All outflows from subsoils (if any) should receive treatment prior to discharge to stormwater system.	Section 3.1 Water Quality Management
Water Quantity: *To maintain the total water cycle balance within development areas relative to the pre development conditions.*	1:1 year and 1:10 year post development ARI events will be attenuated within proposed development area and released from the site as per pre-development and existing stormwater downstream infrastructure as per City Of Albany (CoA) and DoW requirements.	Appendix B Section 3.2 Water Quantity Management
Water Conservation: *To maximise the re-use of stormwater.*	Recommend rainwater tanks plumbed to buildings for non-potable water use, however this will be at the discretion of individual lot owners.	Section 3.3 Water Conservation Section 5 Water Use Sustainability Initiatives
Ecosystem Health: *To retain natural drainage systems and protect ecosystem health.*	1:1 year and 1:10 year post development ARI events released from the site as per pre-development and existing downstream stormwater infrastructure.	Appendix B Section 3.4 Ecosystem Health Management
Economic Viability: *To implement stormwater management systems that are economically viable in the long term.*	The stormwater system is recommended to be designed to allow for ease of maintenance – any batters will be gentle sloping and stabilised for reduced incidence of scouring.	Section 3.5 Economic Viability
Public Health: *To minimise the public risk, including risk of injury or loss of life, to the community*.	To ensure stormwater structural controls meet public health and safety standards any bioretention systems (swales and attenuation areas) are recommended to be designed to be relatively shallow with vegetated slopes to provide erosion control and stability. Adequate hydraulic conductivity of soil within bioretention systems is required so that impact of mosquitoes is reduced. This should be considered at the detailed design stage.	Section 3.6 Public Health

Protection of Property: *To protect the built environment from flooding and waterlogging*.	To protect buildings from flooding and waterlogging in the 100 year ARI event all 1:100 year post development ARI events will be designed where possible to be conveyed within road reserve and POS/ Drainage areas and released off site as per pre-development and existing downstream stormwater infrastructure as per CoA requirements. Allowance has been also made for attenuation of 1:100 year ARI events in Catchment Area 1 due to existing issues with flooding at lot 12 Hudson Road.	Appendix B Section 3.7 Protection of Property Section 6.2 Flood Protection
Social Values: *To ensure that social, aesthetic and cultural values are recognised and maintained when managing stormwater.*	POS/ drainage areas are to be revegetated using appropriate plant species with regard to Water Sensitive Urban Design and to improve visual amenity and provide utility for out of season use.	Section 3.8 Social Values
Development: *To ensure the delivery of best practice stormwater management through planning and development of high quality developed areas in accordance with sustainability and precautionary principles.*	Development of the site will be managed through detailed design. A Construction Management Plan is recommended to be developed to illustrate the environmental risk or issues associated with the development of the site. This shall be developed prior to construction of the stormwater system and control measures recommended to be implemented by the contractor to ensure best practice stormwater management.	To be addressed by the contractor Section 3.9 Development

2 | Introduction

Dykstra Planning engaged Opus Consultants Albany (Opus) on behalf of the lot owners of lots 30 – 35 Catalina Road, Lange to develop an Local Water Management Strategy (IWMS), to re-zone from the "Rural" Zone to the "Residential" Zone under the City of Albany's Town Planning Scheme.

The development proposal for this site includes the provision of sub-divisional roads and POS/ drainage areas, with access to Catalina Road, Hudson Road and Lockheed Road. The subdivision will be serviced with connection to water, sewer, power and telecommunications. Please refer to Appendix A – Outline Development Plan.

The effect of the proposed development would be to replace much of the grassland with impervious surfaces interconnected by a formal drainage network. The result of this change in land use would be to increase the runoff within the catchment. In addition, the intensity of the stormwater runoff would also increases, as a result of the more efficient transport of runoff flows enabled by formal drainage networks.

This LWMS has been developed, as per the Better Urban Water Management Guidelines (WAPC, 2008) so as to outline best practice Water Sensitive Urban Design (WSUD) strategies that may be considered in the future staged development of the site. The 'Best Practise' approach to stormwater management is guided by the *Stormwater Management Manual for Western Australia* (DoW, 2007) and provides co-ordinated guidance for developers on the current best management principles for stormwater management. Opus has recommended these principles on behalf of the client for the planning and overall commitment to sustainability and minimising its ecological footprint.

Water management objectives for this site as per the WA Stormwater Management Manual, are:

- **Water Quality:** *To maintain or improve the surface and groundwater quality with the development areas relative to pre-development conditions;*
- **Water Quantity:** *To maintain the total water cycle balance within the development areas relative to the pre-development conditions by maintaining 1:1 year ARI event on site and to attenuation the 1:10 year ARI events to match pre-development flows;*
- **Water Conservation:** *To maximise the reuse of stormwater;*
- **Ecosystem Health:** *To retain natural drainage systems and protect ecosystem health;*
- **Economic viability:** *To implement stormwater management systems that are economically viable in the long term;*
- **Public Health:** *To minimise the public risk, including risk of injury or loss of life, to the community;*
- **Protection of Property:** *To protect the built environment from flooding and water logging by providing overland flow path for 1:100 year ARI events and attenuation of 1:100 year ARI events for controlled release of stormwater directed to drainage path on Stephen Street;*
- **Social Values:** *To ensure that social, aesthetic and cultural values are recognised and maintained when managing stormwater; and*
- **Development:** *To ensure the delivery of best practice stormwater management through planning and development of high quality developed areas in accordance with sustainability and precautionary principles.*

1.1 | Current Land Use and Location

Lots 30-35 Catalina Road is located south east of Albany and covers an area of approximately 46.4 hectares. Lots 30-35 are bounded by Chester Pass Road to the west, Catalina Road to the North, Hudson and Lockheed Road to the south and east respectively. Please refer to Figure 1 – Site Context Plan.

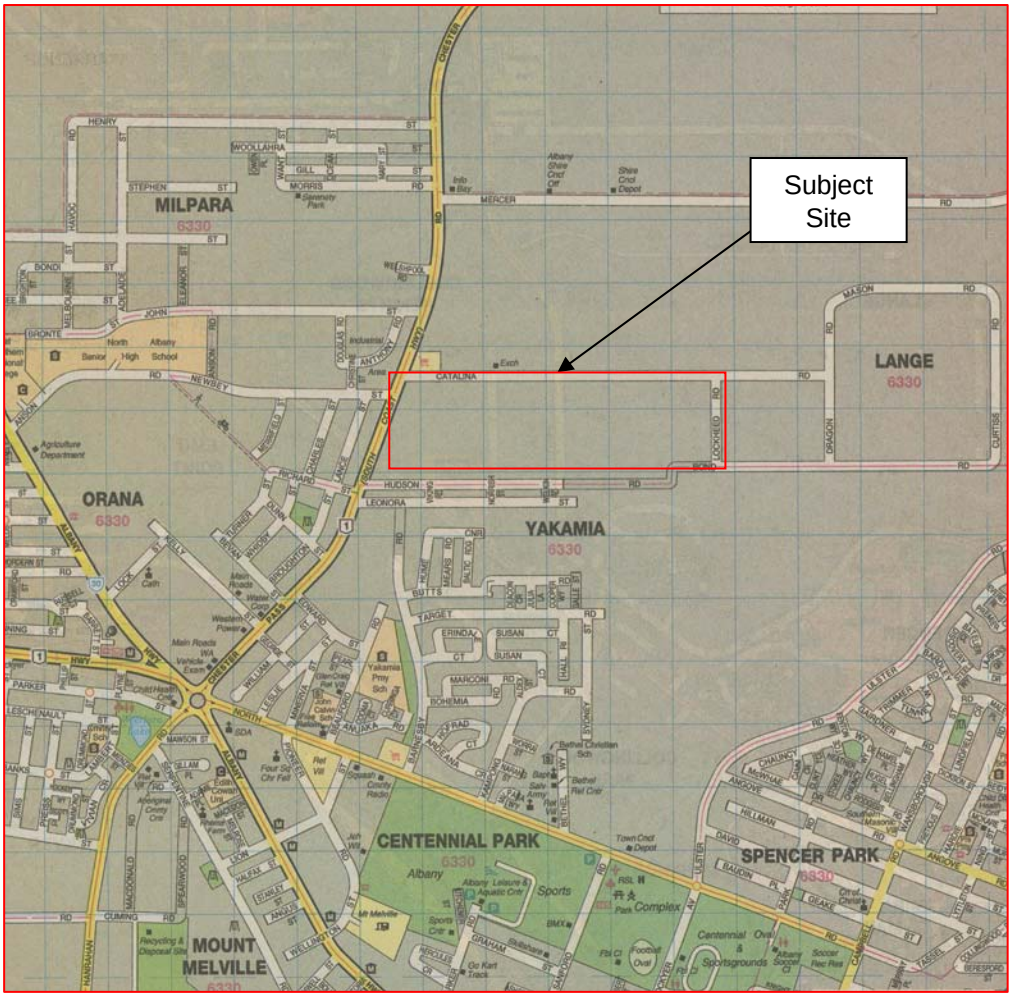


Figure 1: Site Context Plan: Location of Lots 30 – 35 Catalina Road, Lange.

1.2 | Legislation and Policies Applicable to the Site

This report has been prepared to comply with the following legislation, policy and guidelines:

- *Environmental Protection Act* 1986;
- Department of Water, Interim: Developing a Local Water Management Strategy, December 2008; and
- Department of Water (2007) WA Stormwater Management Manual.

1.3 | Other Reports Applicable to the Site

This LWMS has been developed based on compilation of findings from the following reports, previously developed by Opus:

- Preliminary Environmental Assessment, Lots 32, 33 and 34 Catalina Road Albany WA, Opus, May 2007;
- Preliminary Environmental Assessment, Lots 30, 31 and 35 Catalina Road Albany WA, Opus, May 2008; and
- Preliminary Stormwater Management Plan, Lots 30 – 35 Catalina Road, Albany, Opus, August 2009.

1.4 | Consultation Prior to Preparation of this Strategy

Consultation prior to the preparation of this strategy has occurred with:

- Marisa Papalia, Environmental Officer, Department of Water (DoW).

Opus Consultants conducted consultation with Department of Water representative in April 2007 with regard to inundated areas located within lot 33 Catalina Road. The Department of Water (DoW) indicated that "*the subject land is located within the Yakamia Creek catchment and natural drainage lines should be retained. The area forms part of the headwaters for Yakamia Creek*." The outcome of this consultation was a recommendation by DoW that "*stormwater and nutrient management will be very important and these need to be done using water sensitive design principles*".

Further consultation is likely to be required with Department of Water (DoW) and City of Albany (CoA) at the detailed design stage of the development.

3 | Design Criteria

3.1 | Water Quality Management

The following design criteria are proposed for the future industrial development of this site:

Objective

To maintain or improve the surface and groundwater quality within the development areas relative to pre-development conditions.

Design Criteria

1:1 year ARI post development events are proposed to be treated as per the Faculty for Advancing Water Biofiltration (FAWB, 2008) guideline of a treatment area based on 2% of constructed impervious area within the proposed development area. Confirmation of shape, area and DoW best practice methods for stormwater treatment within the proposed development will be determined at the detailed design stage.

All outflows from subsurface drainage (if any) are proposed to receive treatment prior to discharge to stormwater system.

3.2 | Water Quantity Management

Objective

To maintain the total water cycle balance within development areas relative to the pre development conditions.

Design Criteria

1:1 year and 1:10 year ARI events are required to be attenuated and treated as per CoA Subdivision and Development Guidelines and DoW guidelines for treatment of stormwater prior to release off site (as per pre-development flows and existing downstream stormwater infrastructure). Please refer to Section 3.1 Water Quality Management.

Size and shape of bioretention system sites within the proposed development area are to be confirmed at the detailed design stage. Please refer to Appendix B for drainage calculations regarding 1:10 year ARI event attenuation volumes that are likely to be required for the site.

Bioretention systems such as vegetated swales and attenuation areas used for conveyance and treatment of stormwater are to be integrated into the landscaping within the POS areas to provide visual amenity and utility for residences within the subdivision.

Drainage calculations have been based on 70% impervious area and 30% impervious area, as an average of lots, roads and POS/ drainage areas for this residential subdivision. Please refer to Appendix B.

3.3 | Water Conservation

Objective

To maximise the reuse of stormwater.

Design Criteria

It is recommended that, at the time of development, rainwater tanks are installed on each lot by individual lot owners and plumbed to buildings for non-potable water use. An option for control of this would be to stipulate rainwater tank installation on lot titles. If this is not implemented then the use of rainwater tanks will be at the discretion of individual lot owners.

3.4 | Ecosystem Health Management

Objective

To retain natural drainage systems and protect ecosystem health

Design Criteria

All post development ARI events (1:1 year and 1:10 year) are to be released from the site as per pre-development and existing downstream stormwater infrastructure. Calculations have been made for pre and post development flows across the site (please refer to Appendix B for drainage calculations). However locations of attenuation sites, pipe sizes and invert levels for drainage structures within the residential development are to be confirmed at the detailed design stage of this site.

Downstream ecosystem health may be protected by the implementation of 1:1 year ARI treatment areas. The area for which shall be calculated at the detailed design stage for the development as per FAWB (2008) best practice recommendations. Please refer to Appendix B.

3.5 | Economic Viability

Objective

To implement stormwater management systems that are economically viable in the long term.

Design Criteria

Consideration should be made at the detailed design stage for the stormwater conveyance system to allow for ease of maintenance – any batters are recommended to be gentle sloping and stabilised for reduced incidence of scouring. Best practice erosion control measures would be implemented during the development of the site for long term protection of the site.

At the detailed design stage for the development consideration should be made for inclusion of biofiltration basins which may provide a long term, low maintenance option for stormwater treatment across the site. Once native vegetation is established and biofiltration basins functioning as per design, basins would only required periodic maintenance.

3.6 | Public Health

Objective

To minimise the public risk, including risk of injury or loss of life, to the community.

Design Criteria

To ensure stormwater structural controls meet public health and safety standards bioretention system (swales and basins) designs are recommended to be relatively shallow (1:6 slope) with vegetated slopes to provide erosion control and stability.

"*To reduce the health risk of mosquitoes, between the months of November to May, all attenuated immobile stormwater should be released within a time period not exceeding 96 hours*" (DoW, 2008a).

No permanent waterbodies are proposed within the development site.

3.7 | Protection of Property

Objective

To protect the built environment from flooding and waterlogging.

Design Criteria

Lot 12 Hudson Street has a drainage easement including a major stormwater pipe (likely to be 600mm dia. – this was not accessible at time of visit), passing over its property on the west side. Despite this, they still experience flooding during major events. This could potentially get worse when lot 30 Catalina Road is developed and runoff increases towards the southwest corner due to increased hard stand areas in the subdivision. Therefore it is proposed that bioretention basin B-01 should be designed to hold a 1 in 100 year ARI event. The existing pipe in the easement in lot 12 Hudson may also need to be upgraded.

The shape and depth of the drainage structures within the proposed development is to be determined at the detailed design stage however drainage calculations are included in this report indicating volumes required for release of site of 1:100 year ARI events.

Flood routing for the 1:100 year ARI event has been allowed for overland flow within the road reserves on the site to each basin within each sub-catchment. This, however, has not been indicated on the sketch provided in Appendix B as road reserve layout may be subject to change and should be finalised at the detailed design stage.

Finished levels of the lots adjacent to drainage areas will be required to be designed to have a minimum of 300mm freeboard above the 1:100 year ARI event flood level.

3.8 | Social Values

Objective

To ensure that social, aesthetic and cultural values are recognised and maintained when managing stormwater.

Design Criteria

Bioretention systems within POS/ drainage areas are to be integrated into landscaping areas, with appropriate species, to provide stormwater bioretention and provide improved visual amenity to local residences.

3.9 | Development

Objective

To ensure the delivery of best practice stormwater management through planning and development of high quality developed areas in accordance with sustainability and precautionary principles.

Design Criteria

A Construction Management Plan is recommended to be developed to illustrate the environmental risk or issues associated with the development of the site prior to construction of the stormwater system and control measures recommended to be implemented by the contractor to ensure best practice stormwater management.

4 | Pre-Development Environment

4.1 | Site conditions

4.1.1 | Geotechnical

A desktop assessment of the site indicates that the parent material for the area is from recent geological deposits in the tertiary period with dark grey silt top-soils or brown sand containing gravel and silt, commonly containing iron pisoliths and overlying laterite (Australian Geoscience Mapping). In reference to the Soil-Landscape Mapping in South-Western Australia (Schoknecht, *e. al*., 2004) the project site is located in the Albany Sandplain Zone which is described as a number of south flowing short rivers dissecting a gently undulating plain. The area contains '*eocene marine sediments overlying Proterozoic granitic and metamorphic rocks'*. Soils are often alkaline and sodic sandy duplex soils, with some sands, gravels and clays (Schoknecht, *et al.*, 2004).

4.1.2 | Topography

The topography of the site varies from 50m AHD at the northern end of lots 30, 31 and 32 and slopes to the south east to the lowest elevation of 30m AHD in the southern end of lots 33 and 34. The site also slopes to the north east on lot 35 and the south west on lot 30, from the centre of each lot. Please refer to Appendix A – Outline Development Plan for contours of the site.

Detailed feature survey was not obtained for the purpose of this report.

Plate 1: Centre of lot 33 facing north west to Catalina Road.

Plate 2: Centre of lot 33 facing south west to Hudson Road.

Plate 3: Lot 30 facing south west to Hudson road from southern side of residence.

Plate 4: Lot 35 facing north (to Catalina Road) from top of ridge.

4.1.3 | Soil Types

A site assessment was conducted on the 16th April 2007 at lots 32, 33 and 34 Catalina Road and on the 12th May 2008 at lots 20, 31 and 35 Catalina Road. The site assessment included recording soil profiles by visual classification to a depth of 2000mm below ground level (BGL). A total of 33 test pits were excavated by mechanical auger, with 5 test pits in lot 32, 6 test pits on lot 33, 4 test pits in lot 34, 5 test pits in lot 30, 7 test pits on lot 31 and 6 test pits in lot 35. Please refer to Appendix C – Soil Profiles for test pit location maps.

The soils were generally uniform across the site, with 23 of the 33 test pits recording a soil profile of silty sand over sandy gravel over clay.

4 test pits recorded a profile of sand with silt only. These were located at the southern end of lots 32 and 33 and on the eastern boundary of lot 31. This area may be subject to seasonal inundation.

6 test pits recorded either sand with silt over clay only or sand over sandy gravel and may be considered a transitional area to the areas of possible seasonal inundation.

The water table was not intercepted at any of the test pit locations across lots 30 – 35, during assessments undertaken in both April 2007 and May 2008.

4.1.4 | Acid Sulfate Soils

The site is located in an area of Low to No Risk of Actual Acid Sulfate Soil (AASS) or Potential Acid Sulfate Soils (PASS) (WAPC, Planning Bulletin 64 Figure 11 Albany-Torbay Acid Sulfate Soils) (Figure 2).

The boundary of the high risk of ASS indicated in Figure 2 to the south of lot 33 may require monitoring and investigation if there is to be excavation within the southern end of lot 33. At time of writing the majority of the vegetation within the area of inundation on lot 33 is to be contained within a proposed POS/ drainage area. Although the soil types are not indicative of ASS in this area, excavation in the POS/ drainage areas should be restricted to removal of green waste only (weeds) so as not to disturb soils below.

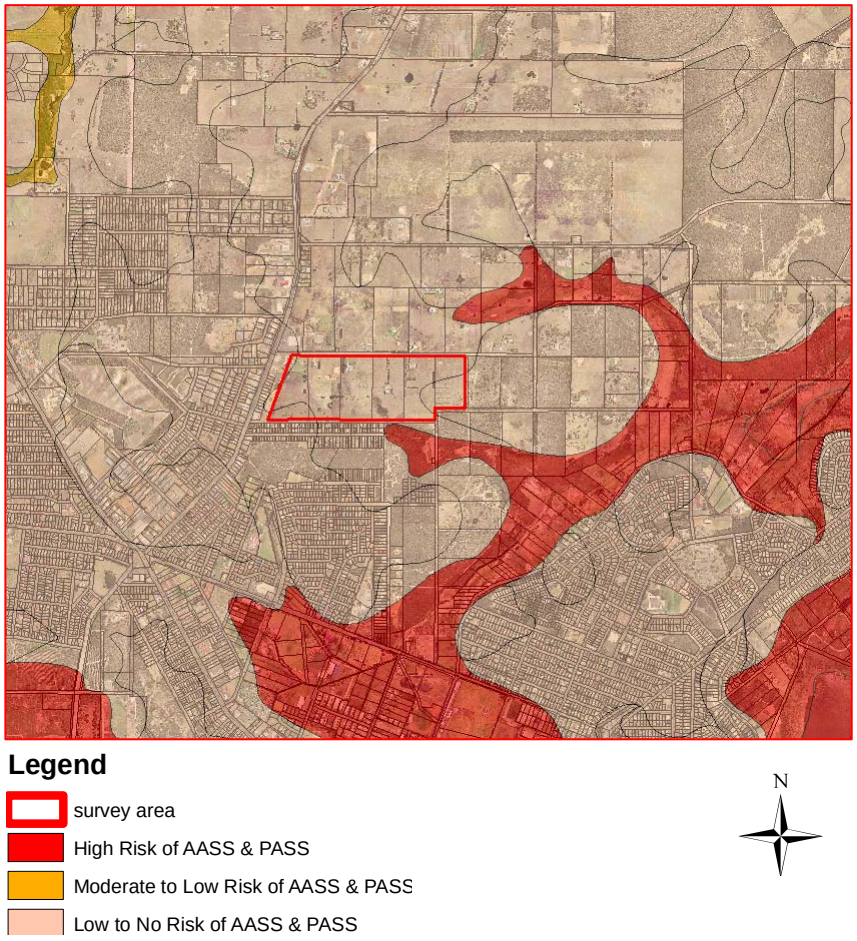


Figure 2: Desktop Assessment of Acid Sulfate Soil Risk of the site [WAPC, Planning Bulletin 64 Figure 11 Albany-Torbay Acid Sulfate Soils].

4.1.5 | Contaminated Sites

A desktop search of the DEC's Contaminated Sites Database, 21st July 2010 to update findings from the April 2007 and May 2008 reports, found there are no contaminated sites pursuant to the *Environmental Protection Act* 1986 in the subject site. Please note that only sites classified as 'contaminated – restricted use', 'contaminated – remediation required' and 'remediated for restricted use' are recorded on the database.

4.2 | Heritage (non-indigenous)

A search of the Heritage Council of Western Australia Places Database, www.heritage.wa.gov.au, on the 28th of July 2010 did not locate any non-indigenous heritage sites for Catalina Road or Hudson Road.

4.3 | Aboriginal Heritage

A search of the Department of Indigenous Affairs (DIA) Aboriginal Heritage Inquiry System, www.dia.wa.gov.au, on the 28th July 2010 indicated that there have been no heritage surveys undertaken or Aboriginal sites located within the subject site. There is, however, 1 site located to the south east of the proposed development site. This site is Yakamia Creek with Open Access and No Restriction to the site. It is not expected that the proposed development will impact on this site if appropriate measures are undertaken within the site to control and treat storm and waste water. Please refer to Appendix D – Heritage Information.

4.4 | Environmental Assets

4.4.1 | Flora and Fauna

The proposed development site lies within the Albany pre-European System Association within the Southern Jarrah Forest IBRA subregion (Hearn *et al*., 2002). A full onsite vegetation survey was not completed for the purpose of this LWMS. The pre-European Vegetation Association for the site is 978: Low forest; jarrah, *Eucalyptus staeri* and *Allocasuarina fraseriana.*

This vegetation association is listed by Shepherd *et al.* (2002) as Low forest; jarrah, *Eucalyptus staeri* and *Allocasuarina fraseriana.* The pre-European extent of this vegetation is 66,468ha, the current extent being 26,010ha, with the estimated remaining extent being 39.1%. The extent of this vegetation type in IUCN reserves is 14.0%, with 0.1% listed in other reserves.

The majority of native vegetation across the site has been previously clear for the purpose of rural activities. The remaining remnant vegetation is however infested with weed species or exists as isolated paddock trees. Windrows of trees have been planted on the boundary of a number of the lots for protection of stock.

It is recommended that areas of POS/ drainage areas are landscaped using local native flora species.

A full fauna trapping program was not conducted as part of this assessment. However evidence of kangaroos was observed during the site assessment. Non native fauna observed included horses, cows, sheep and evidence of rabbits was also noted.

4.4.2 | Wetlands and Water Ways

The subject site is located in the Oyster Harbour/ Kalgan River/ King River Catchment within the Albany Coast Basin in the South West Division (DoW, 2008).

The site does not contain any RAMSAR listed wetlands, or any regionally significant wetlands. There are not any permanent waterways or wetlands on any of the lots with the exception of a number of small constructed dams located across the site for stock.

The Department of Water (DoW) have made comments that the subject land is located within the Yakamia Creek catchment and that the area forms part of the headwaters for Yakamia Creek, which ultimately flows to Oyster Harbour. DoW stated that:

- The natural drainage lines should be retained*;*
- It is generally a requirement to retain wetlands; and
- No direct drainage permitted into wetlands.

DoW have stressed that stormwater and nutrient management is very important and urban water sensitive design principles should be applied to the development (pers comms M. Papalia, DoW, April 2007).

It was suggested that a reconstructed wetland could be developed above the existing naturally inundated area as a way to avoid the development's storm water runoff from directly entering the naturally inundated area (pers comms M. Papalia, April 2007).

Plate 5: Lot 33 facing south west towards seasonally inundated area

Plate 6: Facing west towards seasonally inundated area (the small dam is behind the visible vegetation).

4.2.1 | 100 Year ARI Event Floodways

Lot 12 Hudson Street has a drainage easement including a major stormwater pipe (likely to be 600mm dia. – this was not accessible at time of site visit by Opus Engineer Bart Wassink, 2008), passing over its property on the west side. Despite this, they still experience flooding during major events. This can get potentially get worse when lot 30 Catalina Road is developed and runoff increases towards the southwest corner due to increased hard stand areas in the subdivision. Therefore it is proposed that basin B-01 should be designed to hold a 1 in 100 year ARI event. The existing pipe in the easement in lot 12 Hudson Road may also need to be upgraded.

Where possible 1:100 year ARI event flood routes within the proposed development will be designed to be located in road reserve or POS/ Drainage areas

4.2.2 | Catchment Boundaries

The focus of this report is the drainage management of Lot 30-35 Catalina Road, and considered the site as one development although it will be developed by the different owners. The total catchment area was determined and measured based on the contours from the City of Albany and subdivision boundary as provided by Dykstra Planning. The area of pervious and impervious has been assessed based on the aerial photographs and confirmed by a site visit completed by Opus. The catchment boundaries are illustrated in colour in Appendix B.

Table 1: Size of sub-catchments within the proposed subdivision

Sub-catchment Name	Area (sq.m)
CA-1	83,940
CA-2	77,618
CA-3	78,787
CA-4	152,889
CA-5	70,177

4.2.3 | Groundwater

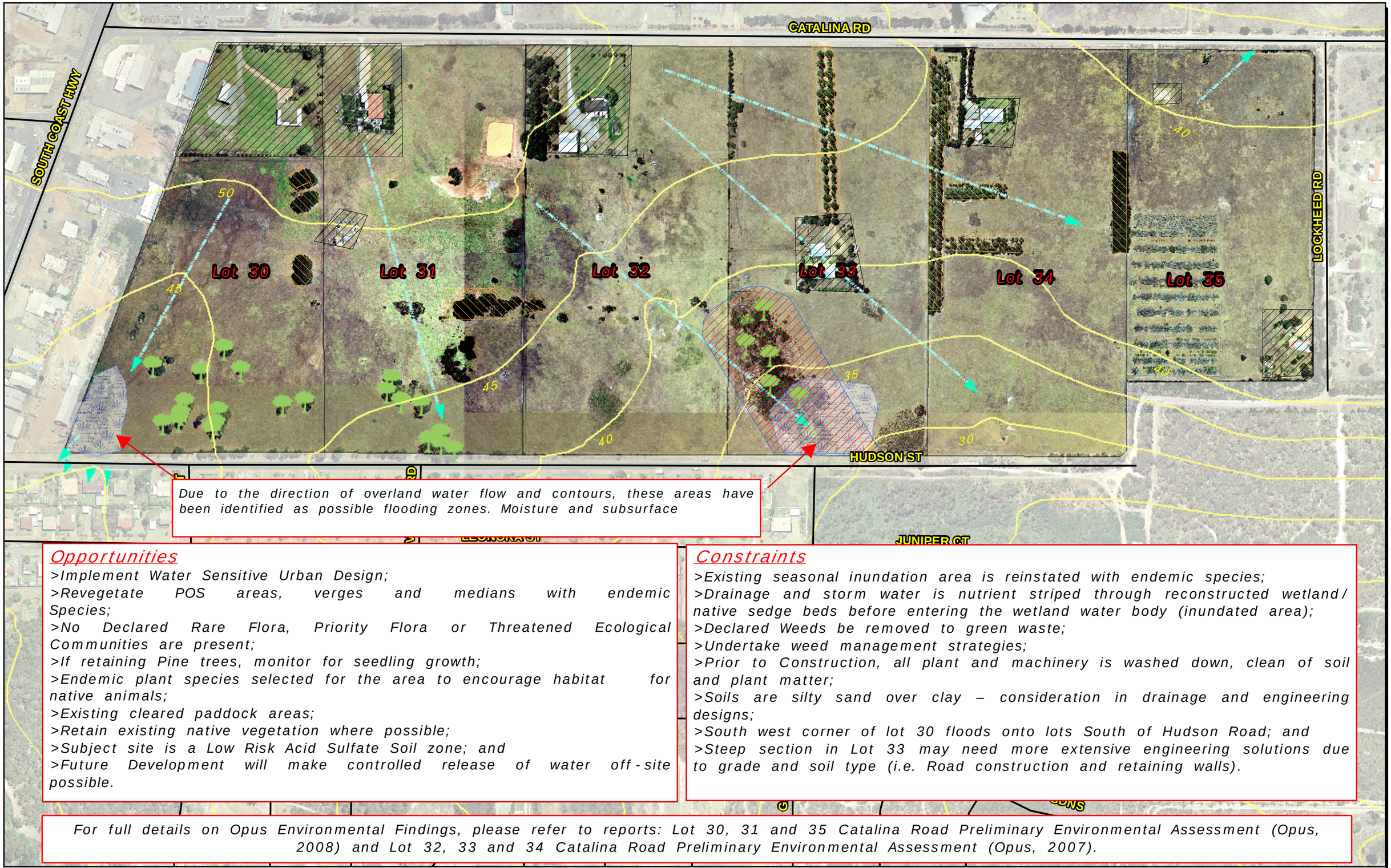
The water table was not intercepted at any of the test pit locations across lots 30 – 35, during assessments undertaken in both April 2007 and May 2008.

4.2.1 | Environmental Opportunities and Constraints

The Environmental Opportunities and Constraints for the proposed development site have been summarised for the environmental assets assessed in the following reports:

- Preliminary Environmental Assessment, Lots 32, 33 and 34 Catalina Road Albany WA, Opus, May 2007; and
- Preliminary Environmental Assessment, Lots 30, 31 and 35 Catalina Road Albany WA, Opus, May 2008.

Please refer to mapping over the page.



Due to the direction of overland water flow and contours, these areas have been identified as possible flooding zones. Moisture and subsurface

Opportunities

>Implement Water Sensitive Urban Design;
>Revegetate POS areas, verges and medians with endemic Species;
>No Declared Rare Flora, Priority Flora or Threatened Ecological Communities are present;
>If retaining Pine trees, monitor for seedling growth;
>Endemic plant species selected for the area to encourage habitat for native animals;
>Existing cleared paddock areas;
>Retain existing native vegetation where possible;
>Subject site is a Low Risk Acid Sulfate Soil zone; and
>Future Development will make controlled release of water off-site possible.

Constraints

>Existing seasonal inundation area is reinstated with endemic species;
>Drainage and storm water is nutrient striped through reconstructed wetland/ native sedge beds before entering the wetland water body (inundated area);
>Declared Weeds be removed to green waste;
>Undertake weed management strategies;
>Prior to Construction, all plant and machinery is washed down, clean of soil and plant matter;
>Soils are silty sand over clay – consideration in drainage and engineering designs;
>South west corner of lot 30 floods onto lots South of Hudson Road; and
>Steep section in Lot 33 may need more extensive engineering solutions due to grade and soil type (i.e. Road construction and retaining walls).

For full details on Opus Environmental Findings, please refer to reports: Lot 30, 31 and 35 Catalina Road Preliminary Environmental Assessment (Opus, 2008) and Lot 32, 33 and 34 Catalina Road Preliminary Environmental Assessment (Opus, 2007).

SCALE AND LEGEND

- Roads
- steep grade
- Existing Introduced Vegetation (Pines, Weeds)
- Existing Residential use areas
- Contours (m ASL) AHD
- Remnant Native Vegetation (Jarrah, Marri scattered Paddock trees)
- Areas may be subject to flooding or moisture
- Existing Plantation
- Overland rainwater direction of runoff

0 100 200 400 Meters

	BY	CHECKED	DATE
DESIGN	SCOTT G	WASSINK	
DRAWN	SCOTT G	WASSINK	
APPROVED			

Dykstra Planning

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TITLE	Lots 30 to 35 Catalina Road Dykstra Planning Projected: GDA 1994 MGA Zone 50 Summary of Opus Environmental Findings Lots 30-35 Catalina Road
STATUS	DRAFT
FILE	wasdv183
SCALE	1:3,500 at A3 Size
PLOT DATE	17 AUG 2009

5 | Water Use Sustainability Initiatives

5.1 | Water Efficiency Measures

It is recommended that this industrial estate is designed with a commitment to sustainable water management which includes the conservation of water resources. The water conservation goal at should be to enhance the productivity and efficiency of water use by:

- Using less water;
- Encouraging use of stormwater (water harvesting in rainwater tanks) on each lot for non-potable use;
- Using native plants in waterwise landscaping; and
- Fitting water quality to its purpose.

By incorporating these measures associated with lower water use and wastewater discharge it presents the community with environmental and financial benefits.

5.2 | Water Supply

The available water sources and their proposed use within the industrial subdivision are presented in the table below.

Table 3: Water Sources and Their Use

Source	Use	Summary
Scheme Water	Mains water – fire protection	Scheme water will provide the mains supply and fire protection water.
Groundwater	Nil	It is not proposed to use groundwater on site.
Rainwater	Nil	Nil
Stormwater	Recharge	Stormwater is proposed to be attenuated within POS/ drainage areas for each Catchment Area. Confirmation of shape and size of attenuation areas are to be determined at the detailed design stage.
Black Water	Sewer	The wastewater from buildings will be disposed of via sewer.
Grey Water	Nil	Nil

5.3 | Wastewater Management

All waste water shall be separate to stormwater control and residential houses shall be connected to reticulated sewer.

6 | Stormwater Management Strategy

Water management strategies aligned to current DoW Best Practise which should been applied to this development include:

1. Maintain and where possible enhance water quality by:
   - Minimise waterborne sediment loading;
   - Minimise export of pollutants to surface or ground water;
   - Minimise post development flows across the site; and
   - Apply point source water management.

2. Encourage water conservation by:
   - Minimise the export and use of scheme water;
   - Promote the use of rainwater;
   - Promote ground water recharge (where appropriate); and
   - Reduce irrigation requirements.

3. Management of the water regime by:
   - Prevent flood damage in existing and proposed development areas;
   - Prevent erosion of adjacent wetlands, waterways and slopes; and
   - Ensure pollutants do not enter into adjacent waterways.

The drainage calculations have been based on the Rational Method as per CoA requirement for residential subdivisions, 70% impervious and 30% pervious areas as an average of lots, roads and POS/ drainage areas. The calculations show pre-development and post-development flows with the difference being the required volume of onsite attenuation. Please refer to Appendix B for drainage calculations for the site.

6.1 | Manage Serviceability

1:5 Year ARI Events

The CoA Subdivision and Development Guidelines (CoA, 2009) require pipe networks to accommodate 1:5 year ARI events so that subdivisional roads are passable. Pipe sizes and locations of gully or side entry pits within the subdivision are to be determined at the detailed design stage.

1:10 Year ARI Events

1:10 year ARI events are to be attenuated on site for the proposed subdivision as per DoW best practice. For the purpose of this LWMS, drainage calculations for 1:10 year ARI events have been based on 70% impervious area and 30% impervious areas as an average of lots, roads and POS/ drainage areas.

Five locations have been proposed to install bioretention systems in order to collect and control the flow rates after the development for each sub-catchment area. Locations have been determined through desk top analysis by analysis of contours combined with proposed road layouts. Some proposed lot and POS locations may be subject to change. Please refer to Appendix B for the proposed locations of the bioretention systems.

The time of concentration for both pre and post development have been calculated using kinematic Wave Equation (refer to Appendix B).

The table shown below is the summary of the Basins capacity for 1 in 10 year ARI event as per CoA requirements. The basins and catchment areas are shown in Appendix B.

Table 2: Estimated basin size for each sub-catchment within the proposed subdivision

Basin No.	Pre-dev Flow Rates	Post-dev Flow Rates	Outlet Pipe Diameter	Volume	Estimated Basin Area Required (1:10yr storm event)
	L/s	L/s	mm	m^3	m^2
B-01	163	163	375	2,276*	2,500*
B-02	141	137	300	1,133	1,600
B-03	267	233	375	929	1,100
B-04	228	170	300	2,549	2,550
B-05	103	87	225	1,138	1,400

*allowed for 1:100yr attenuation

Constructability of the basins is depending on the slope of the ground. Estimated area for the basin may be adjusted to achieve the basins required capacity. This will be determined in the detailed design stage.

6.2 | Flood Protection

It is recommended that bioretention basin B-01 is to be designed, in addition to 1 in 10 year ARI events, to cater for the flow for 1 in 100 year ARI event with release at pre-development rates. During the site visit, Opus staff spoke with the resident on 12 Hudson Street. This lot is located to the south directly opposite the southwest corner of Lot 30 Catalina Road.

Lot 12 Hudson Street has a drainage easement including a major stormwater pipe (likely to be 600mm dia. – this was not accessible at time of visit), passing over its property on the west side. Despite this, they still experience flooding during major events. This could potentially get worse when lot 30 Catalina Road is developed and runoff increases towards the southwest corner due to increased hard stand areas in the subdivision. Therefore it is proposed that basin B-01 should be designed to hold a 1 in 100 year ARI event. The existing pipe in the easement in lot 12 Hudson Road may also need to be upgraded.

The maximum volume required for the bioretention basin to hold the 1 in 100 year ARI event is 2300 cu.m which require approximately 2500 sq.m of area with 1:6 batter as much as possible. Final dimension and sizes of the basins will be determined during detailed design stage.

Maintenance is essential for the correct operation of the basins. It should be routinely inspected ensuring that the inlets and outlets are free from debris in particular after considerable storm events. Sediment builds up will be required to be removed.

The road reserve and POS/ drainage areas within the residential subdivision are proposed as a conveyance system for 1 in 100 year ARI events. The flood route for the subdivisional roads has not been indicated in Appendix B however all flows will be directed via road reserve to the proposed basins within each sub-catchment. The subdivisional road layout is to be finalised at the detailed design stage and the form of drainage infrastructure within the road reserves will be dependent on soil type encountered across the site. Consideration should be made for infiltration at source or as close as possible, on lots and within road reserves where practical as per DoW best practice methods.

Final surface level of buildings should allow finished floor levels to be 300mm above the 100 year flood level as per City of Albany Subdivision Guidelines (2009).

6.3 | Protect Ecology

The treatment for stormwater has been proposed during the planning stages of this subdivision development using DoW Best Practise as in the *Stormwater Management Manual for Western Australia*. It is recommended that stormwater treatment will be undertaken utilising the following:

1. Infiltration Systems;
2. Stormwater Storage and Use; and
3. Conveyance Systems.

1:1 year ARI post development events are proposed to be treated as per FAWB guideline (FAWB, 2008) of a treatment area based on 2% of constructed impervious area within the proposed development area.

The area, form and locations of 1:1 year ARI event treatment areas/drainage structures will be determined at the detailed design stage and are to be integrated into landscaping to provide visual amenity and utility for surrounding residents. Please refer to Appendix B.

1:1 year ARI event treatment should be undertaken as per best practice DoW recommendations at the time of development. This may include (but is not limited to):

- Rain gardens;
- Vegetated swales;
- Bioretention basins; and
- Mechanical treatment methods.

7 | Groundwater Management Strategy

The water table was not intercepted at any of the test pit locations across lots 30 – 35, during assessments undertaken in both April 2007 and May 2008. There are however, areas within the southern end of the site that may be subject to surface water inundation under late winter conditions most likely due to surface saturation of top soils over clay.

7.1 | Post development Groundwater Levels

It is unlikely that the proposed development will impact on groundwater due to the elevated nature of the site. However, if required, all outflows from subsurface drainage should receive treatment prior to discharge to stormwater system.

7.2 | Acid Sulfate Soils or Contamination

The boundary of the high risk of ASS indicated in Section 4.1.4 Acid Sulfate Soils Figure 2, to the south of lot 33 may require monitoring and investigation if there is to be excavation within the southern end of lot 33. At time of writing the majority of the vegetation within the area of inundation on lot 33 is to be contained within a proposed POS/ drainage area. Although the soil types are not indicative of ASS in these areas, excavation within POS should be restricted to removal of green waste only (weeds) so as not to disturb soils below.

At time of writing no contaminated sites were identified within the proposed development site. If however, during development of the site, indication of possible contamination is identified, works should cease and this should be reported to Department of Environment and Conservation. Further investigation may then be required.

8 | The Next Stage – Subdivision and Urban Water Management Plans

The next stage of development of the site, with regard to stormwater management, will involve preparation of an Urban Water Management Plan (UWMP) as per the Better Urban Water Management Guidelines (WAPC, 2008). Such UWMP/s will identify specific best practice Water Sensitive Urban Design (WSUD) infrastructure and design techniques, based on strategies identified within this document, that will be implemented in the future development of the site.

Specific issues that require consideration in the development of an UWMP for the site may include (but not limited to) confirmation of the following:

- Location, type, size and depth of bioretention systems for 1:10 year and 1:100 year (sub-catchment 1 only) ARI events across the site;
- Location, type, size and depth of stormwater treatment areas for 1:1 year ARI events within each sub-catchment;
- Best practice stormwater treatment methods for 1:1 year ARI events as per DoW recommendations;
- Form of stormwater conveyance system within road reserves; and
- Staging of development.

If development is to be staged an UWMP may be required to address each stage outlining the detailed design of the stage and any objectives for stormwater attenuation, control and treatment. Temporary attenuation areas may be required however this would require further drainage calculations to determine the extent. The UWMP shall indicate how design criteria outlined within this UWMS shall be met to satisfy water management objectives as per the WA Stormwater Management Manual.

9 | Environmental Monitoring

Environmental controls to be checked using the project activities table during and post development of the site, the following should also be undertaken:

Table 7: Environmental monitoring activities

Frequency	***Monitoring activity***	***Person responsible***
Daily	Check all sediment control	Site supervisor
	Check waste materials are correctly sorted and stored	Site supervisor
	Check personal safety equipment before each use	All operators
	Check dust filters on equipment	Machine operators
	Check noise suppression devices on equipment	Machine operators
Twice weekly	Check containers of hazardous materials are properly stored and not damaged	Site supervisor
	Ensure dust suppression controls in place	Site supervisor
Weekly	Visually check vehicles and equipment for leaks or potential oil spills	Machine operators
After rain	Inspect all sediment control structures	Site supervisor
	Check all drains are free from debris or chemical	Site supervisor
	Ensure drainage structures are working as per design	Site supervisor

9.1 | Control of Environmental Incidents

An important aspect in any proposed environmental program is management of non-conformance or incidents. An environmental incident is an event which could result in pollution to the local

environment. The planning of site works and methodology as outlined within this management plan limits the risk and harm of construction works impacting on-site or off-site.

If an incident or event occurs during construction, it should be emphasised to all personnel working on site that all incidents are documented. Investigations should be conducted and action plans established in order to ensure the event does not happen again.

9.2 | Corrective and Preventative Actions

An Environmental Investigation should include the following basic elements:

- Identify the cause of the incident;
- Identifying and implementing the necessary corrective action;
- Identifying the personnel responsible for carrying out corrective action;
- Implementing or modifying controls necessary to avoid repetition; and
- Recording changes in written procedures required.

9.3 | Contingency Procedures

Contingency measures should be included within a Construction Management Plan. These protocols would be designed to reduce adverse environmental impacts and provide an early detection of non-conformance and subsequent corrective action. Any modifications to the outlined strategies and methodologies to meet unexpected conditions shall be agreed to by the Environmental Officer. Monitoring is recommended to be used to confirm the effectiveness of any changes.

Should it be identified by any personnel involved in the project there is a non-conformance to acceptable methodology or there is reason to cause environmental harm, in consultation with the Site Manager and Project Manager, activities should cease during resolution of the required change in methodology.

The Environmental Officer should be notified of any environmental non-conformances and undertake site investigation.

10 | Conclusion, LWMS Review and Implementation

It is the conclusion of this LWMS that:

- The developer proposes to treat 1:1 year ARI post development stormwater events as per the Faculty for Advancing Water Biofiltration (FAWB, 2008) guideline of a treatment area based on 2% of constructed impervious area within the proposed development area. Locations of and DoW best practice methods for stormwater treatment within the site will be determined at the detailed design stage.

- As per the CoA requirement for residential subdivisions, 1:10 year post development ARI events are proposed to be attenuated within development area and released from the site as per pre-development and existing downstream stormwater infrastructure. Final confirmation of locations and size of bioretention systems and sites within the proposed development area are to be determined at the detailed design stage.

- 1:100 year post development ARI events are to be attenuated within Catchment Area 1 of the development site to aid in controlling flooding in the residential area to the south of lot 30 Catalina Road. The location and depth of attenuation drainage areas within the proposed development is to be determined at the detailed design stage.

After the document is reviewed, any changes that are made shall be forwarded to the City of Albany and Department of Water for review and comment. Please refer to Document Revision Record at the beginning of this report.

It is the responsibility of the developer to implement this LWMS and future UWMPs for the site.

11 | References

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Department of Water (DoW) (2007) *The South Coast Wetland Mapping Classification and Evaluation Project, Mapping and Assessing the Values of Albany's Wetlands*, SCRIPT.

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Hearn, R., Williams, K., Comer, S. and Beecham, B. (2002) *Jarrah Forest 2 (JF2 – Southern Jarrah Forest subregion)*, A Biodiversity Audit of Western Australia's 53 Biogeographical Subregions in 2002, The Department of Conservation and Land Management, Government of Western Australia.

Shepherd, D.P, Beeston, G.R. and Hopkins, A.J.M (2002) *Native Vegetation in Western Australia extent, type and status*. Department of Agriculture, Government of Western Australia.

Western Australian Planning Commission (WAPC) (2008) *Better Urban Water Management*, State of Western Australia.

APPENDICES

APPENDIX A

Outline Development Plan – Dykstra Planning

OUTLINE DEVELOPMENT PLAN

Lot 30 - 35 Catalina Road, LANGE

DYKSTRA PLANNING

Subdivision, Rezoning, Structure Planning, Development Planning, Design, Advocacy

2953 Albany Highway,
Kelmscott WA 6111

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29 July 2010

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Figure 3A

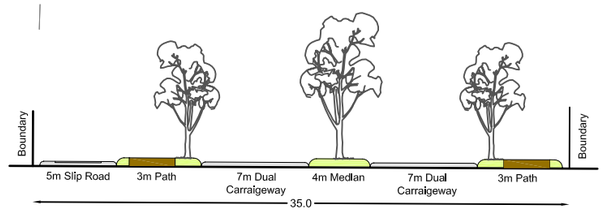
Notes:

- 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.

01136-CDP-F3-100728-D

PUBLIC OPEN SPACE SCHEDULE

Lot No	Lot Area	POS/Drainage	Drainage	POS Less than 50% Drainage	Variation POS
30	7.51 Ha	5420m²	2500m²	4170m²	-3340m²
31	8.19 Ha	11268m²	1600m²	10468m²	+2278m²
32	8.34 Ha	11024m²	Nill	11024m²	+2684m²
33	8.15 Ha	6362m²	1100m²	5812m²	-2338m²
34	8.03 Ha	4248m²	2250m²	3123m²	-4907m²
35	6.22 Ha	6950m²	1400m²	6250m²	+30m²
Sub Totals	**46.44 Ha**	**45273m²**	**8850m²**	**40848m² (8.8%)**	**-5592m² (1.2%)**



RANGE ROAD CROSS SECTION
(including service road)

Future Road Reserve

DEVELOPMENT REQUIREMENTS

1. Catalina Road and Hudson Road will need to be constructed to an urban standard at the time of subdivision, including drainage to be piped, road to be kerbed and road surface to be upgraded.
2. Pathways within the ODP area shall be required as follows:-
   - A 2.5 m shared path along Hudson Road and Catalina Road;
   - A 2.5 m shared path along each of the connector roads between Hudson Road and Catalina Road;
   - 3.0 m pathways on either side of Range Road;
   - 1.5 m pathways where grouped housing lots are situated to connect to the shared paths; and
   - 1.5 m pathways along all other roads.
3. Parallel car parking bays are to be provided on the edge of the larger public open space areas, generally as depicted on the Plan.
4. Range Road will need to be developed as a two lane sealed road between Hudson Road and Catalina Road, as part of the subdivision under this ODP. Contributions to upgrade Range Road from Target Road to Catalina Road to a higher standard in future (ie. 4 lanes) will be required from each subdivider within the ODP area in accordance with an agreed contribution schedule.
5. The 25m width road reserve connecting Catalina to Hudson Roads will need to be designed in a manner that ensures retention of the mature trees along the eastern side
6. All lots interfacing with industrial land to the west will be subject to a detailed area plan requirement, which shall stipulate as a minimum: a 2.0m high masonry wall to the rear boundary; a 15m rear setback requirement for all dwellings; and notifications on titles advising of the adjoining land use
7. All R30 and R40 areas shall be subject to a Detailed Area Plan requirement, particularly to ensure appropriate interface with road reserves, public open space and pedestrian networks
8. Other than for super-lot subdivision, P.O.S area shall be given up as part of the initial stage of subdivision on each lot. Cash-in-lieu shall be paid for any shortfall in P.O.S, whereas P.O.S that exceeds the 10% requirement shall be set aside as a separate P.O.S lot for acquisition.

OUTLINE DEVELOPMENT PLAN

Lot 30 - 35 Catalina Road, LANGE

DYKSTRA PLANNING

Subdivision, Rezoning, Structure Planning, Development Planning, Design, Advocacy

2953 Albany Highway,
Kelmscott WA 6111

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29 July 2010

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Figure 3

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.

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APPENDIX B

Conceptual Stormwater Management Strategy

Drainage Calculations

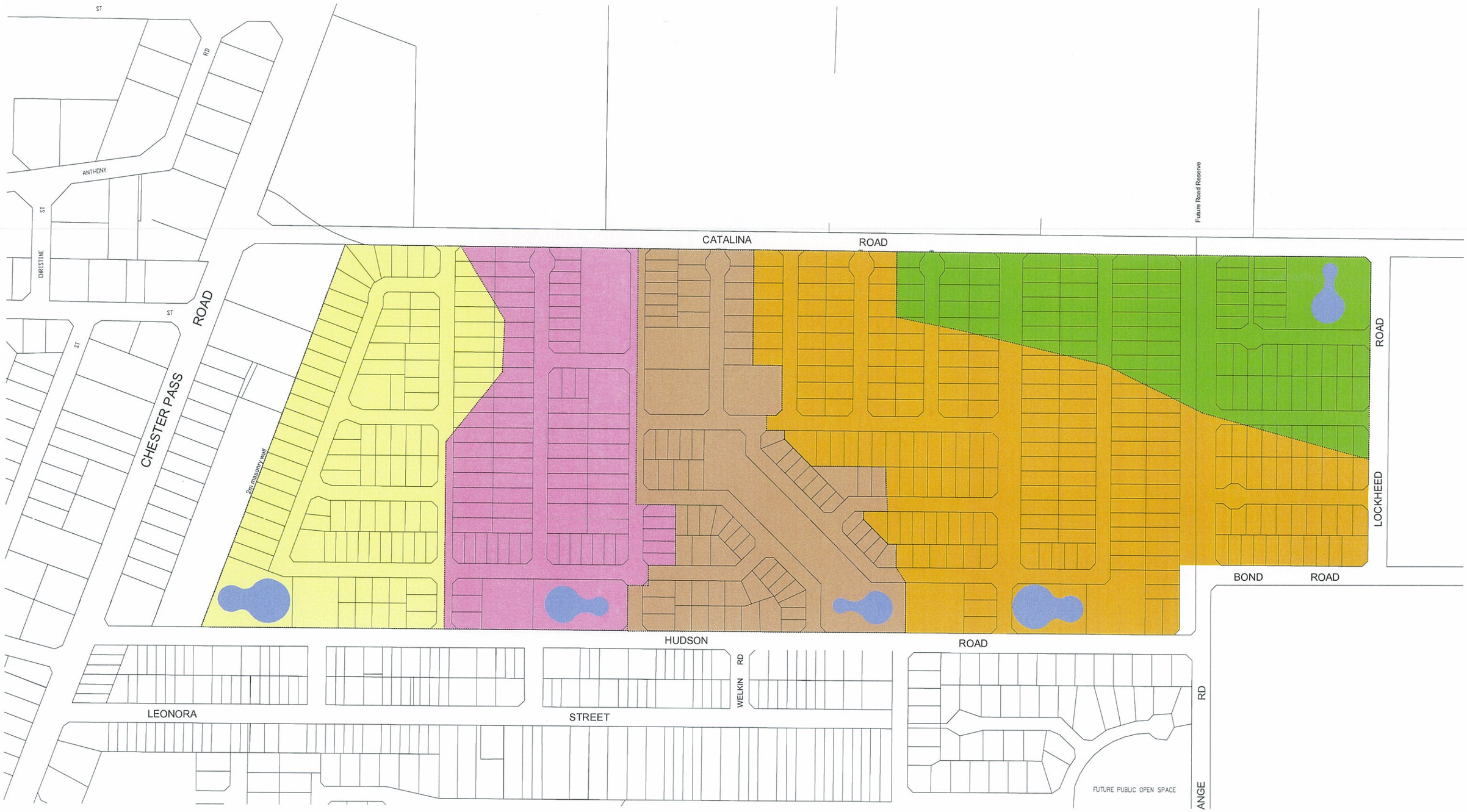


FIGURE 1
SCALE 1:2000

LEGEND

- CATCHMENT AREA 1 : 83,940 m²
- CATCHMENT AREA 2 : 77,619 m²
- CATCHMENT AREA 3 : 78,787 m²
- CATCHMENT AREA 4 : 152,889 m²
- CATCHMENT AREA 5 : 70,177 m²
- PROPOSED BASIN

BASIN AREAS

BASIN AREA 1 : 2,500 m²
BASIN AREA 2 : 1,600 m²
BASIN AREA 3 : 1,100 m²
BASIN AREA 4 : 2,550 m²
BASIN AREA 5 : 1,400 m²

SUMMARY OF DRAINS OUTPUT

PRE-DEVELOPMENT 1 in 5yrs

Pervious = 46.4 Ha
Impervious = 0 Ha

PIPE DETAILS

Name	Max Q (cu.m/s)	Max V (m/s)	Due to Storm	
Pipe1	0.163	1.7	AR&R 5 year, 20 minutes storm, average 46.3 mm/h, Zone 8	**@ Basin B-01**
Pipe2	0.141	1.6	AR&R 5 year, 20 minutes storm, average 46.3 mm/h, Zone 8	**@ Basin B-02**
Pipe3	0.267	1.9	AR&R 5 year, 20 minutes storm, average 46.3 mm/h, Zone 8	**@ Basin B-03**
Pipe4	0.228	1.9	AR&R 5 year, 20 minutes storm, average 46.3 mm/h, Zone 8	**@ Basin B-04**
Pipe5	0.103	1.3	AR&R 5 year, 20 minutes storm, average 46.3 mm/h, Zone 8	**@ Basin B-05**

POST-DEVELOPMENT 1 in 10yrs (Outlet of the Basins)

Pervious = 13.9 Ha
Impervious = 32.5 Ha

PIPE DETAILS

Name	Max Q (cu.m/s)	Max V (m/s)	Due to Storm	
Pipe1	0.163	1.8	AR&R 10 year, 1.5 hours storm, average 19.69 mm/h, Zone 8	**@ Basin B-01**
Pipe2	0.137	2	AR&R 10 year, 1.5 hours storm, average 19.69 mm/h, Zone 8	**@ Basin B-02**
Pipe3	0.233	2.2	AR&R 10 year, 1 hour storm, average 24.94 mm/h, Zone 8	**@ Basin B-03**
Pipe4	0.17	2.4	AR&R 10 year, 1.5 hours storm, average 19.69 mm/h, Zone 8	**@ Basin B-04**
Pipe5	0.087	2.2	AR&R 10 year, 1.5 hours storm, average 19.69 mm/h, Zone 8	**@ Basin B-05**

DETENTION BASIN DETAILS

Name	Max WL	MaxVol	Max Q Total	Max Q Low Level
Basin 01	41.49	**1225.8**	0.165	0.165
Basin 02	40.71	**1133.9**	0.137	0.137
Basin 03	31.84	**929.8**	0.233	0.233
Basin 04	30.3	**2549**	0.17	0.17
Basin 05	36.61	**1138.8**	0.087	0.087

1:10yr ATTENUATION CAPACITY

Q1:10yr post less or equal to Q1:5yr pre
(this will be refined during detailed design to a comparison between 1:10 post-pre development flows)

Meets attenuation requirement	**@ Basin B-01**
Meets attenuation requirement	**@ Basin B-02**
Meets attenuation requirement	**@ Basin B-03**
Meets attenuation requirement	**@ Basin B-04**
Meets attenuation requirement	**@ Basin B-05**

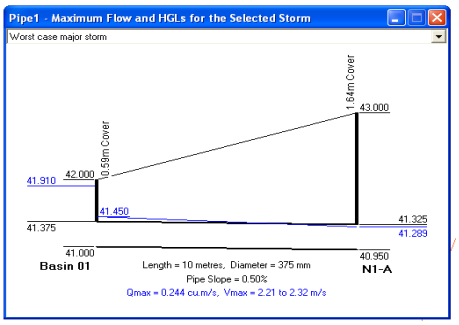
POST-DEVELOPMENT 1 in 100yrs Flood control capacity Basin 1

PIPE DETAILS

Name	Max Q (cu.m/s)	Max V (m/s)	Max U/S HGL (m)	Max D/S HGL (m)	Due to Storm
Pipe1	0.244	2.3	41.45	41.289	AR&R 100 year, 1.5 hours storm, average 31.72 mm/h, Zone 8

DETENTION BASIN DETAILS

Name	Max WL	**MaxVol**	Max Q Total	Max Q Low Level
Basin 01	41.91	**2276.9**	0.244	0.244



DRAINS results prepared 17 March, 2009 from Version 2008.07

SUB-CATCHMENT DETAILS

Name	Max Flow Q (cu.m/s)	Paved Max Q (cu.m/s)	Grassed Max Q (cu.m/s)	Paved Tc (min)	Grassed Tc (min)	Supp. Tc (min)	Due to Storm
CA-1B	0.081	0	0.081	0	17.52		0 AR&R 5 year, 20 minutes storm, average 46.3 mm/h, Zone 8
CA -1A	0.081	0	0.081	0	17.52		0 AR&R 5 year, 20 minutes storm, average 46.3 mm/h, Zone 8
CA-3B	0.134	0	0.134	0	18.07		0 AR&R 5 year, 20 minutes storm, average 46.3 mm/h, Zone 8
CA-3A	0.134	0	0.134	0	18.07		0 AR&R 5 year, 20 minutes storm, average 46.3 mm/h, Zone 8
CA-2A	0.07	0	0.07	0	21.34		0 AR&R 5 year, 20 minutes storm, average 46.3 mm/h, Zone 8
CA-2B	0.07	0	0.07	0	21.34		0 AR&R 5 year, 20 minutes storm, average 46.3 mm/h, Zone 8
CA-4A	0.114	0	0.114	0	18.17		0 AR&R 5 year, 20 minutes storm, average 46.3 mm/h, Zone 8
CA-4B	0.114	0	0.114	0	18.17		0 AR&R 5 year, 20 minutes storm, average 46.3 mm/h, Zone 8
CA-5A	0.052	0	0.052	0	24.21		0 AR&R 5 year, 20 minutes storm, average 46.3 mm/h, Zone 8
CA-5B	0.052	0	0.052	0	24.21		0 AR&R 5 year, 20 minutes storm, average 46.3 mm/h, Zone 8

Outflow Volumes for Total Catchment (0.00 impervious + 46.4 pervious = 46.4 total ha)

Storm	Total Rainfall cu.m	Total Runoff cu.m (Runoff %)	Impervious Runoff cu.m (Runoff %)	Pervious Runoff cu.m (Runoff %)
AR&R 5 year, 10 minutes storm, average 68.89 mm/h, Zone 8	5327.86	122.65 (2.3%)	0.00 (0.0%)	122.65 (2.3%)
AR&R 5 year, 15 minutes storm, average 55.02 mm/h, Zone 8	6382.76	317.52 (5.0%)	0.00 (0.0%)	317.52 (5.0%)
AR&R 5 year, 20 minutes storm, average 46.3 mm/h, Zone 8	7161.56	454.77 (6.4%)	0.00 (0.0%)	454.77 (6.4%)
AR&R 5 year, 25 minutes storm, average 40.21 mm/h, Zone 8	7774.47	572.25 (7.4%)	0.00 (0.0%)	572.25 (7.4%)
AR&R 5 year, 30 minutes storm, average 35.69 mm/h, Zone 8	8280.65	500.49 (6.0%)	0.00 (0.0%)	500.49 (6.0%)
AR&R 5 year, 45 minutes storm, average 27.06 mm/h, Zone 8	9417.53	441.34 (4.7%)	0.00 (0.0%)	441.34 (4.7%)
AR&R 5 year, 1 hour storm, average 22.05 mm/h, Zone 8	10231.91	571.94 (5.6%)	0.00 (0.0%)	571.94 (5.6%)
AR&R 5 year, 1.5 hours storm, average 17.42 mm/h, Zone 8	12125.16	428.49 (3.5%)	0.00 (0.0%)	428.49 (3.5%)

PIPE DETAILS

Name	Max Q (cu.m/s)	Max V (m/s)	Max U/S HGL (m)	Max D/S HGL (m)	Due to Storm
Pipe1	0.163	1.7	41.87	41.865	AR&R 5 year, 20 minutes storm, average 46.3 mm/h, Zone 8
Pipe3	0.267	1.9	31.516	31.511	AR&R 5 year, 20 minutes storm, average 46.3 mm/h, Zone 8
Pipe2	0.141	1.6	40.66	40.655	AR&R 5 year, 20 minutes storm, average 46.3 mm/h, Zone 8
Pipe4	0.228	1.9	27.504	27.499	AR&R 5 year, 20 minutes storm, average 46.3 mm/h, Zone 8
Pipe5	0.103	1.3	35.448	35.443	AR&R 5 year, 20 minutes storm, average 46.3 mm/h, Zone 8

Run Log for Pre1 Development.drn run at 08:20:32 on 17/3/2009

No water upwelling from any pit. Freeboard was adequate at all pits.

DRAINS results prepared 12 July, 2010 from Version 2010.06

SUB-CATCHMENT DETAILS

Name	Max Flow Q (cu.m/s)	Paved Max Q (cu.m/s)	Grassed Max Q (cu.m/s)	Paved Tc (min)	Grassed Tc (min)	Supp. Tc (min)	Due to Storm
CA-1B	0.857	0.619	0.238	10.64	0	0	AR&R 10 year, 25 minutes storm, average 46.66 mm/h, Zone 8
CA -1A	0.857	0.619	0.238	10.64	0	0	AR&R 10 year, 25 minutes storm, average 46.66 mm/h, Zone 8
CA-2A	0.814	0.594	0.22	9.61	0	0	AR&R 10 year, 25 minutes storm, average 46.66 mm/h, Zone 8
CA-2B	0.814	0.594	0.22	9.61	0	0	AR&R 10 year, 25 minutes storm, average 46.66 mm/h, Zone 8
CA-3B	0.685	0.48	0.224	15.29	0	0	AR&R 10 year, 25 minutes storm, average 46.66 mm/h, Zone 8
CA-3A	0.685	0.48	0.224	15.29	0	0	AR&R 10 year, 25 minutes storm, average 46.66 mm/h, Zone 8
CA-4A	1.56	1.126	0.434	10.66	0	0	AR&R 10 year, 25 minutes storm, average 46.66 mm/h, Zone 8
CA-4B	1.56	1.126	0.434	10.66	0	0	AR&R 10 year, 25 minutes storm, average 46.66 mm/h, Zone 8
CA-5A	0.735	0.535	0.199	9.78	0	0	AR&R 10 year, 25 minutes storm, average 46.66 mm/h, Zone 8
CA-5B	0.735	0.535	0.199	9.78	0	0	AR&R 10 year, 25 minutes storm, average 46.66 mm/h, Zone 8

Outflow Volumes for Total Catchment (32.4 impervious + 13.9 pervious = 46.3 total ha)

Storm	Total Rainfall cu.m	Total Runoff cu.m (Runoff %)	Impervious Runoff cu.m (Runoff %)	Pervious Runoff cu.m (Runoff %)
AR&R 10 year, 10 minutes storm, average 81.8 mm/h, Zone 8	6317.82	4612.65 (73.0%)	4098.00 (92.7%)	514.65 (27.2%)
AR&R 10 year, 15 minutes storm, average 64.7 mm/h, Zone 8	7495.66	5508.97 (73.5%)	4922.57 (93.8%)	586.40 (26.1%)
AR&R 10 year, 20 minutes storm, average 54.04 mm/h, Zone 8	8347.56	6160.53 (73.8%)	5518.90 (94.4%)	641.63 (25.6%)
AR&R 10 year, 25 minutes storm, average 46.66 mm/h, Zone 8	9009.46	6591.45 (73.2%)	5982.24 (94.9%)	609.21 (22.5%)
AR&R 10 year, 30 minutes storm, average 41.21 mm/h, Zone 8	9548.56	6920.02 (72.5%)	6359.59 (95.1%)	560.42 (19.6%)
AR&R 10 year, 45 minutes storm, average 30.87 mm/h, Zone 8	10729.1	7721.55 (72.0%)	7185.98 (95.7%)	535.57 (16.6%)
AR&R 10 year, 1 hour storm, average 24.94 mm/h, Zone 8	11557.44	8293.04 (71.8%)	7765.82 (96.0%)	527.22 (15.2%)
AR&R 10 year, 1.5 hours storm, average 19.69 mm/h, Zone 8	13686.82	9874.08 (72.1%)	9256.38 (96.6%)	617.69 (15.0%)

PIPE DETAILS

Name	Max Q (cu.m/s)	Max V (m/s)	Max U/S HGL (m)	Max D/S HGL (m)	Due to Storm
Pipe1	0.165	1.8	41.329	41.248	AR&R 10 year, 1.5 hours storm, average 19.69 mm/h, Zone 8
Pipe2	0.137	2	40.329	40.17	AR&R 10 year, 1.5 hours storm, average 19.69 mm/h, Zone 8
Pipe3	0.233	2.2	31.37	31.234	AR&R 10 year, 1 hour storm, average 24.94 mm/h, Zone 8
Pipe4	0.17	2.4	29.711	29.487	AR&R 10 year, 1.5 hours storm, average 19.69 mm/h, Zone 8
Pipe5	0.087	2.2	36.183	35.918	AR&R 10 year, 1.5 hours storm, average 19.69 mm/h, Zone 8

DETENTION BASIN DETAILS

Name	Max WL (m)	**MaxVol (cu.m.)**	Max Q Total (cu.m/s)	Max Q Low Level (cu.m/s)
Basin 01	41.49	**1225.8**	0.165	0.165
Basin 02	40.71	**1133.9**	0.137	0.137
Basin 03	31.84	**929.8**	0.233	0.233
Basin 04	30.3	**2549**	0.17	0.17
Basin 05	36.61	**1138.8**	0.087	0.087

CONTINUITY CHECK for AR&R 10 year, 25 minutes storm, average 46.66 mm/h, Zone 8

Node	Inflow (cu.m)	Outflow (cu.m)	Storage Change (cu.m)	Difference %
Basin 01	1194.52	471.53	723.03	0
Basin 02	1104.02	531.1	572.97	0
Basin 03	1120.91	789.31	331.64	0
Basin 04	2175.49	659.81	1515.75	0
Basin 05	998.52	340.85	657.71	0

Run Log for Post Development 10yr revC.drn run at 15:35:42 on 12/7/2010

DRAINS results prepared 12 July, 2010 from Version 2010.06

SUB-CATCHMENT DETAILS

Name	**Max** Flow Q (cu.m/s)	**Paved** Max Q (cu.m/s)	**Grassed** Max Q (cu.m/s)	**Paved** Tc (min)	**Grassed** Tc (min)	**Supp.** Tc (min)	**Due to Storm**
CA-1B	1.502	1.082	0.481	10.64	0	0	AR&R 100 year, 15 minutes storm, average 115.89 mm/h, Zone 8
CA -1A	1.502	1.082	0.481	10.64	0	0	AR&R 100 year, 15 minutes storm, average 115.89 mm/h, Zone 8

PIPE DETAILS

Name	Max Q (cu.m/s)	Max V (m/s)	Max U/S HGL (m)	Max D/S HGL (m)	Due to Storm
Pipe1	0.244	2.3	41.45	41.289	AR&R 100 year, 1.5 hours storm, average 31.72 mm/h, Zone 8

OVERFLOW ROUTE DETAILS

Name	Max Q U/S	Max Q D/S	Safe Q	Max D	Max DxV	Max Width	Max V	Due to Storm
OF1	0	0	1.391	0	0	0	0	

DETENTION BASIN DETAILS

Name	Max WL	**MaxVol**	Max Q Total	Max Q Low Level
Basin 01	41.91	**2276.9**	0.244	0.244

CONTINUITY CHECK for AR&R 100 year, 25 minutes storm, average 80.62 mm/h, Zone 8

Node	Inflow (cu.m)	Outflow (cu.m)	Storage Change (cu.m)	Difference %
Basin 01	2375.36	1015.32	1360.14	0

Run Log for Post Development 10yr revC.drn run at 11:39:08 on 12/7/2010

Stormwater Design Calculation

PROJECT : **LOT 30-35 CATALINA ROAD**

Design By: B. Wassink
Date : 12-Jul-10

Checked By :
Date : 12-Jul-10

CATCHMENT : CA-1 (PRE DEV)

Estimated Time of Concentration

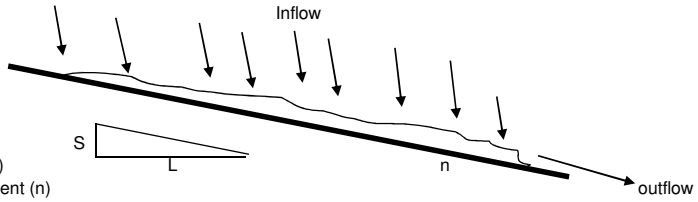
Design Annual recurrence Interval **1 in** **5**

ARI = **5** yrs
Area = **83940** m^2

DETERMINE THE DESIGN INTENSITY - FREQUENCY - DURATION (IFD)

Time of Concentration Kinematic Wave Equation

$$T = \frac{6.94\ (L \times n)^{0.6}}{I^{0.4}\ S^{0.3}}$$



Where

T	Travel time (min.)
L	Overland flow path length (m)
n	Manning's roughness coefficient (n)
I	Rainfall Intensity (mm/hr)
S	Overland flow path slope (m/m)

Overland Flow Plane

L = 366 m
n = 0.03
S = 0.0297 m/m

$$T = \frac{83.93}{I^{0.4}}$$

T_A = **17.52** min

Determine the Duration and Intensity (Table 2)

By Interpolation for event 1 in **5**

Duration	From Table 2
17	82.00
17.53	83.93
18	85.64

Design Intensity	
17	51.10
17.53	**50.19**
18	49.38

Design Duration= **17.53**

Design Intensity= **50.19**

Estimated Time of Concentration (PRE-DEV)

T= **17.52** min

Stormwater Design Calculation

PROJECT : **LOT 30-35 CATALINA ROAD**

Design By: B. Wassink
Date : 12-Jul-10

Checked By :
Date : 12-Jul-10

CATCHMENT : CA-2 (PRE DEV)

Estimated Time of Concentration

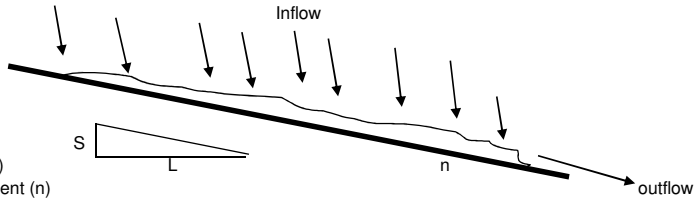
Design Annual recurrence Interval **1 in** **5**

ARI = **5** yrs
Area = **77618** m^2

DETERMINE THE DESIGN INTENSITY - FREQUENCY - DURATION (IFD)

Time of Concentration Kinematic Wave Equation

$$T = \frac{6.94\,(L \times n)^{0.6}}{I^{0.4}\,S^{0.3}}$$



Where

T	Travel time (min.)
L	Overland flow path length (m)
n	Manning's roughness coefficient (n)
I	Rainfall Intensity (mm/hr)
S	Overland flow path slope (m/m)

Overland Flow Plane

L = 436 m
n = 0.03
S = 0.0256 m/m

$$T = \frac{97.47}{I^{0.4}}$$

T_A = **21.34** min

Determine the Duration and Intensity (Table 2)

By Interpolation for event 1 in **5**

Duration	From Table 2
20	92.74
21.40	97.47
25	109.57

Design Intensity	
20	46.30
21.40	**44.59**
25	40.21

Design Duration= **21.40**

Design Intensity= **44.59**

Estimated Time of Concentration (PRE-DEV)

T= **21.34** min

Stormwater Design Calculation

PROJECT : **LOT 30-35 CATALINA ROAD**

Design By: B. Wassink
Date : 12-Jul-10

Checked By :
Date : 12-Jul-10

CATCHMENT : CA-3 (PRE DEV)

Estimated Time of Concentration

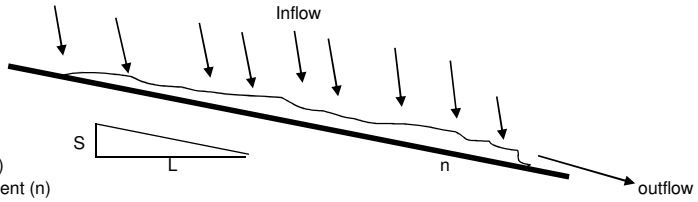
Design Annual recurrence Interval **1 in** **5**

ARI = **5** yrs
Area = **78787** m^2

DETERMINE THE DESIGN INTENSITY - FREQUENCY - DURATION (IFD)

Time of Concentration Kinematic Wave Equation

$$T = \frac{6.94\,(L \times n)^{0.6}}{I^{0.4}\,S^{0.3}}$$



Where

T	Travel time (min.)
L	Overland flow path length (m)
n	Manning's roughness coefficient (n)
I	Rainfall Intensity (mm/hr)
S	Overland flow path slope (m/m)

Overland Flow Plane

L = 462 m
n = 0.03
S = 0.0438 m/m

$$T = \frac{85.90}{I^{0.4}}$$

T_A = **18.07** min

Determine the Duration and Intensity (Table 2)

By Interpolation for event 1 in **5**

Duration	From Table 2
18	85.64
18.07	85.90
20	92.74

Design Intensity	
18	49.38
18.07	**49.27**
20	46.3

Design Duration= **18.07** Design Intensity= **49.27**

Estimated Time of Concentration(PRE-DEV)

T= **18.07** min

Stormwater Design Calculation

PROJECT : **LOT 30-35 CATALINA ROAD**

Design By: B. Wassink
Date : 12-Jul-10

Checked By :
Date : 12-Jul-10

CATCHMENT : CA-4 (PRE DEV)

Estimated Time of Concentration

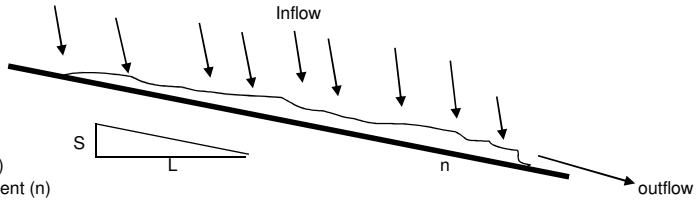
Design Annual recurrence Interval **1 in** **5**

ARI = **5** yrs
Area = **152889** m^2

DETERMINE THE DESIGN INTENSITY - FREQUENCY - DURATION (IFD)

Time of Concentration Kinematic Wave Equation

$$T = \frac{6.94\ (L \times n)^{0.6}}{I^{0.4}\ S^{0.3}}$$



Where

T	Travel time (min.)
L	Overland flow path length (m)
n	Manning's roughness coefficient (n)
I	Rainfall Intensity (mm/hr)
S	Overland flow path slope (m/m)

Overland Flow Plane

L = 429.34 m
n = 0.03
S = 0.0373 m/m

$$T = \frac{86.26}{I^{0.4}}$$

T_A = **18.17** min

Determine the Duration and Intensity (Table 2)

By Interpolation for event 1 in **5**

Duration	From Table 2
18	85.64
18.17	86.26
20	92.74

Design Intensity	
18	49.38
18.17	**49.11**
20	46.3

Design Duration= **18.17**

Design Intensity= **49.11**

Estimated Time of Concentration(PRE-DEV)

T= **18.17** min

Stormwater Design Calculation

PROJECT : **LOT 30-35 CATALINA ROAD**

Design By: B. Wassink
Date : 12-Jul-10

Checked By :
Date : 12-Jul-10

CATCHMENT : CA-5 (PRE DEV)

Estimated Time of Concentration

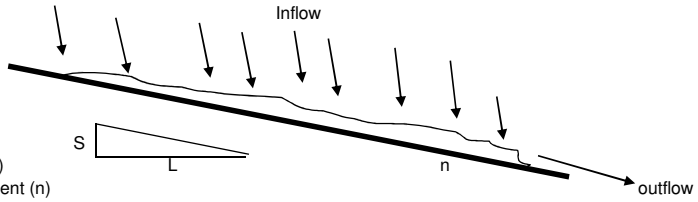
Design Annual recurrence Interval **1 in** **5**

ARI = **5** yrs
Area = **70177** m^2

DETERMINE THE DESIGN INTENSITY - FREQUENCY - DURATION (IFD)

Time of Concentration Kinematic Wave Equation

$$T = \frac{6.94\ (L \times n)^{0.6}}{I^{0.4}\ S^{0.3}}$$



Where

T	Travel time (min.)
L	Overland flow path length (m)
n	Manning's roughness coefficient (n)
I	Rainfall Intensity (mm/hr)
S	Overland flow path slope (m/m)

Overland Flow Plane

L = 470.4 m
n = 0.03
S = 0.0218 m/m

$$T = \frac{107.05}{I^{0.4}}$$

T_A = **24.21** min

Determine the Duration and Intensity (Table 2)

By Interpolation for event 1 in **5**

Duration	From Table 2
20	92.74
24.25	107.05
25	109.57

Design Intensity	
20	46.30
24.25	**41.12**
25	40.21

Design Duration= **24.25** Design Intensity= **41.12**

Estimated Time of Concentration(PRE-DEV)

T= **24.21** min

Stormwater Design Calculation

PROJECT : **LOT 30-35 CATALINA ROAD**

Design By: B. Wassink
Date : 12-Jul-10

Checked By :
Date : 12-Jul-10

CATCHMENT : CA-1 (POST DEV)

Estimated Time of Concentration

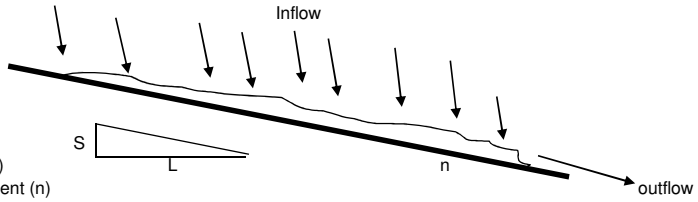
Design Annual recurrence Interval **1 in** **10**

ARI = **10** yrs
Area = **83940** m^2

DETERMINE THE DESIGN INTENSITY - FREQUENCY - DURATION (IFD)

Time of Concentration Kinematic Wave Equation

$$T = \frac{6.94\,(L \times n)^{0.6}}{I^{0.4}\,S^{0.3}}$$



Where

T	Travel time (min.)
L	Overland flow path length (m)
n	Manning's roughness coefficient (n)
I	Rainfall Intensity (mm/hr)
S	Overland flow path slope (m/m)

Overland Flow Plane

L = 460.96 m
n = 0.013
S = 0.0255 m/m

$$T = \frac{61.09}{I^{0.4}}$$

T_A = **10.64** min

Determine the Duration and Intensity (Table 2)

By Interpolation for event 1 in **10**

Duration	From Table 2
11	62.70
10.63	61.09
12	67.06

Design Intensity	
11	77.57
10.63	**78.96**
12	73.82

Design Duration= **10.63** Design Intensity= **78.96**

Estimated Time of Concentration

T= **10.64** min

Stormwater Design Calculation

PROJECT : **LOT 30-35 CATALINA ROAD**

Design By: B. Wassink
Date : 12-Jul-10

Checked By :
Date : 12-Jul-10

CATCHMENT : CA-2 (POST DEV)

Estimated Time of Concentration

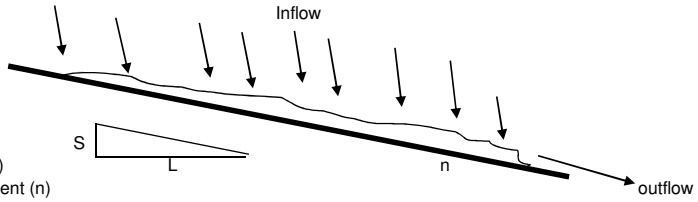
Design Annual recurrence Interval **1 in** **10**

ARI = **10** yrs
Area = **77618** m^2

DETERMINE THE DESIGN INTENSITY - FREQUENCY - DURATION (IFD)

Time of Concentration Kinematic Wave Equation

$$T = \frac{6.94\,(L \times n)^{0.6}}{I^{0.4}\,S^{0.3}}$$



Where

T	Travel time (min.)
L	Overland flow path length (m)
n	Manning's roughness coefficient (n)
I	Rainfall Intensity (mm/hr)
S	Overland flow path slope (m/m)

Overland Flow Plane

L = 415 m
n = 0.013
S = 0.0269 m/m

$$T = \frac{56.45}{I^{0.4}}$$

T_A = **9.61** min

Determine the Duration and Intensity (Table 2)

By Interpolation for event 1 in **10**

Duration	From Table 2
9	53.61
9.62	56.45
10	58.22

Design Intensity	
9	86.61
9.62	**83.65**
10	81.8

Design Duration= **9.62** Design Intensity= **83.65**

Estimated Time of Concentration

T= **9.61** min

Stormwater Design Calculation

PROJECT : **LOT 30-35 CATALINA ROAD**

Design By: B. Wassink
Date : 12-Jul-10

Checked By :
Date : 12-Jul-10

CATCHMENT : CA-3 (POST DEV)

Estimated Time of Concentration

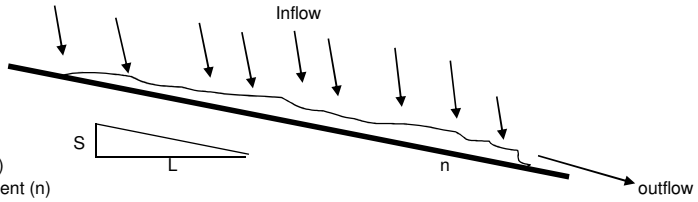
Design Annual recurrence Interval **1 in** **10**

ARI = **10** yrs
Area = **78787** m^2

DETERMINE THE DESIGN INTENSITY - FREQUENCY - DURATION (IFD)

Time of Concentration Kinematic Wave Equation

$$T = \frac{6.94\,(L \times n)^{0.6}}{I^{0.4}\,S^{0.3}}$$



Where

T	Travel time (min.)
L	Overland flow path length (m)
n	Manning's roughness coefficient (n)
I	Rainfall Intensity (mm/hr)
S	Overland flow path slope (m/m)

Overland Flow Plane

L = 775 m
n = 0.013
S = 0.0285 m/m

$$T = \frac{80.70}{I^{0.4}}$$

T_A = **15.29** min

Determine the Duration and Intensity (Table 2)

By Interpolation for event 1 in **10**

Duration	From Table 2
15	79.52
15.30	80.70
16	83.49

Design Intensity	
15	64.70
15.30	**63.96**
16	62.2

Design Duration= **15.30**

Design Intensity= **63.96**

Estimated Time of Concentration

T= **15.29** min

Stormwater Design Calculation

PROJECT : **LOT 30-35 CATALINA ROAD**

Design By: B. Wassink
Date : 12-Jul-10

Checked By :
Date : 12-Jul-10

CATCHMENT : CA-4 (POST DEV)

Estimated Time of Concentration

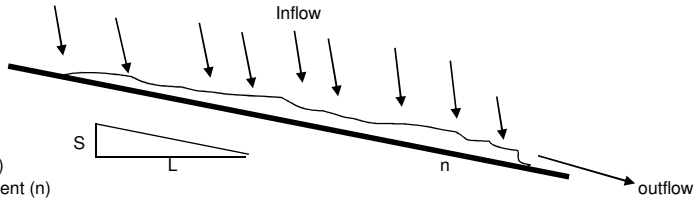
Design Annual recurrence Interval **1 in** **10**

ARI = **10** yrs
Area = **152889** m^2

DETERMINE THE DESIGN INTENSITY - FREQUENCY - DURATION (IFD)

Time of Concentration Kinematic Wave Equation

$$T = \frac{6.94\ (L \times n)^{0.6}}{I^{0.4}\ S^{0.3}}$$



Where

T	Travel time (min.)
L	Overland flow path length (m)
n	Manning's roughness coefficient (n)
I	Rainfall Intensity (mm/hr)
S	Overland flow path slope (m/m)

Overland Flow Plane

L = 493 m
n = 0.013
S = 0.0372 m/m

$$T = \frac{56.79}{I^{0.4}}$$

T_A = **10.66** min

Determine the Duration and Intensity (Table 2)

By Interpolation for event 1 in **10**

Duration	From Table 2
10	54.04
10.68	56.79
12	62.07

Design Intensity	
10	67.90
10.68	**65.49**
12	60.85

Design Duration= **10.68**

Design Intensity= **65.49**

Estimated Time of Concentration

T= **10.66** min

Stormwater Design Calculation

PROJECT : **LOT 30-35 CATALINA ROAD**

Design By: B. Wassink
Date : 12-Jul-10

Checked By :
Date : 12-Jul-10

CATCHMENT : CA-5 (POST DEV)

Estimated Time of Concentration

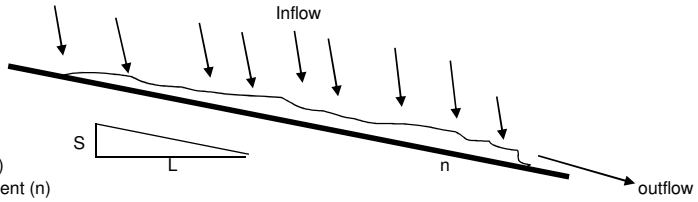
Design Annual recurrence Interval **1 in** **10**

ARI = **10** yrs
Area = **70177** m^2

DETERMINE THE DESIGN INTENSITY - FREQUENCY - DURATION (IFD)

Time of Concentration Kinematic Wave Equation

$$T = \frac{6.94\ (L \times n)^{0.6}}{I^{0.4}\ S^{0.3}}$$



Where

T	Travel time (min.)
L	Overland flow path length (m)
n	Manning's roughness coefficient (n)
I	Rainfall Intensity (mm/hr)
S	Overland flow path slope (m/m)

Overland Flow Plane

L = 392.41 m
n = 0.013
S = 0.023 m/m

$$T = \frac{57.21}{I^{0.4}}$$

T_A = **9.78** min

Determine the Duration and Intensity (Table 2)

By Interpolation for event 1 in **10**

Duration	From Table 2
9	53.61
9.78	57.21
10	58.22

Design Intensity	
9	86.61
9.78	**82.86**
10	81.8

Design Duration= **9.78** Design Intensity= **82.86**

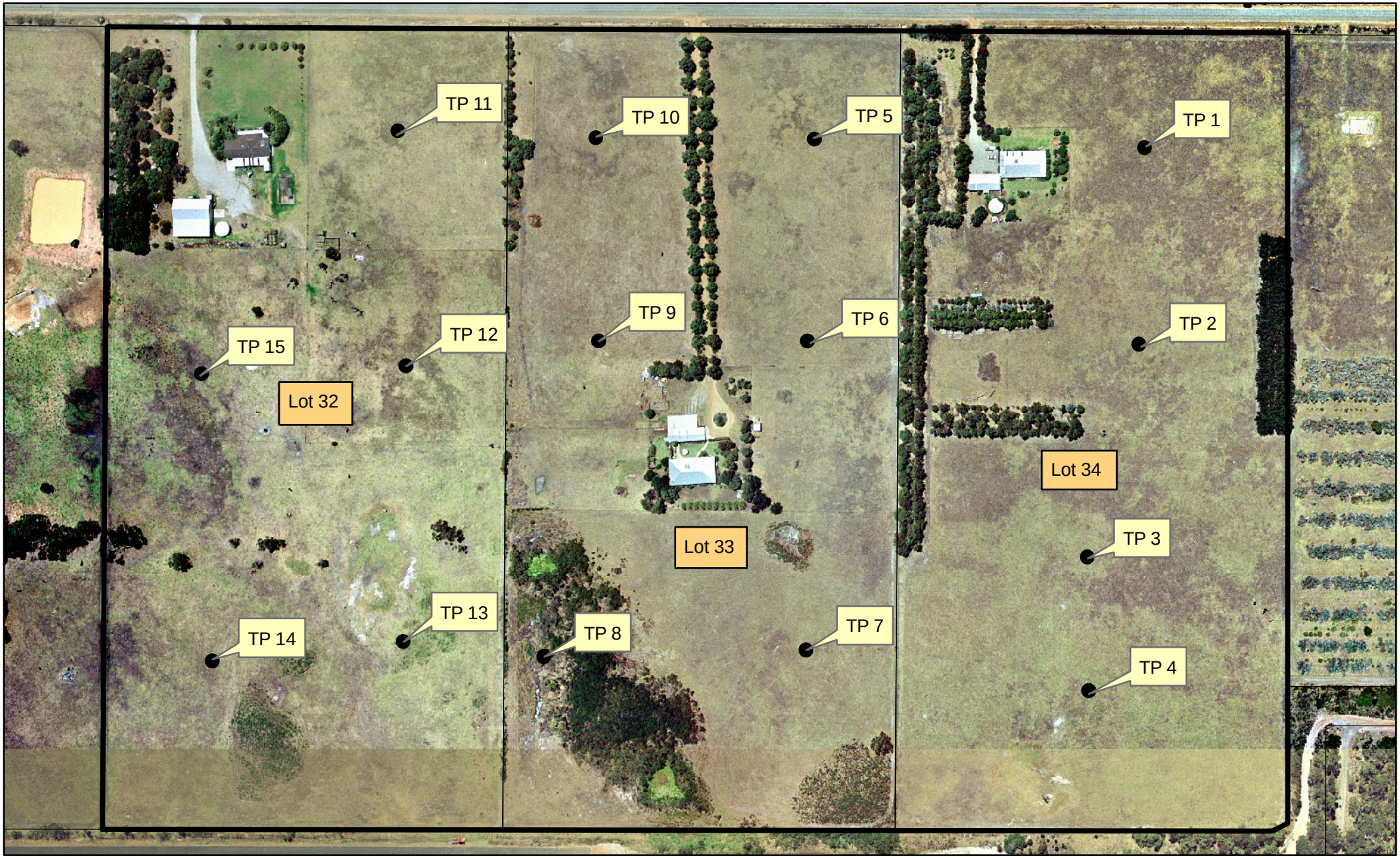
Estimated Time of Concentration

T= **9.78** min

APPENDIX C

Soil Profile and Test Pit Locations

Lots 32, 33 & 34 Catalina Rd Albany
Test Pit Locations



0 30 60 120 Meters

OPUS

Soil Profile Catalina Rd

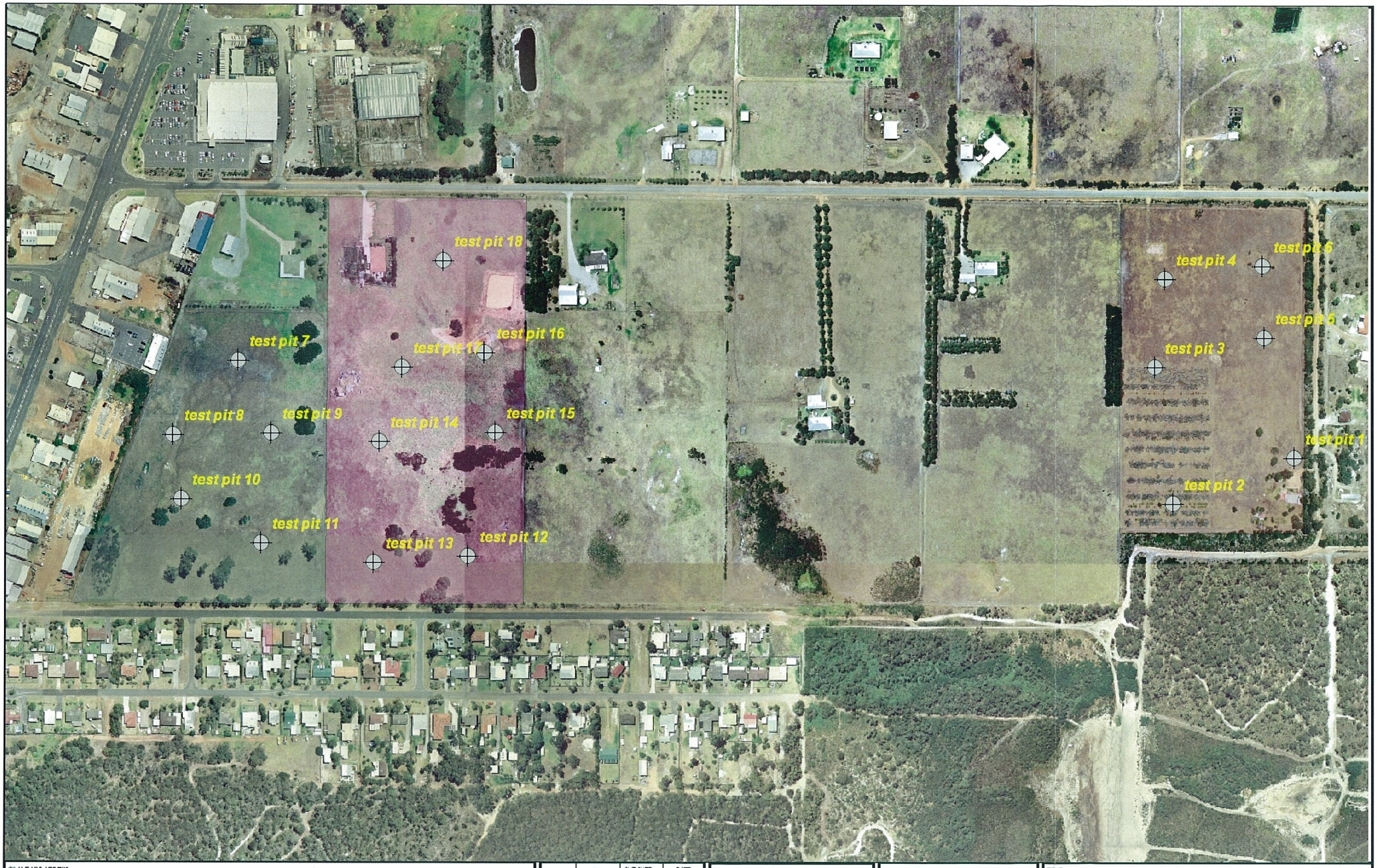
Location: Lots 32, 33 and 34 Catalina Rd, Albany

Date tested: 16th April 2007

Sampled by: Emma Huxley

Location	Site description	Depth of profile (mm)	Soil Description
Test Pit 1	lot 34 open paddock	0 – 100 100 – 750 750 – 2000	dry grey silty sandy topsoil dry browny orange sandy gravel dry to slightly moist yellow white red clay
Test Pit 2	lot 34 open paddock	0 – 100 100 – 600 600 – 1100 1100 – 2000	dry grey silty sandy topsoil dry browny orange sandy gravel dry white yellow red clay slightly moist white yellow red clay
Test Pit 3	lot 34 open paddock	0 – 100 100 – 200 200 – 500 500 – 1700 1700 – 2000	dry dark grey silty sandy topsoil dry light grey silty sand dry light grey sandy silt with gravel dry browny orange sandy gravel dry browny orange sand with gravel
Test Pit 4	lot 34 open paddock	0 – 100 100 – 1700 1700 – 2000	dry grey silty sandy topsoil dry light grey to white silty sand dry orangey brown sandy gravel
Test Pit 5	lot 33 open paddock	0 – 100 100 – 200 200 – 800 800 – 2000	dry dark grey silty sandy topsoil dry grey brown silty sand dry orangey brown sandy gravel dry to slightly moist yellow red white clay
Test pit 6	lot 33 open paddock	0 – 100 100 – 200 200 – 750 750 – 2000	dry dark grey silty sandy topsoil dry grey silty sand dry orangey brown sandy gravel dry to slightly moist yellow red white clay
Test Pit 7	lot 33 open paddock	0 – 100 100 – 500 500 – 1250 1250	dry grey silty sandy topsoil dry grey brown silty sand dry orangey brown sandy gravel hit rock – most likely a floater
Test Pit 8	lot 33 seasonally inundated area	0 – 100 100 – 2000	moist dry dark grey topsoil with organic matter moist light grey to white silty sand
Test Pit 9	lot 33 open paddock	0 – 100 100 – 250 250 – 700 700 – 2000	dry dark grey silty sandy topsoil dry grey brown silty sand dry brown sandy gravel dry to slightly moist yellow red white clay

Test Pit 10	lot 33open paddock	0 – 100 100 – 150 150 – 700 700 – 2000	dry dark grey silty sandy topsoil dry grey brown silty sand dry brown sandy gravel dry to slightly moist yellow red white clay
Test Pit 11	lot 32 open paddock	0 – 100 100 – 300 300 – 800 800 – 2000	dry dark grey silty sandy topsoil dry grey silty sand dry orangey brown sandy gravel dry yellow red white clay
Test Pit 12	lot 32 open paddock	0 – 100 100 – 300 300 – 900 900 – 2000	dry dark grey silty sandy topsoil dry grey silty sand dry brown sandy gravel dry to slightly moist yellow red white clay
Test Pit 13	lot 32 open paddock	0 – 150 150 – 2000	dry grey silty sandy topsoil dry light grey to white silty sand
Test Pit 14	lot 32 open paddock	0 – 100 100 – 600 600 – 1000 1000 – 2000	dry dark grey silty sandy topsoil dry light grey silty sand dry orangey brown sandy gravel dry yellow red white clay
Test Pit 15	lot 32 open paddock	0 – 100 100 – 500 500 – 1000 1000 – 2000	dry dark grey silty sandy topsoil dry grey silty sand dry grey brown sandy silt with gravel dry yellow red white clay



SCALE AND LEGEND

Legend

Albany Cadastre

Lot Number

N

W E

S

0 55 110 220 Meters

1 centimeter equals 35 meters

	By	CHECKED	DATE
DESIGN			
DRAWN	S Glasbrook		22/05/08
APPROVED			2/6/08.

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Client

Dykstra Planning

OPUS

Albany Office

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Albany WA 6330, Australia

Tel: +61 8 9842 0166
Fax: +61 8 9842 0066

TITLE

Actual Test Pit Locations

Test Pits on Lots 30, 31 and 35 Catalina Road

STATUS	FILE
STATUS	waenw078
SCALE	PLOT DATE
1:3,500	Mapped on 22. May. 2008

ALBANY SOIL AND CONCRETE TESTING

39 Hill St, Albany. W.A. 6330
Phone/Fax: 08 98415309 Mobile: 0427 277797
Email: albsoil@omninet.net.au
A.B.N. : 65 229 884 872

REF: 11630

CLIENT: OPUS INTERNATIONAL

PROJECT: LOTS 30, 31 & 35 CATALINA RD

DATE TESTED: 12-05-08 **TESTED BY:** SCOTT DRAKE-BROCKMAN

APPROVED BY: COLIN GOUGH **SIGNATURE:**

SITE INVESTIGATION

LOT 35

LOC 1	0- 150mm	DARK GREY SAND WITH SILT (TOPSOIL). MOIST
	150- 600mm	DARK BROWN SANDY GRAVEL WITH SILT. MOIST
	600-1200mm	LIGHT BROWN SILTY CLAY. MOIST
	1200-2000mm	RED/GREY SILTY CLAY. MOIST
		WATER TABLE NOT REACHED
LOC 2	0- 200mm	DARK GREY SAND WITH SILT (TOPSOIL). MOIST
	200- 500mm	BROWN SANDY GRAVEL. MOIST
	500-1500mm	BROWN SILTY SAND MINOR CLAY. MOIST
	1500-2000mm	BROWN SILTY CLAYEY SAND WITH GRAVEL. MOIST
		WATER TABLE NOT REACHED
LOC 3	0- 100mm	DARK GREY SAND WITH SILT (TOPSOIL). MOIST
	100- 700mm	DARK BROWN SANDY GRAVEL WITH SILT. MOIST
	700-1500mm	LIGHT BROWN SILTY CLAY. MOIST
	1500-2000mm	RED/GREY SILTY CLAY WITH MINOR GRAVEL. MOIST
		WATER TABLE NOT REACHED
LOC 4	0- 100mm	DARK GREY SAND WITH SILT (TOPSOIL). MOIST
	100- 750mm	DARK BROWN SANDY GRAVEL WITH SILT. MOIST
	750-1300mm	LIGHT BROWN SILTY CLAY. MOIST
	1300-2000mm	RED/GREY SILTY CLAY
		WATER TABLE NOT REACHED
LOC 5	0- 100mm	DARK GREY SAND WITH SILT (TOPSOIL). MOIST
	100- 750mm	DARK BROWN SANDY GRAVEL WITH SILT. MOIST
	750-1200mm	LIGHT BROWN SILTY CLAY. MOIST
	1200-2000mm	GREY/BROWN SILTY CLAY. MOIST
		WATER TABLE NOT REACHED
LOC 6	0- 100mm	DARK GREY SAND WITH SILT (TOPSOIL). MOIST
	100- 900mm	DARK BROWN SANDY GRAVEL. MOIST
	900-1300mm	LIGHT BROWN SILTY CLAY. MOIST
	1300-2000mm	RED/GREY SILTY CLAY. MOIST
		WATER TABLE NOT REACHED

LOT 30

LOC 7	0- 150mm	DARK GREY SAND WITH SILT (TOPSOIL). MOIST
	150- 400mm	DARK GREY SAND WITH SILT. MOIST
	400- 700mm	DARK BROWN GRAVELLY SAND WITH SILT. MOIST
	700-1200mm	BROWN SANDY GRAVEL WITH SILT. DRY
	1200-1800mm	BROWN SANDY CLAY MINOR GRAVEL. MOIST
	1800-2000mm	RED/GREY SILTY CLAY. MOIST
		WATER TABLE NOT REACHED
LOC 8	0- 150mm	DARK GREY SAND WITH SILT (TOPSOIL). MOIST
	150- 400mm	GREY SAND WITH SILT. MOIST
	400- 800mm	DARK BROWN GRAVELLY SAND WITH SILT (CEMENTED). MOIST
	800-1800mm	BROWN SILTY SAND MINOR CLAY. MOIST
	1800-2000mm	BROWN/ORANGE SILTY CLAY. MOIST
		WATER TABLE NOT REACHED

LOC 9	0- 150mm	DARK GREY SAND WITH SILT (TOPSOIL). MOIST
	150- 900mm	BROWN SANDY GRAVEL WITH SILT. MOIST
	900-1200mm	LIGHT BROWN SILTY CLAY. MOIST
	1200-2000mm	RED/GREY SILTY CLAY. MOIST
		WATER TABLE NOT REACHED
LOC 10	0- 200mm	DARK GREY SAND WITH SILT (TOPSOIL). MOIST
	200- 700mm	LIGHT GREY SAND WITH SILT. MOIST
	700- 900mm	LIGHT BROWN CLAYEY SANDY GRAVEL. MOIST
	900-1600mm	LIGHT BROWN/ORANGE SILTY CLAY. MOIST
	1600-2000mm	LIGHT BROWN/ORANGE SILTY CLAY. MOIST
		WATER TABLE NOT REACHED
LOC 11	0- 50mm	DARK GREY SAND WITH SILT (TOPSOIL). MOIST
	50- 900mm	LIGHT BROWN SILTY CLAY. MOIST
	900-1600mm	BROWN/GREY SILTY CLAY. MOIST
	1600-2000mm	RED SILTY CLAY. MOIST
		WATER TABLE NOT REACHED
LOT 31		
LOC 12	0- 100mm	DARK GREY AND WITH SILT (TOPSOIL). MOIST
	100- 500mm	LIGHT GREY SAND WITH SILT. MOIST
	500-1200mm	BROWN SANDY GRAVEL WITH SILT. MOIST
	1200-2000mm	LIGHT BROWN SILTY CLAY. MOIST
		WATER TABLE NOT REACHED
LOC 13	0- 100mm	DARK GREY SAND WITH SILT (TOPSOIL). MOIST
	100- 400mm	BROWN SILTY ANDY GRAVEL. MOIST
	400-1500mm	BROWN SILTY CLAY. MOIST
	1500-2000mm	GREY/BROWN SILTY CLAY. MOIST
		WATER TABLE NOT REACHED
LOC 14	0- 100mm	DARK GREY SAND WITH SILT (TOPSOIL). MOIST
	100- 300mm	DARK GREY SAND WITH SILT. MOIST
	300- 700mm	LIGHT GREY SAND WITH SILT. MOIST
	700- 900mm	BROWN CLAYEY SAND. MOIST
	900-1300mm	BROWN SILTY CLAY. MOIST
	1300-1900mm	LIGHT GREY/BROWN SILTY CLAY. MOIST
	1900-2000mm	RED/BROWN SILTY CLAY. MOIST
		WATER TABLE NOT REACHED
LOC 15	0- 100mm	DARK GREY SAND WITH SILT (TOPSOIL). MOIST
	100-2000mm	LIGHT GREY SAND WITH SILT. MOIST
		WATER TABLE NOT REACHED
LOC 16	0- 100mm	DARK GREY SAND WITH SILT (TOPSOIL). MOIST
	100-2000mm	LIGHT GREY SAND WITH SILT. MOIST
		WATER TABLE MOT REACHED
LOC 17	0- 100mm	DARK GREY SAND WITH SILT (TOPSOIL). MOIST
	100-1500mm	GREY/LIGHT GREY SAND WITH SILT. MOIST
	1500-1600mm	BLACK SILTY SAND (CEMENTED). MOIST
	1600-2000mm	LIGHT GREY/LIGHT BROWN SILTY CLAY. MOIST
		WATER TABLE NOT REACHED
LOC 18	0- 100mm	DARK GREY SAND WITH SILT (TOPSOIL). MOIST
	100- 300mm	GREY SAND WITH SILT. MOIST
	300- 500mm	DARK BROWN SAND WITH SILT. MOIST
	500-1000mm	CREAM SAND WITH SILT. MOIST
	1000-1100mm	BROWN SANDY GRAVEL WITH SILT. MOIST
	1100-1500mm	LIGHT BROWN SILTY CLAY. MOIST
	1500-2000mm	LIGHT GREY/BROWN SILTY CLAY. MOIST
		WATER TABLE NOT REACHED

APPENDIX D

Heritage Information

Aboriginal Heritage Inquiry System

Register of Aboriginal Sites

Search Criteria

1 sites in a search box. The box is formed by these diagonally opposed corner points:

MGA Zone 50	
Northing	Easting
6126332	579478
6127948	581586

Disclaimer

Aboriginal sites exist that are not recorded on the Register of Aboriginal Sites, and some registered sites may no longer exist. Consultation with Aboriginal communities is on-going to identify additional sites. The AHA protects all Aboriginal sites in Western Australia whether or not they are registered.

Copyright

Legend

Restriction

N	No restriction
M	Male access only
F	Female access

Access

C	Closed
O	Open
V	Vulnerable

Coordinate Accuracy

Accuracy is shown as a code in brackets following the site coordinates.

[Reliable]	The spatial information recorded in the site file is deemed to be reliable, due to methods of capture.
[Unreliable	The spatial information recorded in the site file is deemed to be unreliable due to errors of spatial data capture and/or quality of spatial information reported.

Status

L	Lodged
I	Insufficient Information
P	Permanent register
S	Stored data

IR	Insufficient Information (as assessed by Site Assessment Group)
PR	Permanent register (as assessed by Site Assessment Group)
SR	Stored data (as assessed by Site Assessment Group)

Site Assessment Group (SAG)

Sites lodged with the Department are assessed under the direction of the Registrar of Aboriginal Sites. These are not to be considered the final assessment.

Final assessment will be determined by the Aboriginal Cultural Material Committee (ACMC).

Spatial Accuracy

Index coordinates are indicative locations and may not necessarily represent the centre of sites, especially for sites with an access code “closed” or “vulnerable”. Map coordinates (Lat/Long) and (Easting/Northing) are based on the GDA 94 datum. The Easting / Northing map grid can be across one or more zones. The zone is indicated for each Easting on the map, i.e. '5000000:Z50' means Easting=5000000, Zone=50.

Aboriginal Heritage Inquiry System

Register of Aboriginal Sites

Site ID	Status	Access	Restriction	Site Name	Site Type	Additional Info	Informants	Coordinates	Site No.
24418	L	O	N	Yakamia Creek	Mythological, Historical	Natural Feature, Water Source, [Other: Path of migration between a chain of historical]	*Registered Informant names available from DIA.	582591mE 6126976mN Zone 50 [Reliable]	

Legend

- Highlighted Area
- Town
- Map Area
- Search Area

Search Criteria

0 surveys in a search box. The box is formed by these diagonally opposed corner points:

MGA Zone 50	
Northing	Easting
6126402	579491
6127978	581607

Disclaimer

Heritage Surveys have been mapped using information from the reports and / or other relevant data sources. Heritage Surveys consisting of small discrete areas may not be visible except at large scales. Reports shown may not be held at DIA. Please consult report holder for more information. Refer to www.dia.wa.gov.au/heritage for information on requesting reports held by DIA.

Copyright

Legend

Access

Some reports are restricted. The type of restriction is shown as a code in brackets following the catalogue number. No code indicates an unrestricted report.

[CLOSED]	Closed
[OWE]	Open with exception
[TBD]	To be determined
[RESTRICTED PENDING]	Restricted pending

Legend

- Highlighted Area
- Town
- Map Area
- Search Area

Appendix D:
Traffic Management Statement – Opus International Consultants

Outline Development Plan
Lots 30 – 35 Catalina Rd and Lot 1000 Lockheed Rd Lange

30 July 2010

Henry Dykstra
Director
Dykstra Planning
PO Box 319
KELSCOTT WA 6991

File: WAMSC280 2ZA V2

Dear Henry

Traffic Statement: Lots 30 -35 Catalina Road.

This traffic statement reviews the attached ODP 01136-CDP-F3-100728-D for Lots 30-35 Catalina Road dated 29 July 2010. The current ODP incorporates recommendations from Opus' previous traffic statement on ODP 01136-CDP-F1-100623-B a3 dated 23 July 2010.

The statement is limited to:

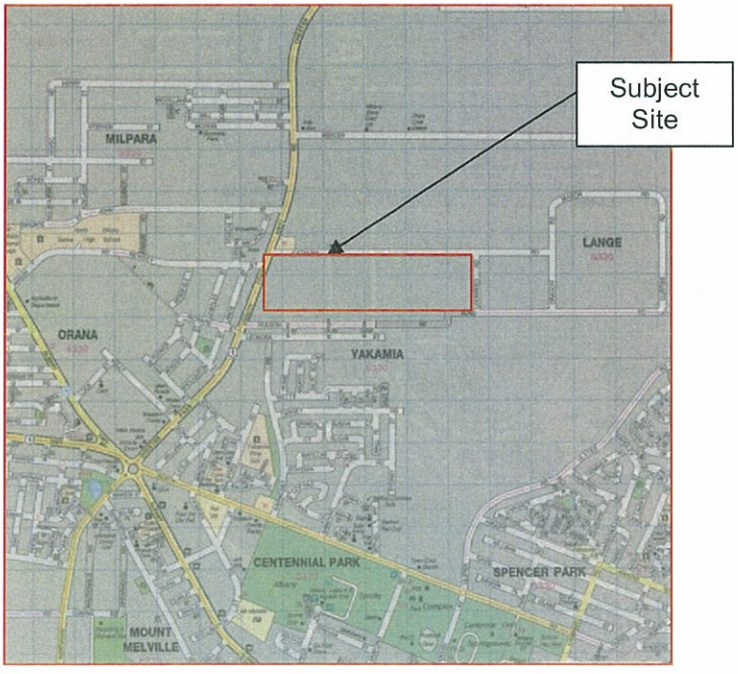
- A desk top review of the ODP.
- Brief comments on the appropriate standards, obvious safety issues and traffic circulation access / issues.

The desktop assessment has broadly followed the WAPC "*Transport Assessment Guidelines For Developments Volume 2 – Structure August 2006"* and the requirements of the WAPC "*Liveable Neighbourhoods October 2004".*

The statement does not include a detailed assessment of traffic generation or detailed impacts on the adjoining road network or land uses. It is understood that these may be required in more detail as the approval process proceeds.

Location

Lots 30-35 Catalina Road is located south east of Albany and covers an area of approximately 46.4 hectares. Lots 30-35 are bounded by Chester Pass Road to the west, Catalina Road to the north, Hudson and Lockheed Road to the south and east respectively. Please refer to Locality Map Below.



CONSULT AUSTRALIA
Business | Engineering | Design
Member Firm

Context with Surrounds

As shown in the attached aerial photo the existing site is predominantly rural grassland, undulating hills with few trees of various sizes, and some existing houses.

- The areas adjoining the development to the West (Chester Pass Road) are mixed use and industrial areas.
- The areas to the south of the development (Hudson Road) are well established existing residential areas.
- The area to the north west of the site is Brooks Gardens Shopping centre and a proposed residential subdivision on lot 1002 Catalina Road.
- The area to the north east and east is rural, similar to the current state of the proposed development site.

As described in the sections below, Opus considers that the traffic impact on the existing residential streets of Hudson Road and Leonora Street needs to be minimised. Traffic should be encouraged to utilise Catalina Road to the north and, when developed, Range Road to the east of the existing residential area.

Development Proposal

As per the outline development plan (ODP) for Lots 30-35 Catalina Road the proposal is to develop the 46.44 ha site into the following approximate number of lots:

- 354 R20 lots;
- 107 R30 lots;
- 7 multi dwelling R30 Lots;
- 3 multi dwelling R40 lots; and
- Pos / drainage 4.42ha.

Total subdivision = 471 lots, approximately 500 dwellings.

From an engineering point of view, it is recommended that construction of the development should start from the higher ground near Catalina Road and move southwards. This recommended because:

1. Traffic can be accessed through Catalina Road which intersection with Chester pass Road is to a higher standard currently than the intersection with Hudson Road;
2. Upgrade options for Catalina Road are easier and therefore initially cheaper than the potential cost of upgrading Hudson Road in the short term.
3. Established lots will not be damaged and have flooding issues during construction from lots above; and
4. Temporary drainage facilities can be built below each stage better controlling run-off from the site during construction.

As per the ODP the proposed subdivision requirements will be:

- Catalina Road and Hudson Road will be constructed to an urban *(City of Albany)* standard at the time of subdivision, including drainage to be piped, road to be kerbed and road surface to be upgraded;
- Pathways within the ODP area shall be required as follows:
    - 2.5m shared path along Hudson Road and Catalina Road *(to connect to the paths on Chester pass Road);*
    - 2.5m shared path along each of the connector streets between Hudson Road and Catalina Road;
    - 3.0m shared pathways on either side of Range Road *(these only need to be 2.5m)*
    - 1.5m pathways where grouped housing lots are situated to connect to the shared paths; and
    - 1.5m paths on all other roads.
- Parallel parking bays are to be provided on the edge of the larger POS as depicted on the ODP plan;

- Range Road is to be developed as a two lane sealed road between Hudson and Catalina Roads as part of this subdivision. With contributions to the range road from Target Road to 4 lanes in the future; and
- The 25m width road reserve connecting Catalina and Hudson Roads will be designed in a manner to that ensures retention of the mature trees along the eastern side.

Existing Traffic Volumes
Traffic volumes for the site and adjoining road network have not been assessed as part of this traffic statement.

Crash History
The 5 year reported crash statistics in the vicinity have not been reviewed as part of this traffic statement.

Road Hierarchy
A summary of the current Road Hierarchy as defined in the Draft City of Albany Transport Model, attached, is listed in the table below. Standards appropriate to the current Road Hierarchy should be determined within the frame work of Liveable Neighbourhoods and in accordance with the City of Albany Subdivision Guidelines.

Table 1: Road Hierarchy and Current Function

NAME	Defined Road Hierarchy	Desired standard (Liveable Neighbourhood)
Chester pass Road	Integrator Arterial (Main Road)	(20-30 road reserve) 60km/h Urban standard, 4 lanes, 2 carriageways X 10.7m pavement median divided.
Catalina Road	Neighbourhood Connector	(20m road reserve) 50km/h, urban standard up to 3000vpd 11.2m un divided pavement plus shared path.
Hudson Road	Access Street	(20m Existing road reserve) 50km/h urban standard up to 3000vpd 7.5 to 9.7m if parking required.
Range Road	Integrator Arterial	(20-30 road reserve) 60km/h Urban standard, 4 lanes, 2 carriageways X 10.7m pavement median divided. Service roads included.
All other roads	Access Streets or lanes	(15.4 to 16m road reserve) 50/40 km/h Major access roads 7 – 7.5 m pavement. If significant parking required – 9.7m Cul-de-sacs, lanes and small loops 6.0m

Recommended traffic pavements and design standards should be adopted as per the Hierarchy table described above and designed to comply with the City of Albany Guidelines.

Where ever possible the traffic flows should be encouraged to utilise roads higher in the hierarchy. The development ODP is structured to provide more traffic onto Catalina Road (to be built as a Neighbourhood Connector road standard) than onto Hudson Road which is classified as and to be constructed as an Access Street.

In the long term, traffic flows to and from the subdivision would be split using Range Road in preference to Chester Pass Road, as Range Road will provide the more direct link into the CBD. However, as there is no timetable for the Range Road connection to North Road and Mercer Road to be completed, and it must be assumed for this traffic statement that all traffic will enter onto Chester Pass Road.

Bus Routes
There are no regular bus routes in the vicinity of the development. The nearest being approximately 1.5km from site via North Road Shopping Centre along Edward Street and returning to Albany Highway via Chester Pass Road. The bus stop on Chester Pass Road is accessible by

foot with pedestrians using proposed connection footpaths along Hudson Road and existing footpaths on Chester Pass Road.

Pedestrians
There are no existing pedestrian facilities in the immediate vicinity of the proposed development on Catalina Road or Hudson Road.

The ODP caters for an extensive pedestrian network within the development and links to tie to the existing paths on Chester Pass Road and the Brooks Garden Shopping Centre on Catalina Road.

Cyclists
There are no existing cyclist facilities in the immediate vicinity of the proposed development.

The largest potential generator of cyclist traffic in the area is the North Albany Senior High School and the TAFE which are connected by a path network on the west side of Chester Pass Road.

Dual use paths are to be connected from the development to Chester Pass road along Catalina Road and Hudson Road. These join to the Dual Use Path on the east side of Chester Pass Road

On Street Parking
On street parallel parking bays are to be provided on the edge of the larger POS as depicted on the ODP plan. The Bays will be designed in Accordance to AustRoads and City of Albany Standards.

Traffic Generation
Predicted traffic volumes have been assessed in accordance with: WAPC Transport Assessment Guidelines for Developments August 2006. Section 8.9.3 Subdivision generated traffic.

Method A: RTA

- Daily traffic generation = 9 trips per dwelling.
- Evening peak hour = 0.85 trips per dwelling.

Total Daily Traffic Generated for the total development= 500*9 = 4,500 trips per day
Evening peak hour = 500*0.85 = 425 trips per hour.

Method B: WAPC
The WAPC peak hour trip rates for dwellings are the similar to as RTA above, however the trip rates are split between inward and outward trips as follows:

TOTAL SITE 500 dwellings	In	Peak volume hr	out	Peak volume hr
AM Peak	0.2	100	0.6	300
PM peak	0.6	300	0.2	100

In terms of the WAPC Transport Assessment Guidelines for Developments Volume 2, there is a high traffic impact from this subdivision (over 100 vehicles in the peak hour) and that a full traffic assessment will be required in the later stages of the development process.

Impact of Generated Traffic on the Existing Road Network
Modelling and traffic movement predictions are limited for this traffic statement without detailed knowledge of staging of the proposed subdivision or proposals for the Range Road connection to North Road and Mercer Road.

The simplest assessment would be to assume that the completed site will generate approximately 4500 vehicles per day. The preference for the split of traffic movements from the subdivision would to be to encourage use of Catalina Road as the main access to the site because it is defined as a neighbourhood connector and will be developed to a higher standard than Hudson Road which is an access street under the City of Albany Transport Hierarchy.

The ODP provides connections for two intersections onto Hudson Road from the development, and six onto Catalina Road. This would encourage an approximately 30/70% split in traffic between Hudson and Catalina Road as Catalina Road will provide the most direct and convenient exit / entry routes for most of the proposed lots.

Although not confirmed as part of this study, Main Roads Western Australia do have long term proposals to median divide Chester Pass Road with controlled major intersections as identified in the Draft City of Albany Transport Network. Major intersections are proposed at Barnesby Drive, Newby/Catalina, and Henry/Mercer. The long term objective of Main Roads, in accordance with the Draft Transport Network, is to median divide Chester Pass Road restricting all other intersections along Chester Pass Road to left in / left out only. This strategy is beyond the current ten year plan for Main Roads WA however it should be a consideration in planning this sub division.

The median proposal would restrict the Chester Pass Road / Hudson Road intersection to left in / left out access only. The un-confirmed long term option for Chester Pass Road and Catalina Road may be a traffic signal controlled intersection.

At this stage Opus does not have detailed information as to when Range Road will be connecting from Mercer to North Road. The traffic modelling of the Draft Transport Network (including Range Road) is currently being undertaken by the City of Albany. However the results are not available to form part of this impact statement.

Construction of Range Road to North Road will resolve potential capacity issues on Chester Pass Road and will provide a more direct access to the development either from Hudson Road or Catalina Road. Although the full impact cannot modelled as part of this stage of investigation, the long term connection of Range Road will be beneficial in terms traffic flows in the area and in terms of easier access to and from the subdivision.

Impact of Through Traffic on the Development

No allowance has been made as to the amount of through traffic will be using the development. However there is a high likelihood that traffic from south of the site from the Yakamia area (Hudson and Leonora Street) will use the developments local street network to access through to the Brooks Gardens Shopping centre to the north.

Roads connecting from Hudson Road to Catalina Road would need to be of sufficient standard to carry a portion of through traffic. This further supports the recommendation to have only two road connections to Hudson Road to limit the amount of uncontrolled through traffic through the subdivision and to ensure the intersections on these routes are designed to a higher standard than the others.

Impact of Generated Traffic on Intersection Capacity.

Intersection Capacities have not been assessed as part of this statement. However, in the medium term, until Range Road is connected between Mercer Road and North Road the Chester Pass Road / Catalina and Hudson Road intersections will carry the majority of the traffic generated from the development and will have increased capacity issues. Main Roads Western Australia may provide comment regarding access onto Chester Pass Road from Hudson Road and Catalina Road during the ODP consultation progression.

As discussed above it will be desirable to encourage the use of Catalina Road as the main intersection onto Chester Pass Road as it is already identified as a major intersection in the City of Albany Draft Transport Strategy and Hudson Road is not. Catalina Road intersection is also already constructed to a higher standard than the Hudson Road Intersection.

There is not likely to be any significant capacity issues on Intersections from the development onto Catalina Road in the short to medium term as the spacing of the intersections keeps traffic flows

from each to a minimum and as yet there is little development south of the site that is likely to generate significant traffic volume.

The City of Albany Draft Transport Plan and the ODP shows that Range Road will eventually form a cross road with Catalina Road. Although this should not be a requirement of this subdivision, the City needs to consider their intentions for controlling the intersection. The ODP has adopted truncations sufficient to accommodate a large roundabout at this location if required in the future.

Impact on Adjacent Traffic Generators
Brooks Gardens Shopping Centre is located on Catalina Road north west of the development site with major access ways onto Catalina Road. Any upgrade of Catalina Road would be required to take into account traffic turning movements entering and exiting the Shopping Centre.

Further investigation would be required to assess whether additional widening is required on Catalina Road to accommodate turning movements into the Shopping Centre.

Proposed ODP Internal Road Network
The ODP has been reviewed in terms of Liveable Neighbourhoods and City of Albany guidelines. The main points for consideration include:

Traffic Hierarchy – promote the distribution of traffic through a flatter hierarchy of streets, reducing pressure at major intersections:

- Providing the majority of access points onto Catalina Road as a neighbourhood connector rather than Hudson Road as an access street.
- Limiting the number of access points onto Hudson Road (say 2) as shown on the attached plan, this would result in the majority of traffic accessing to Catalina Road as the most direct route. Cul-de-sacs would be possible to allow future connections to Hudson Road roads if traffic volumes increase in future and would still allow for the ease of pedestrian and cyclist movement's through the neighbourhood.
- It will be desirable to encourage the use of Catalina Road as the main intersection onto Chester Pass Road as it is already identified as a major intersection in the City of Albany Draft Transport Strategy and Hudson Road is not. Catalina Road intersection is also already constructed to a higher standard than the Hudson Road Intersection.

Control of speeds in local streets: appropriate pavement widths with short legs between intersections:

- As identified on ODP, the eastern road closest to Range Road will have central traffic islands to control speeds. The remainder of the development either has short links between intersections and roundabouts at significant cross roads to assist in controlling speeds and too highlight the higher priority roads that exit from the development.

I trust this traffic statement will assist in your development approval process, please contact me if you have any questions relating to the above.

Yours Faithfully

Evan Chadfield
Manager, Albany
Opus International Consultants.

OUTLINE DEVELOPMENT PLAN

Lot 30 - 35 Catalina Road, LANGE

DYKSTRA PLANNING
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29 July 2010

N

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Figure 3

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.

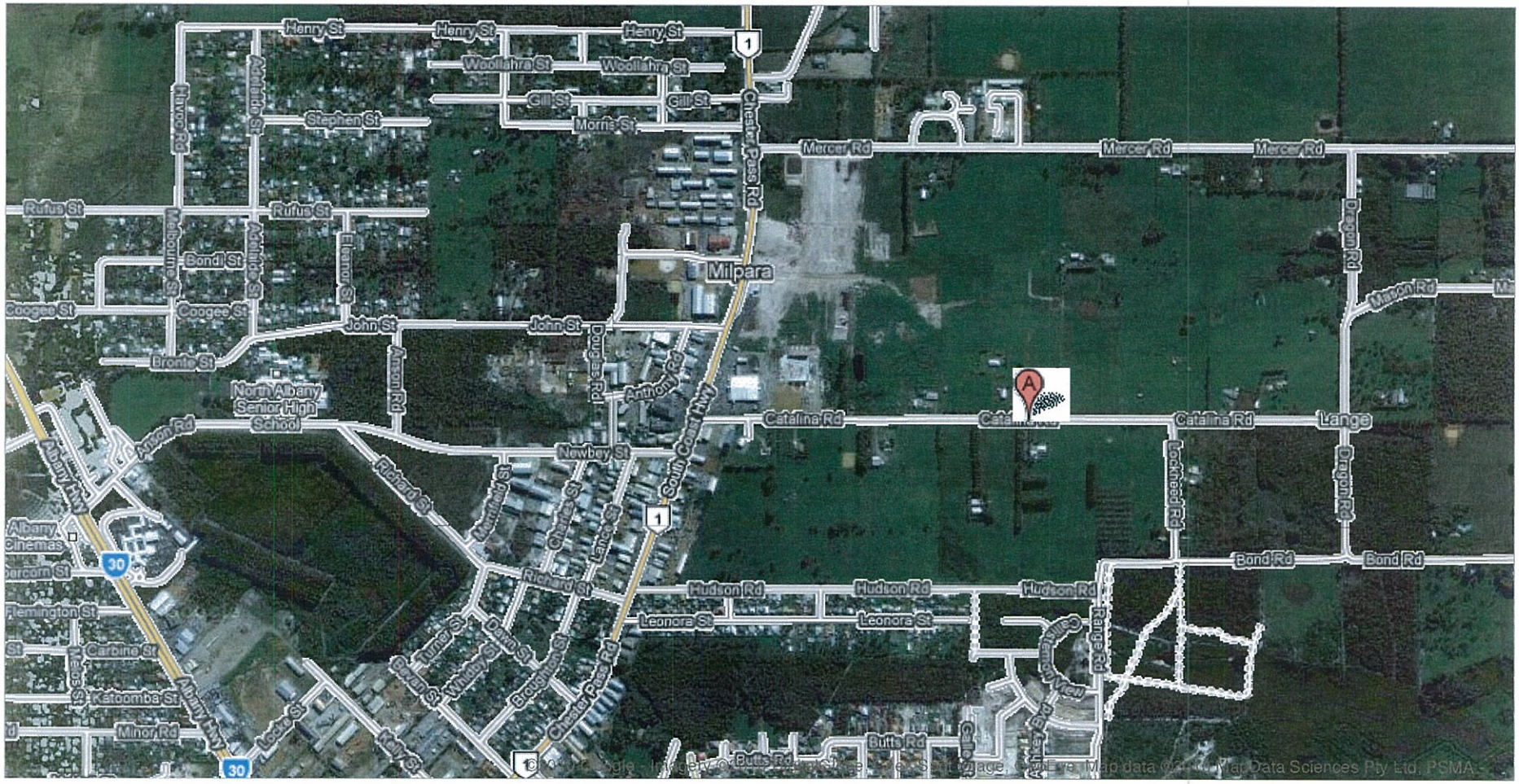
01136-ODP-F3-100728-0

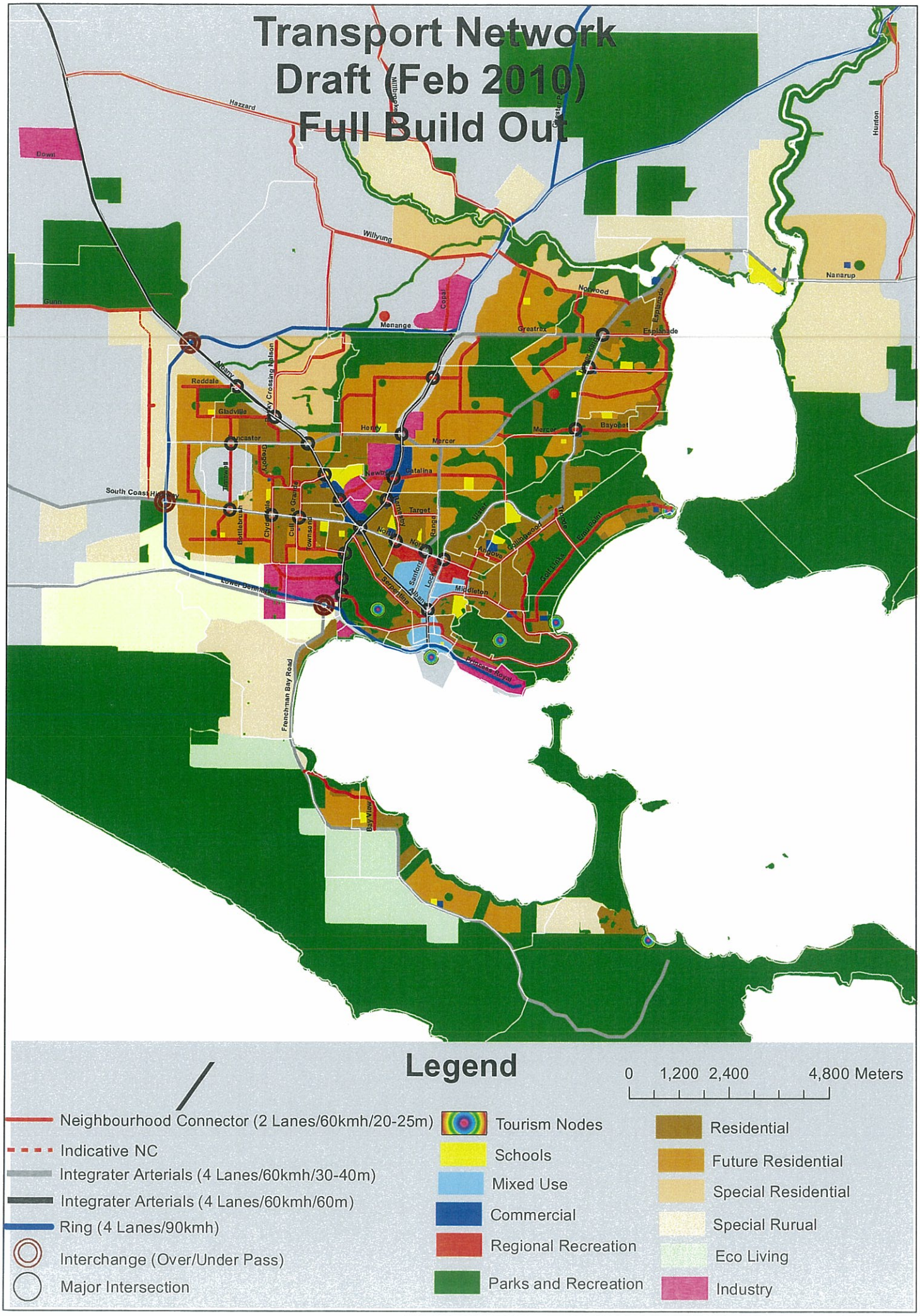
Google maps Australia

Address

To see all the details that are visible on the screen,use the "Print" link next to the map.

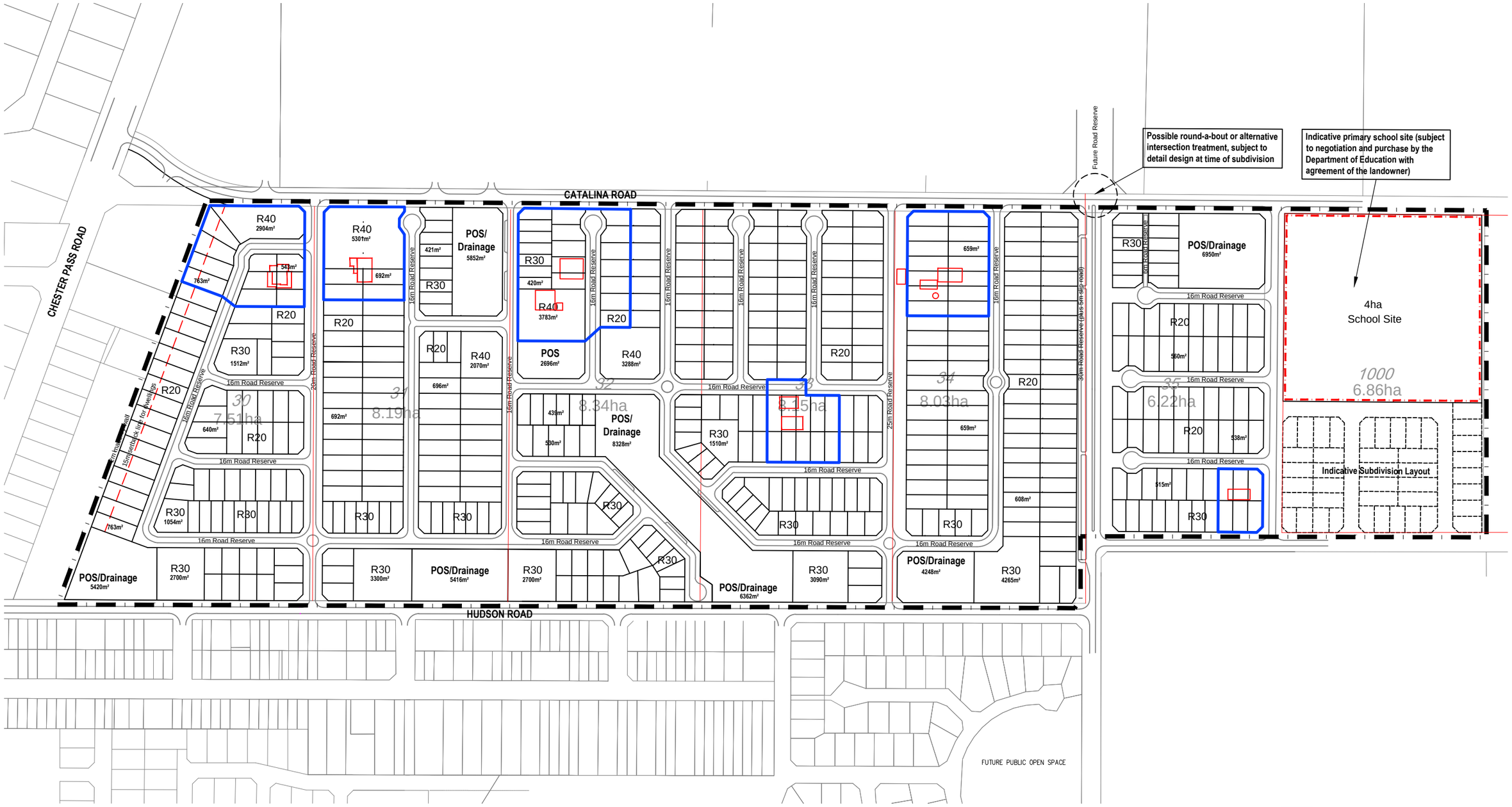
Print Send Link




Transport Network
Draft (Feb 2010)
Full Build Out
Hazzard
Millbridge
Great Park
Hunton
Dowl
Willyung
Nanarup
Gunn
Nettwood
Esplanade
Menange
Copal
Greatrex
Albany
Sky Crossing Albion
Reddale
Gledville
Henry
Mercer
Bayonet
Lancaster
Catalina
Jimmbin
Bottlebrush
Clydesdale
Cullen Grande
Townsend
South Coast Highway
Target
Ring
Lower Denmark
Middleton
Princess Royal
Frenchman Bay Road
Bay View
Emu Point
Goldlinks
Grillidwood
Legend
0 1,200 2,400 4,800 Meters
Neighbourhood Connector (2 Lanes/60kmh/20-25m)
Indicative NC
Integrater Arterials (4 Lanes/60kmh/30-40m)
Integrater Arterials (4 Lanes/60kmh/60m)
Ring (4 Lanes/90kmh)
Interchange (Over/Under Pass)
Major Intersection
Tourism Nodes
Schools
Mixed Use
Commercial
Regional Recreation
Parks and Recreation
Residential
Future Residential
Special Residential
Special Rurual
Eco Living
Industry

Appendix E:
Homestead Lot Subdivision Concept

Outline Development Plan
Lots 30 – 35 Catalina Rd and Lot 1000 Lockheed Rd Lange



OUTLINE DEVELOPMENT PLAN

Lot 30 - 35 Catalina Rd & Lot 1000 Lockheed Rd, LANGE

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7 February 2012

N

1:400 @ A3

Figure 3A

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01136-ODP-F3-111018-F