



DEVELOPMENT PLAN REPORT

**Lot 3435 Daylesford Close, Lots 3505, 3506,
3508, 3713 & 3715 Koojarra Loop, Lot 3509
Kabbarli Loop and Lots 3570 & 3625 Captains
Way, South Hedland
(Former Koombana School Site)**

Part I – Statutory Provisions

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TABLE OF AMENDMENTS – DEVELOPMENT PLAN FOR LOT 3435 DAYLESFORD CLOSE, LOTS 3505, 3506 3508, 3713 & 3715 KOOJARRA LOOP, LOT 3509 KABBARLI LOOP AND LOTS 3570 & 3625 CAPTAINS WAY, SOUTH HEDLAND (KOOMBANA)

<i>Amendment No.</i>	<i>Description of Amendment</i>	<i>Endorsed by Council</i>	<i>Endorsed by WAPC</i>

CERTIFICATION OF DEVELOPMENT PLAN

IT IS HEREBY CERTIFIED THAT THE DEVELOPMENT PLAN FOR LOT 3435 DAYLESFORD CLOSE, LOTS 3505, 3506, 3713 & 3715 KOOJARRA LOOP, LOT 3509 KABBARLI LOOP AND LOTS 3570 & 3625 CAPTAINS WAY, SOUTH HEDLAND WAS:

ENDORSED BY A RESOLUTION OF THE COUNCIL OF THE TOWN OF PORT HEDLAND ON

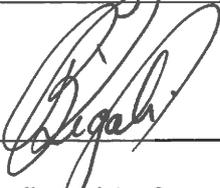
26 April 2012



Director Planning and Development, Town of Port Hedland

AND ADOPTED BY RESOLUTION OF THE WESTERN AUSTRALIAN PLANNING COMMISSION ON

31 August 2012



Being an officer of the Commission duly
Authorised by the Commission pursuant to
Section 16 of the Planning and Development Act 2005

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1.0 DEVELOPMENT PLAN AREA

The Development Plan area relates to Lot 3435 Daylesford Close, Lots 3505, 3506 & 3508 Koojarra Loop, Lot 3509 Kabbarli Loop and Lots 3570 & 3625 Captains Way, South Hedland as identified on the Development Plan (Ref: 40019-4-002).

2.0 DEVELOPMENT PLAN CONTENT

The Development Plan comprises the following sections:

- Part One – Statutory Section
- Part Two – Explanatory Information
- Appendices – Technical Reports

Part One includes only the provisions and requirements that need statutory effect including the Development Plan Map.

Part Two of the Development Plan provides justification and clarity on the provisions contained in Part One, and is to be used as a reference to guide interpretation and implementation of Part One.

3.0 INTERPRETATIONS

The terms used in the Development Plan have the respective meaning given to them in the Town of Port Hedland Town Planning Scheme No. 5.

4.0 OPERATION DATE

The Development Plan will become operative following the endorsement of the Plan by the Town of Port Hedland and adoption of the Plan by the Western Australian Planning Commission pursuant to Clause 5.2 of Town Planning Scheme No. 5. The operative date of the Plan is the later of the endorsement or adoption as identified on the Certification page.

5.0 RELATIONSHIP TO THE SCHEME

The provisions of this Development Plan are made pursuant to Clause 5.2, Clause 6.4 and Appendix 6 of the Town of Port Hedland Town Planning Scheme No. 5. The Development Plan is a Policy Statement and forms part of the Town of Port Hedland Land Use Planning Policy Manual.

The Town of Port Hedland Town Planning Scheme No. 5 provides that land use, development and subdivision of land within the Development Plan area shall be generally be in accordance with the Development Plan subject to compliance with the provisions of the Scheme.

Land uses permitted within the Development Plan area shall be in accordance with the Town of Port Hedland Town Planning Scheme No. 5 “Urban Development” zone.

6.0 PUBLIC OPEN SPACE PROVISION

The Development Plan contemplates the provision of a component of land for the purposes of Public Open Space (POS), totalling 1,100m². The POS is located eastern edge of the central portion of the project area and represents approximately 1.8% of the subdivisible area.

It is intended that the remainder of the POS contribution be provided through a cash-in-lieu arrangement via Developer Contributions to be agreed with the Town of Port Hedland.

7.0 RESIDENTIAL DENSITY

The residential areas of the Development Plan are coded R30 and R40, as illustrated on the Development Plan.

Part Two of the Development Plan provides justification for the location and distribution of residential densities within the Development Plan area.

8.0 SUBDIVISION AND DEVELOPMENT REQUIREMENTS

Subdivision is to be in accordance with the applicable density code indicated on the Development Plan Map and the minimum lot sizes listed under Table 1 of State Planning Policy 3.1 – Residential Design Codes.

9.0 OPERATION AND IMPLEMENTATION

Prior to any subdivision or development being supported, the Town will, as a minimum, require the following reports to be completed (refer Table A below).

Table 1 – Reports and Plans

Documentation	Approval Stage	Approving Authority
Urban Water Management Plan	Prior to clearance of development and/or subdivision conditions	Town of Port Hedland & Department of Water

Local Water Management Strategy	Concurrent with Development Plan	Town of Port Hedland and Department of Water
Landscaping Plan	Prior to clearance of development and/or subdivision conditions.	Town of Port Hedland

DEVELOPMENT PLAN

LOT 3435 DAYLESFORD CLOSE, LOTS 3505, 3506, 3713 & 3715 KOOJARRA LOOP, LOT 3509 KABBARLI LOOP AND LOTS 3570 & 3625 CAPTAINS WAY, SOUTH HEDLAND (KOOMBANA)

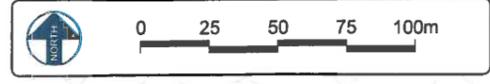
DEVELOPMENT PLAN PROVISIONS

1. Dwellings on lots fronting and/or abutting Public Open Space and/or Drainage Reserves are to be oriented to front the Public Open Space and/or Drainage Reserves and vehicular access shall be via the rear laneway.
2. Lots with dual frontage shall front the road and vehicular access shall be via the rear laneway.
3. Lots with dual frontage to a road and a laneway, shall have vehicular access restricted to the rear laneway.
4. Uniform fencing is required for lots fronting Public Open Space and/or Drainage Reserves.



LEGEND

- Development Plan Boundary
- Existing Cadastre
- R20/30 General Single Residence
- R40 Multiple / Grouped Residential
- Public Open Space
- Access Street C
- Access Street D
- Laneway - 9m
- Footpath





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Way, South Hedland
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Part 2 – Explanatory Report

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APPENDIX 1

Development Plan

APPENDIX 2

Environmental Assessment Report (RPS)

APPENDIX 3

Simon Youngleson Built Form Vision

APPENDIX 4

Transport Assessment Report (Shawmac)

APPENDIX 5

Landscape Concept Plan (RPS)

APPENDIX 6

Drainage Strategy (BCH)

APPENDIX 7

Engineering Servicing Report (BCH)

1.0 PLANNING BACKGROUND

1.1 Introduction and Purpose

This Development Plan report has been prepared on behalf of JAXON for Lot 3435 Daylesford Close, Lots 3505, 3506, 3508, 3713 & 3715 Koojarra Loop, Lot 3509 Kabbarli Loop and Lots 3570 & 3625 Captains Way, South Hedland (the 'subject land').

In 2010, the Department of Regional Development and Lands (RDL) sought Expressions of Interest (EOI) from proponents to enter into a Structured Sale Agreement for development of an 8.16ha site in Koombana, South Hedland. The land was identified as being surplus to Department of Education and Town of Port Hedland requirements and was recognised as appropriate for residential development to meet ongoing housing demand in the area.

JAXON's proposal was accepted by RDL and both parties are now entering into a conditional Option to Lease and Development Lease arrangement for the site.

JAXON's intent is to deliver a high quality residential estate that recognises the existing nature of the surrounding area, whilst providing diversity in housing options and a high level of connectivity with surrounding areas.

In addition to Planning and Urban Design considerations, the preparation of the Development Plan has been informed by a number of technical and design investigations, including input from the following disciplines:

- **RPS Landscape** – Landscape Design
- **RPS Environment** – Environmental Investigations and Local Water Management Strategy
- **BCH Engineering** – Civil Infrastructure
- **Shawmac** - Traffic and Transportation
- **Simon Youngleson Architects** – Architecture
- **Vekta** – Surveying
- **Heritage** – Anthropos Australis

The Development Plan (refer **Appendix I**) has been prepared in accordance with the design requirements outlined in Liveable Neighbourhoods, and responds to Town of Port Town Planning Scheme No 5 (TPS 5) requirements where relevant.

1.2 Land Description

1.2.1 Location

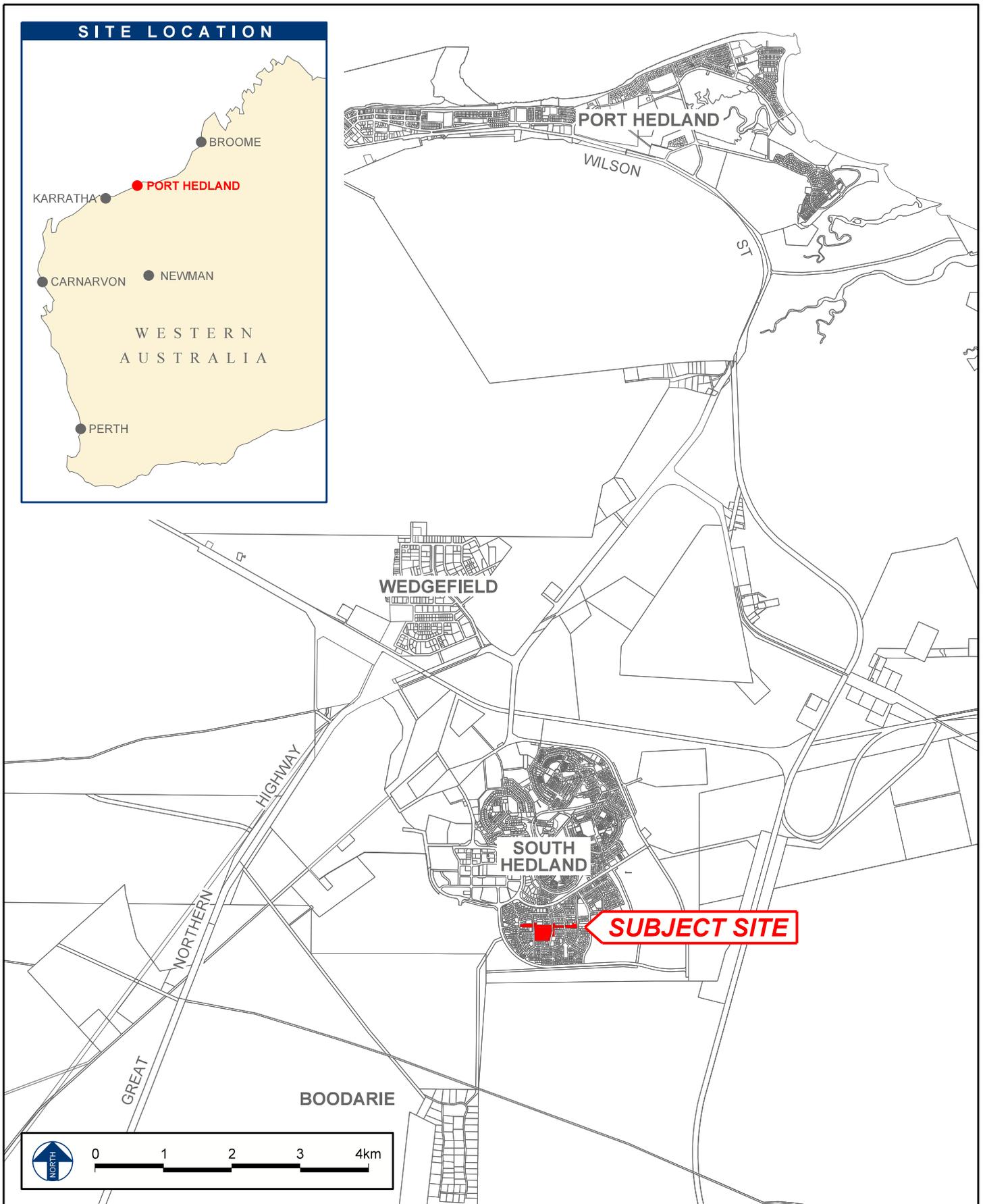
The subject land is located centrally within Koombana, which is one of a number of suburbs comprising the broader South Hedland town site. The subject land is relatively fragmented, with a number of sites separated by drainage corridors and existing roads and housing. The subject land is generally bounded by Captains Way to the east, Koojarra Crescent to the South, Karballi Loop to the north and Daylesford Close to the west (refer **Figure 1 - Location Plan**).

The subject land is located approximately 750 metres to the south east of the South Hedland Town Centre, which is the key focus of retail, commercial, health and community activities within South Hedland. The town centre is currently undergoing significant expansion consistent with the South Hedland Town Centre Development Plan (SHTCDP), which envisages the development of a new vibrant centre supported by commercial and retail development; and increased housing diversity. The revitalised town centre will be oriented around a new main street along Colebatch Way, with construction works well progressed.

The new South Hedland Regional Hospital is located at the corner of Wise Street and Colebatch Way in the South Hedland Town Centre and is approximately 800 metres to the west of the subject site. Regional recreational and education facilities are located further to the north of the subject site (refer **Figure 2 - Local Context Plan**).

1.2.2 Current Land Use

The subject land is vacant, with some degraded areas of remnant scrub and numerous informal vehicle and pedestrian paths intersecting the site (refer **Figure 3 - Aerial Plan** and **Plates 1 - 3**).



LOCATION PLAN

Property Description

KOOMBANA SCHOOL SITE

Lot 3435 Daylesford Close, Lots 3505, 3506
 3508, 3713 & 3715 Koojarra Crescent, Lot 3509
 Kabbarli Loop and Lots 3570 & 3625 Captains
 Way, SOUTH HEDLAND

Base data supplied by Landgate.
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 Areas and dimensions shown are subject to final survey calculations.
 All carriageways are shown for illustrative purposes
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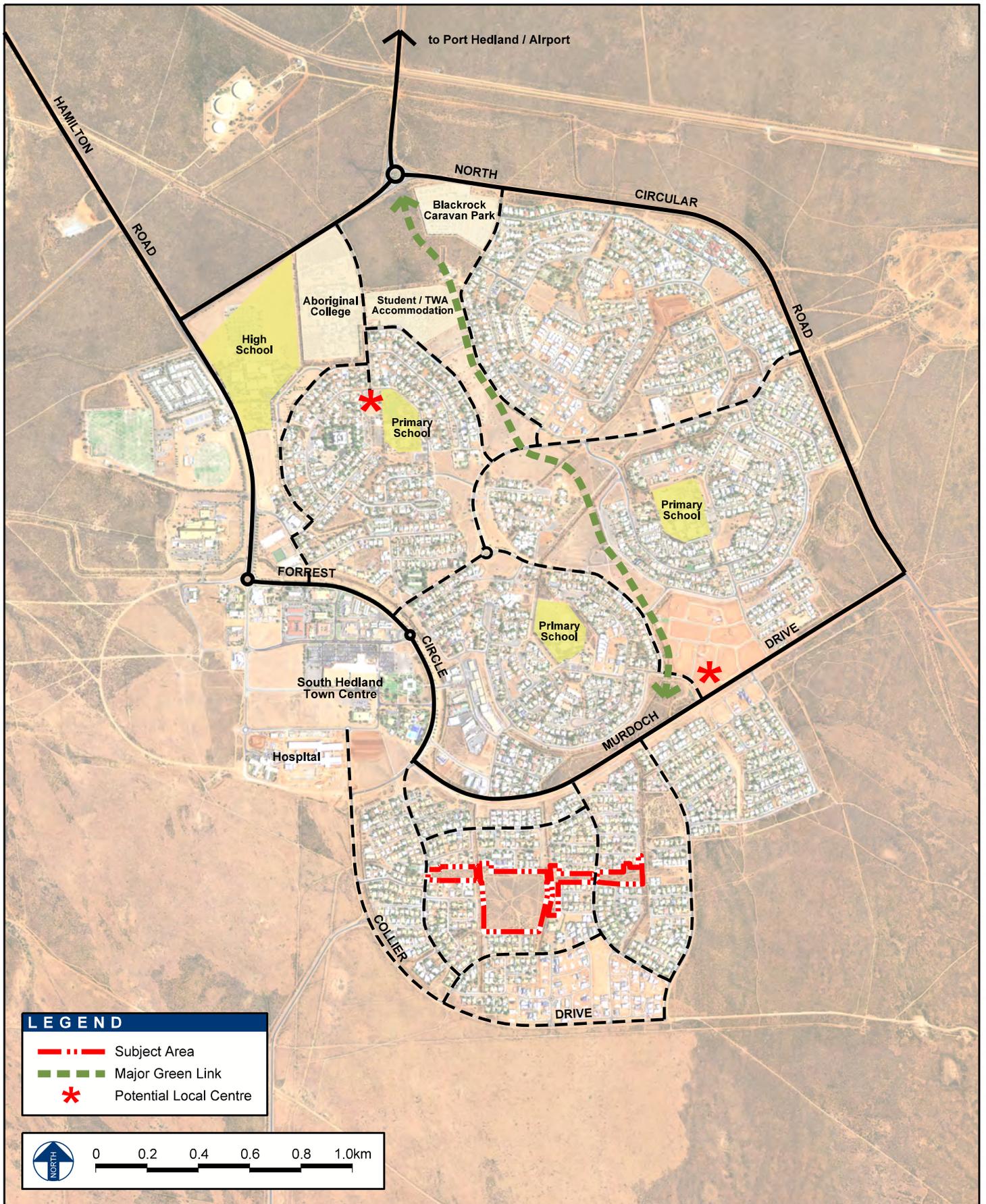
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LOCAL CONTEXT PLAN

Property Description

KOOMBANA SCHOOL SITE

Lot 3435 Daylesford Close, Lots 3505, 3506
3508, 3713 & 3715 Koojarra Crescent, Lot 3509
Kabbarli Loop and Lots 3570 & 3625 Captains
Way, SOUTH HEDLAND

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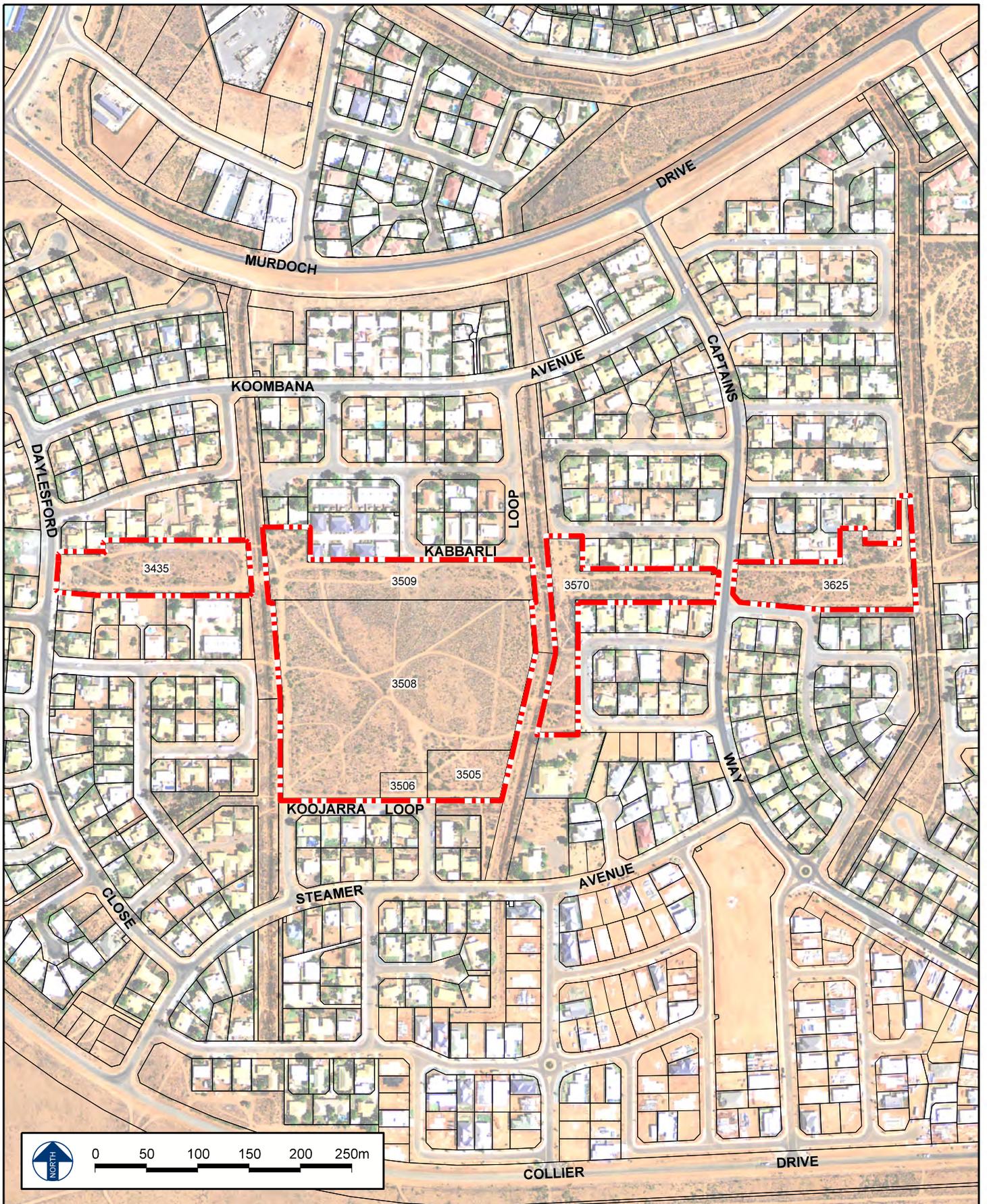
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AERIAL PLAN

Property Description

KOOMBANA SCHOOL SITE
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 3508, 3713 & 3715 Koojarra Crescent, Lot 3509
 Kabbarli Loop and Lots 3570 & 3625 Captains
 Way, SOUTH HEDLAND

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Plate 1: View north along eastern drainage line



Plate 2: View north along western drainage line



Plate 3: View east along Koojarra Loop

1.2.3 Legal Description and Ownership

The subject site is formally described as follows:

Table 1: Legal Description and Ownership

Lot No.	Plan/Diagram	Volume/Folio	Area (m)	Responsible Agency	Management Orders
3435	P214018	LR3149/637	8,521	Department of Planning	Town of Port Hedland
3509	P214019	LR3149/653	10,816	Department of Planning	Town of Port Hedland
3508	P214018	LR3149/640	40,671	Department of Education	Town of Port Hedland
3506	P214018	LR3149/639	1,150	Department of Education	Town of Port Hedland
3505	P214018	LR3149/638	3,559	Department of Education	N/A
3570	P214187	LR3013/711	8,428	Department of Regional Development Lands	Town of Port Hedland
3625	P214187	LR3013/714	8,732	Department of Regional Development Lands	Town of Port Hedland
3713	P214018	LR3013/718	779	Department of Regional Development Lands	Town of Port Hedland
3715	P214018	LR3149/644	2,613	Department of Planning	Town of Port Hedland

** Whilst Lots 3713 and 3715 were not formally included as part of the development area as awarded to JAXON as part of the conditional Contract of Sale, their inclusion within the Development Plan area recognises the practicality of their inclusion as part of the broader rationalisation of underutilised land within South Hedland.*

1.2.4 Historical Context

A review of information available from the Certificate of Titles indicates that Lot 3508, being the area previously identified for a Primary School, was first reserved for this purpose in 1978. No subsequent improvements were ever made to the site, with schools provided in the nearby suburbs of Lawson, Cassia and Shellborough.

Adjoining areas identified for Parks and Recreation purposes were similarly never subject to any form of physical improvement and have generally remained undeveloped and unused.

Lots 3713 and 3715 function as pedestrian access ways enabling south to north movement within the site, however this is now proposed to be addressed through the provision of footpaths within the drainage corridors.

1.2.5 Surrounding Land Use and Development Pattern

The local area surrounding the subject site has generally been developed for single residential purposes at an R20 density. There are also a number of small isolated parcels of land zoned R30, where grouped dwelling lots have been constructed.

1.2.6 Port Hedland Housing Market

Port Hedland is currently experiencing a critical shortage of accommodation for both long-term residents and short-term fly-in / fly-out workers. This is recognised as one of the biggest constraints affecting the growth of the town into a city as envisaged by the draft City Growth Plan.

The quarterly Housing and Land Snapshot report prepared by the Pilbara Development Commission (PDC) in June 2011 outlines the average advertised price of the residential properties for sale in Port Hedland based on the number of bedrooms, over the previous three quarters.

Table 2: South Hedland Housing Market

South Hedland	Quarter	Number	Min \$	Max \$	Avg \$
One Bedroom	Sep-10	0			
	Dec-10	1	\$ 550,000	\$ 550,000	\$ 550,000
	Mar-11	2	\$ 699,000	\$ 699,000	\$ 699,000
Two Bedroom	Sep-10	13	\$ 560,000	\$ 950,000	\$ 685,385
	Dec-10	18	\$ 398,000	\$ 950,000	\$ 643,278
	Mar-11	11	\$ 532,000	\$ 750,000	\$ 656,455
Three Bedroom	Sep-10	130	\$ 425,000	\$ 1,125,000	\$ 715,758
	Dec-10	113	\$ 480,000	\$ 1,125,000	\$ 740,557
	Mar-11	103	\$ 495,000	\$ 1,125,000	\$ 731,131
Four Bedroom & above	Sep-10	75	\$ 690,000	\$ 1,500,000	\$ 927,792
	Dec-10	75	\$ 690,000	\$ 1,500,000	\$ 933,500
	Mar-11	75	\$ 689,000	\$ 1,500,000	\$ 929,973
Total	Sep-10	218	\$ 425,000	\$ 1,500,000	\$ 786,894
	Dec-10	207	\$ 398,000	\$ 1,500,000	\$ 801,084
	Mar-11	191	\$ 495,000	\$ 1,500,000	\$ 804,573

The proposed Development Plan will facilitate development of critical additional housing stock, which in turn will assist in relieving the severe housing shortage currently being experienced throughout South Hedland and the broader Pilbara region.

1.3 Planning Framework

1.3.1 Zoning

The subject site is currently rezoned “Community – Education”, “Other Public Purposes – Water and Drainage”, “Residential R20” and “Parks and Recreation” under TPS 5. A Scheme Amendment (Scheme Amendment 49) seeks to rezone the subject land to “Urban Development” zone under TPS 5. The Amendment has been initiated by the Town of Port Hedland and is currently out for public comment. Section 1.3.3 below provides further details in relation to the Amendment.

The purpose of the ‘Urban Development’ zone is to “*identify land where detailed planning and the provision of infrastructure is required prior to the further subdivision and development of land*” as per Clause 6.4.1 of TPS 5.

TPS 5 requires the preparation of a Development Plan for all land zoned ‘Urban Development’ in accordance with the provisions of Clause 5.2 of the Scheme. Appendix 6 to TPS 5 sets out matters required to be addressed by Development Plans in general.

The proposed Development Plan has been prepared in accordance with the relevant Scheme provisions.

1.3.2 Scheme Amendment No. 49

The subject land is currently subject to Scheme Amendment 49 which seeks to rezone the land to “Urban Development”. Amendment 49 is currently out for public comment and under the provisions of TPS 5:

- An approved Development Plan shall apply to land zoned for “Urban Development” in order to guide subdivision and development;
- The purpose of the zone is to provide for residential development; and
- Land uses classified on the Development Plan will apply in accordance with Clause 5.2.10 of TPS 5.

The proposed Scheme Amendment is shown in **Figure 4**.

1.3.3 Policies

Liveable Neighbourhoods

Liveable Neighbourhoods is a WAPC adopted policy intended to guide the subdivision and development of land in Western Australia. The key principles of this policy include:

- Providing a variety of lots sizes and housing types to cater for the diverse housing needs of the community at a density that can ultimately support the provision of local services;

SCHEME AMENDMENT MAP

Town of Port Hedland
Town Planning Scheme 5
Amendment No. 49

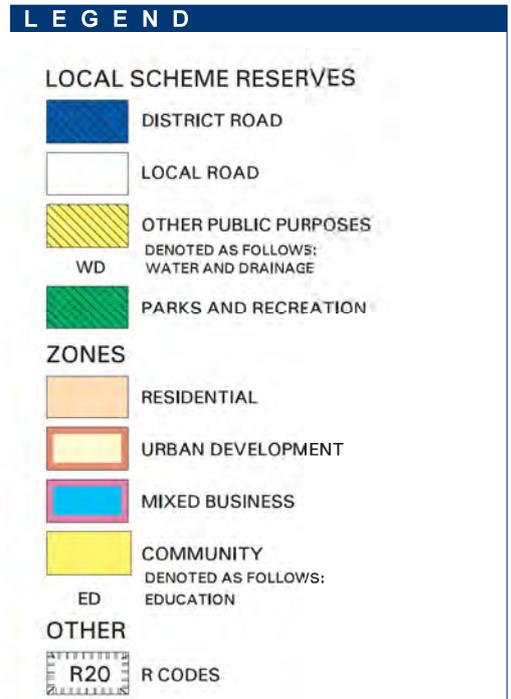
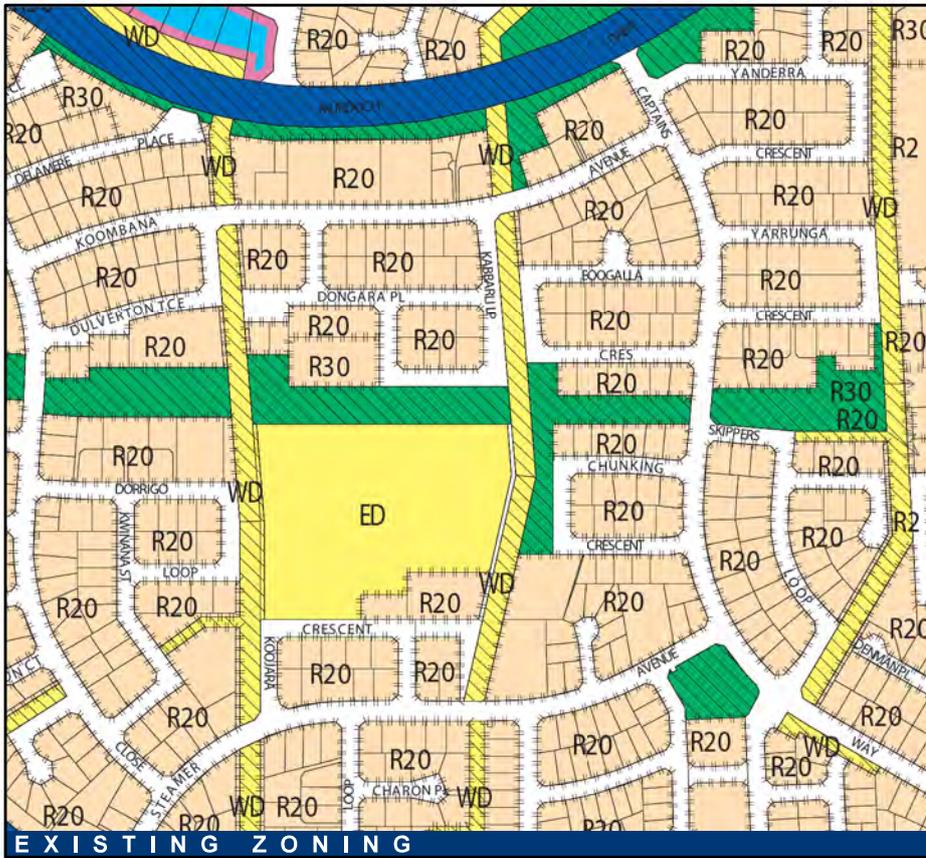


FIGURE 4

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- To ensure cost-effective and resource efficient development to promote affordable housing; and
- To maximise land efficiency.

The proposed Development Plan not only acknowledges the objectives of Liveable Neighbourhoods in providing a greater diversity in housing types, but meets the important objective of maximising land efficiency by facilitating development in an established and well serviced residential area. The proposed development will also allow for the development of housing options that will directly target ongoing affordability constraints and housing demand in South Hedland.

Liveable Neighbourhoods also provided guidance in relation to POS provision, with provisions relating to reduced POS provision in regional areas and cash-in-lieu provisions. Further comment in relation to these specific elements is further outlined in Part 3.4 of this report.

Town of Port Hedland Land Use Master Plan

The Town of Port Hedland prepared a long term Land Use Master Plan (LUMP). Through a focus on the use of land, the LUMP was intended to guide the growth and development of Port Hedland through a 15 – 20 year period. It was seen as the first step towards updating TPS 5 which was last reviewed in 2001. The LUMP defined the community's long range vision of how the town should develop.

The land the subject of this Development Plan is identified by the LUMP as being suitable for new housing.

Hedland Land Availability Plan

The Hedland Land Availability Plan (LAP) is a strategic document adopted by the Town of Port Hedland to guide the Town of Port Hedland and other government authorities on the divestment or development of Crown Land within Port and South Hedland.

All lots within the subject land are identified in the LAP, with the document recognising that redevelopment is being coordinated through the Stage I land release program.

Port Hedland Draft City Growth Plan

The Town of Port Hedland recently commissioned the preparation of a comprehensive Pilbara Port 'City Growth Plan' document, as a strategic response to the many growth pressures being faced by the Town of Port Hedland.

The Draft City Growth Plan will fulfil a number of important functions, in line with the broader Pilbara Cities Framework, including:

- To provide key overarching strategies for the integrated response to growth requirements, including a range of initiatives such as 'diversifying the economy'; community development; youth development; Fly-in/Fly-out (FIFO) integration, and the like;
- To address the need for a Strategic Plan (Growth Plan) and formally identify and prioritise in one overarching document the many priority land release areas (Growth Plan Precincts);
- To provide the Town of Port Hedland (ToPH) with a Strategic Plan which will ultimately be adopted as the Town's Local Planning Strategy, as a precursor to a more comprehensive review of Town Planning Scheme No. 5 (TPS5);
- To provide a planned land use response to the Port Hedland Dust and Noise Management Plan recommendations; and
- To facilitate the continued, where possible and appropriate, simultaneous progression of agreed priority 'Growth Plan Precincts' to ensure the further de-risking of land for release and development.

The Draft City Growth Plan has recently been advertised for public comment and submissions are currently being assessed by the Town of Port Hedland and the project team. Following the completion of modifications in response to submissions received as part of the public comment period, the City Growth Plan is expected to go to the WAPC for their endorsement. Upon final endorsement the Growth Plan will effectively replace the LUMP and inform the preparation of Scheme Amendments and / or a new Town Planning Scheme for the Town of Port Hedland.

The Growth Plan identifies a number of Growth Precincts; the subject land is located within Precinct 12. Precinct 12 specifically identifies Koombana as an area suitable for immediate term housing supply.

Scheme Amendment 49 and this Development Plan will therefore enable development of the subject land for residential purposes consistent with the objectives of Precinct 12 and the broader Growth Plan initiatives.

2.0 SITE CONDITIONS AND ENVIRONMENT

2.1 Environmental Overview

A preliminary Environmental Assessment Report (EAR) has been prepared for the subject land in support of Scheme Amendment 49. The purpose of the EAR was to ascertain the current environmental factors in relation to the site (refer **Appendix 2**). The EPA assessed the Scheme Amendment under Section 48A of the *Environmental Protection Act 1986* and determined that the Scheme Amendment was “not assessed” and no further information was required.

A summary of the findings of the investigation is provided below.

2.1.1 Climate

Port Hedland is located within a hot, semi-arid climatic zone. Summers (October to April) are extremely hot with an average maximum temperature of 36.1°C. Winters average a minimum temperature of 13.6°C.

2.1.2 Contaminated Sites

The EAR indicates there are no known risks of Acid Sulfate Soils occurring within three metres of the natural surface on site.

A search of the DEC Contaminated Sites Database reveals that the Development Plan area and surrounding land have not been identified as contaminated sites.

2.1.3 Flora and Fauna

Vegetation on the site is degraded with no over storey. There is no known Declared Rare and Priority Flora or Threatened Fauna on the site.

2.1.4 Landform and Soils

The PSI indicates that the subject site is relatively flat with an elevation of approximately 13m AHD across the site.

Soils within the subject site are categorised as alluvial plains and sand plains of alluvial and marine deposits over rocks of the northern Pilbara Craton. They consist of red deep sandy duplexes with deep red loamy earths and some red/brown clays.

2.1.5 Ground Water and Surface Water

The EAR has concluded that no detailed information is available on the depth of groundwater at the subject site. However, based on information provided in the Department of Water (DoW) bore search, it is likely to be at depths greater than 4m below Ground Level (bGL).

There are no potentially sensitive environmental receptors in the form of surface water, wetlands or watercourses on or in close proximity to the subject site.

2.1.6 Heritage and Cultural Significance

A search of the Australian Government Heritage Database confirms that there are no areas of Aboriginal or European heritage significance within the subject land.

A Preliminary Aboriginal Heritage Investigation prepared by Anthropos Australis did not identify any additional sites of significance, but did provide recommendations in relation to additional work at subsequent stages of development.

2.1.7 Potential Constraints and Management Issues

A summary of the key impacts resulting from development of the site and the subsequent management requirements/commitments in relation to surface water and surrounding land uses are summarised in the table below (as per the EAR). It is noted that no further work is required in relation to wetlands, Acid Sulfate Soils, site contamination, vegetation or fauna:

	Objective	Potential Impact	Management Recommendations
Surface water	To maintain the quantity and quality of water so that existing and potential environmental values, including ecosystem function, are protected.	There are no ecologically sensitive ecosystems or wetlands within vicinity of the site that may be impacted by changes in the hydrological regime as a result of from development. Stormwater within the development will require management.	A LWMS will be prepared at appropriate planning and development stages in accordance with <i>Better Urban Water Management Guidelines</i> (WAPC 2008). This plan will provide further detail in respect to surface and ground water management relevant to detailed planning and engineering of the development design.

	Objective	Potential Impact	Management Recommendations
Surrounding Land Uses	To ensure surrounding land uses do not impact future development of the site.	<p>Surrounding land uses that may potentially impact the site are decommissioned fuel storage facilities located approximately 1 km away from the site.</p> <p>Noise and dust during construction may also impact neighbouring residences.</p>	Noise and dust management during construction will have to be undertaken to protect neighbouring residential land. This should be addressed in a Construction Management Plan for the site

3.0 PROPOSED DEVELOPMENT PLAN

3.1 Design Philosophy

The Development Plan has been prepared by RPS, with a strong focus on climate responsiveness and a legible street network. The following provides an overview of the design rationale which has informed the preparation of the Development Plan:

- Increased passive surveillance of the existing drainage corridors and proposed POS areas through the provision of lots with direct frontages to these areas, as well as roads running adjacent to these areas. A high level of surveillance of these areas from both the public and private realm is therefore provided;
- The provision of a range of lot sizes and lot types to provide a number of built form product types to meet a range of cost points and dwelling type requirements;
- Improved pedestrian and cyclist movement through the site and to the broader South Hedland area. This is achieved in part through the increased utilisation of the existing drainage corridors by both pedestrians and cyclists;
- The provision of a permeable and safe road network that provides an overland flow path for stormwater drainage; and
- The provision of laneways that are well surveilled, with vehicle clear sightlines.

More specific comment in relation to a number of key design considerations is provided below:

3.1.1 Breezeways

Consideration has been given to orienting the majority of roads to create breeze corridors, or breezeways, through the site. Roads are generally oriented north-south with lots facing east and west. This will facilitate appropriate cross ventilation to dwellings. East-west orientation will also reduce opportunity for solar gain within the dwelling, which in the local context is undesirable.

3.1.2 Shade

Street widths and dwelling position are located to provide the best opportunity for shadowing of the public realm. North-south orientated roads and built form with minimal setbacks will provide some shade to footpaths in the morning and afternoon.

3.1.3 POS and Drainage Corridors

The main east-west spine road provides a clear link between the two drainage corridors and provides interaction with the park. Development will be oriented to encourage passive surveillance of the drainage corridors and POS.

POS considerations are addressed in more detail in Section 3.4 of the report.

3.1.4 Integration with Surrounding Development

Surrounding development consists of predominantly single detached residential dwellings, with small isolated pockets of grouped housing sites.

Surrounding land uses are physically separated by a number of existing roads or drainage corridors. All new development is encouraged to front these public areas, increasing the surveillance of the streets and drainage corridors.

JAXON engaged Simon Youngleson to consider the broader design vision for built form on the subject land, with the following key design elements identified:

- An appropriate aesthetic;
- Climate sensitive design;
- A diversity of housing types;
- Walkable streets; and
- Design for community interaction.

Further information in relation to these built form requirements is outlined at **Appendix 3**.

3.2 Movement Network

One of the main elements of the Development Plan is to provide an improved vehicular, cycle and pedestrian network for the locality. The existing road network is relatively impermeable and inefficient, resulting in a lack of connectivity within Koombana and the wider regional road network.

A key recommendation of the South Hedland Town Centre redevelopment relevant to the subject land is for the improvement of connections between the 'town centre' and the Koombana locality. In this regard, initiatives are currently underway to extend Daylesford Close in a northerly direction, connecting to the

intersection of Forrest Circle and Murdoch Drive. This will greatly improve permeability and surveillance, particularly for the western portion of Koombana.

The Development Plan builds upon this initiative, proposing the:

- Extension of Dorrigo Loop in an easterly direction, connecting to Chunking Loop;
- Extension of Koojarra Loop in a northerly direction, connecting to the proposed Dorrigo Loop extension; and the
- Extension of Kabbarli Loop in a southerly direction, connecting to proposed Dorrigo Loop extension.

The planned road extensions involve crossing the existing drainage reserves. Where possible, the number of crossings have been minimised to reduce the costs involved in upgrading the road network. Two crossings have been identified on the Development Plan in order to improve the legibility and permeability of vehicle and pedestrian movements through the subject land.

Several new local roads are also proposed on Lot 3508 in a permeable modified-grid road layout.

A detailed Transport Assessment Report (TAR) has been prepared by Shawmac (refer **Appendix 4**) and assesses the impacts of the proposed development on the adjacent road network. The following summarises these investigations:

3.2.1 Surrounding Road Network

The surrounding road network is generally classified as “access roads”, with Forrest Circle, Murdoch Drive, Masters Way and Collier Drive classified as Local Distributors.

3.2.2 Local Streets

The internal road network consists of “Access Street B” and “Access Street C” streets, where an approximately 15m road reserve applies. Where streets run adjacent to public open space areas or existing drainage reserves a 12m road reserve is proposed. Further detail in relation to the proposed road hierarchy is provided in the TAR provided as **Appendix 3**.

Laneways are proposed to be 9m wide to provide opportunities for embayed parking and lighting where appropriate, with laneway widths down to 6m permitted consistent with Liveable Neighbourhoods and the TAR.

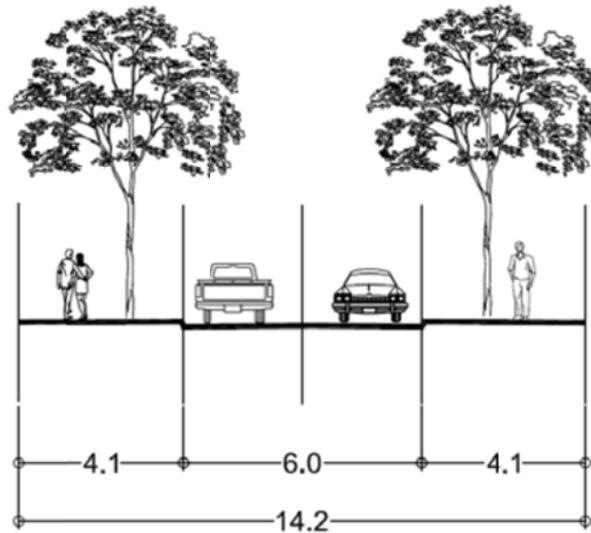


Figure 5: Indicative Cross-Section of Access Street D

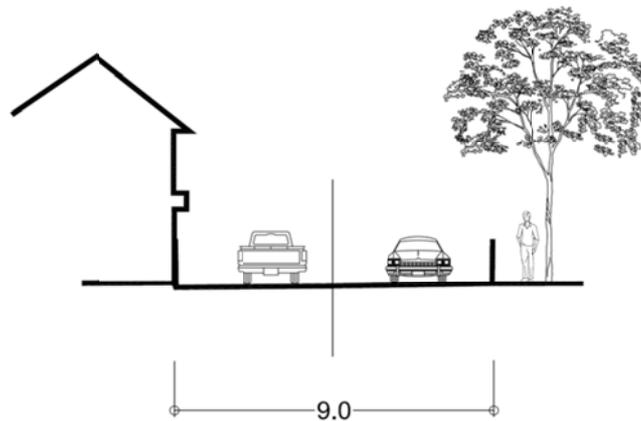


Figure 6: Indicative Cross-Section of Laneway (9m Reservation)

Source: Shawmac

3.2.3 Intersection Spacing

All intersections are spaced so as to comply with the requirements of the Liveable Neighbourhoods. Accordingly, the Development Plan will result in a safe environment for pedestrians, cyclists and motorists.

3.2.4 Traffic Speed

The local streets proposed by the Development Plan are designed to produce the target vehicle speeds as prescribed by Liveable Neighbourhoods. The proposed local streets are short in length and do not create opportunities for speeding.

3.2.5 Public Transport

Figure 9 of the TAR identifies existing bus routes and bus stops within proximity to the site, with bus services along Daylesford Close, Koombana Avenue, Steamer Avenue and Captains Way within easy walking distance.

3.2.6 Pedestrian Circulation and Amenity

The proposed path network will integrate and connect with the existing pedestrian and cycle system and will be developed in consultation with the Town of Port Hedland, responding to the objectives of the Town of Port Hedland Cycle Plan, which promotes a strong north-south link through the site.

The use of reduced front setbacks to dwellings may ultimately be applied following detailed subdivision design to increase the level of amenity for pedestrians, through the shading of footpaths and increased levels of surveillance by the built form.

3.2.7 Streetscape

The proposed street network has been designed to convey to its user its primary function, character and identity and encourages appropriate driver behaviour. Development will be subject to specific design provisions, promoting a high standard of design and passive surveillance of public areas.

3.3 Lot Layout

3.3.1 Density and Diversity

The Development Plan incorporates a mix of medium density lot sizes at a Residential R30 and Residential R40 density. A breakdown of the potential lot yield based on the proposed density is provided in the table below:

Table 3: Lot Density and Diversity

Lot Density and Diversity			
Density code	Area	Estimated lots	ESTIMATED DWELLING UNITS ¹
R30	3.93 ha	92	96
R40	2.87 ha	5	120
Total	6.8 ha	97	216
Average number of dwellings per hectare			31.7

¹Based on preliminary concept design

The above lot and dwelling yields for the Residential R40 areas are based on preliminary calculations and would be subject to further refinement as part of the detailed subdivision design process.

The majority of the lots are proposed to be developed at a Residential R30 density, with frontages to proposed new internal roads and existing adjoining road networks where appropriate.

The density of the Development Plan area is complimentary to the surrounding area and will not be inconsistent with the existing urban form, which is characterised by a mix of single detached dwellings and grouped housing sites. The acceptability of a base coding of R30 is generally consistent with the recommendations of the draft City Growth Plan and Scheme Amendment No. 59 to TPS 5 as recently initiated by the Town of Port Hedland.

A number of Residential R40 grouped housing sites are located in areas where there is restricted access due to existing patterns of subdivision and development, in addition to existing drainage corridors. These R40 sites will be developed as grouped housing sites with a common access way to manage the impacts of access to and from the sites. A number of the R40 sites also adjoin existing drainage corridors, which will increase passive surveillance of these corridors through appropriately orientated development and landscape treatments.

The proposed densities identified on the Development Plan will assist in delivering a variety of housing typologies. There are ongoing supply issues with housing in this region, and the medium density sites will provide the greatest opportunity for housing to be delivered at a lower price points. Development at R40 will also enable a variety in housing choice, providing low-maintenance housing options that are suited to the needs of a significant portion of residents in this region.

3.3.2 Lot Type and Shape

The Residential R30 areas will predominately be single residential lot product, generally characterised by frontages of 12m, 13.5m and 14m to allow cooling breezes to access living areas of dwellings. Minimum and average lot sizes will be provided consistent with Residential Design Code (R-Code) requirements and appropriate built form design measures will respond to the climatic conditions of the Pilbara.

The Residential R40 grouped housing sites will be developed to incorporate key design elements such as design orientation and controlled vehicular access points.

3.3.3 Climatic Responsiveness

In contrast to southern Australia, which experiences lower sun angles and cooler conditions, the more overhead sun angle experienced in the north-west is not a strong climatic factor for individual lot solar orientation. Lot orientation that favours an east-west alignment will reduce solar exposure and therefore

reduce heat gain to otherwise large external walls. In addition, the east-west alignment encourages cross flow and the potential to capture the cooling westerly breezes. The R30 areas, where typical single residential dwellings are likely to be located (rather than grouped or multiple), have therefore been predominately configured to facilitate an east-west lot orientation.

3.4 Public Open Space

3.4.1 Public Open Space Provision

The Town of Port Hedland has previously determined that the portion of the site previously identified for 'Parks and Recreation' is surplus to its requirements, and therefore no longer required for a neighbourhood park as previously identified in the Town's Parks Improvement Plan. Accordingly, a small public open space area has been proposed within the Development Plan immediately adjacent to the existing drainage corridor and highly accessible from the proposed residential areas.

In the context of the above, it is proposed to provide POS in the following manner:

- Provision of a 3.8% public open space area within the development as per Liveable Neighbourhoods. This is based on a 0.11 ha unrestricted POS area adjacent to the eastern drainage corridor, as well as a 2% restricted POS contribution given betterment works proposed within the existing drainage corridor. Liveable Neighbours identifies a reduction in the required amount of POS within regional areas as per Element 4 (R34) of Liveable Neighbourhoods.
- Upgrading an additional 1.28ha of drainage reserve land owned by the Town of Port Hedland - equivalent to 22% of the total land area.
- Building culvert crossings across Town of Port Hedland land to improve east - west traffic movement within the suburb.
- Creating a linear link within the existing Town of Port Hedland drainage corridor through the provision of high quality landscaping, including a walkway and cycle path connecting Koombana Avenue through to Steamer Avenue . This path will tie into the existing surrounding path network and enable access south to the park on the corner of Steamer Avenue and Captains Way and north towards the South Hedland Town Centre.

This is summarised further in the schedule overleaf:

Table 4: Public Open Space Schedule

Public Open Space Schedule	Area (ha)
Site Area (based on central land area)	5.77
Deductions	Nil
Gross Subdivisible Area	5.77
Public Open Space @ 5% (as per Element 4, R34 of LN)	0.29
Unrestricted Public Open Space Provided	0.11
Restricted Public Open Space Provided	0.11
Percentage of Gross Subdivisible Area	3.8%

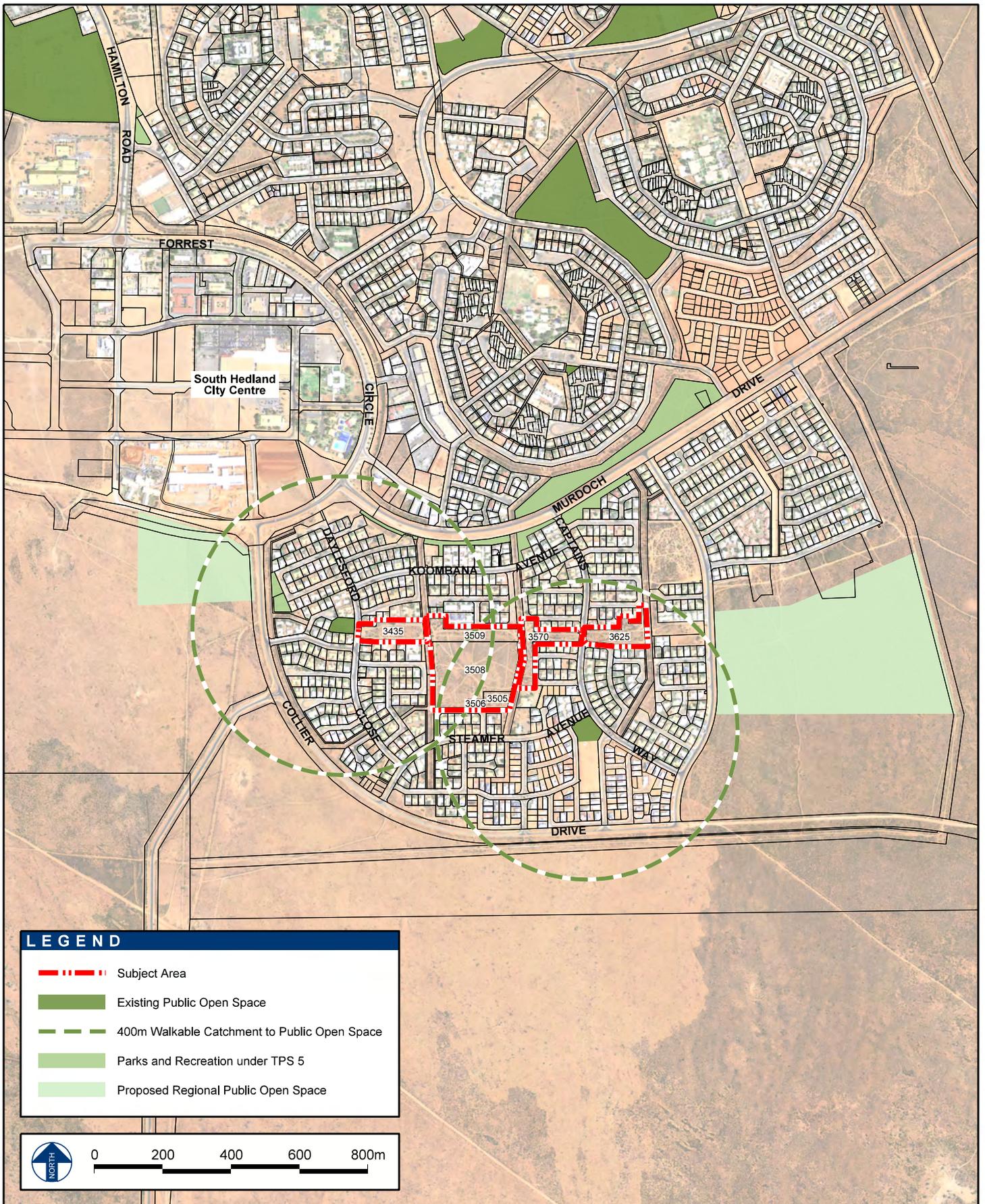
While the shortfall in provision of POS is acknowledged, this is in response to a stated preference to minimise public open space areas in this locality, acknowledging the under-utilisation of existing POS areas and on-going maintenance issues identified by the Town of Port Hedland.

There are a number of additional reasons to justify a reduced POS provision, namely:

Adequate Parkland – There is already adequate local public parkland within walkable catchments of the development site (refer **Figure 7**).

Land rationalization program – The State Government has recently undertaken an extensive land review of South Hedland and concluded it was appropriate to rationalise surplus undeveloped parks and recreation reserves for residential use. To provide additional areas of land for POS would therefore appear to be at odds with the objectives of the Land Availability Plan.

Access to secure water supply for irrigation – The Water Corporation is currently unable to guarantee water for the irrigation of public open space, both active and passive. As this resource is likely to continue to be difficult to secure in the future, a more pragmatic and sustainable approach to the planning and design of public open space in South Hedland is required.



LEGEND

- - - - - Subject Area
- Existing Public Open Space
- - - - - 400m Walkable Catchment to Public Open Space
- Parks and Recreation under TPS 5
- Proposed Regional Public Open Space



PUBLIC OPEN SPACE ANALYSIS PLAN

Property Description

KOOMBANA SCHOOL SITE
 Lot 3435 Daylesford Close, Lots 3505, 3506
 3508, 3713 & 3715 Koojarra Crescent, Lot 3509
 Kabbarli Loop and Lots 3570 & 3625 Captains
 Way, SOUTH HEDLAND

Base data supplied by Landgate.
 Accuracy +/- 4m. Projection MGA Zone 50.
 Areas and dimensions shown are subject to final survey calculations.
 All carriageways are shown for illustrative purposes
 only and are subject to detailed engineering design.

Jaxon : CLIENT
 1:15,000@A4 : SCALE
 24 November 2011 : DATE
 40019-5-005.dgn : PLAN No
 - : REVISION
 T.C. : PLANNER
 R.F. : DRAWN
 N.T. : CHECKED



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Climate – Port Hedland is located in a hot climate where parks that offer little shade or refuge from the heat can have limited appeal during the day. At night when it is cool enough, under-developed and under-surveilled areas may be used for anti-social behaviour.

Long-term maintenance costs – the ongoing cost of maintaining POS beyond the period of developer maintenance is significant, particularly where the standard of development is above what is normally provided by the Town of Port Hedland.

Lack of variety in POS design – when land is fully cleared to make way for development, POS needs to be built from the ground up, resulting in spaces that lack local character or mature trees. There are no redeeming features on the site that would contribute to an interesting space, and the retention of existing vegetation is not achievable in this instance.

Large number of small pocket parks – The standard application of Liveable Neighbourhoods requirements does not recognise local climatic and behavioural trends and results in a large number of small pocket parks that have little practical use for passive recreation, and are generally of similar design and function. Although this generally enables ready access to these areas, it is often at the expense of the provision of larger, more flexible spaces.

Lack of appropriately sized spaces for sporting use – active POS within suburbs is generally of insufficient size and shape to accommodate sporting pursuits. The Town of Port Hedland are currently investigating the feasibility of providing a future regional active open space area to the west as part of the South Hedland Town Centre, and to the east of the Development Plan area.

3.4.2 Landscape Amenity

It is envisaged that the function of the proposed public open space area will be for passive recreation and will include low maintenance planting and informal rest areas. Final design will be confirmed at the detailed design phase with the Town of Port Hedland.

The following provides an overview of the other proposed landscape treatments in and around the Development Plan area as proposed by landscape consultant RPS:

- Landscaping will extend along the adjoining drainage reserve to the east and west of the Development Plan area. Landscape works to include new footpaths and eucalyptus tree plantings within the drains to improve amenity, including management works undertaken on the drains as required to improve surveillance of the drains;
- A POS area with turfing recreation area, amenity and seating;

- A large transplant signature tree within the POS area; and
- The provision of a dual use path consistent with the Town's Cycle Plan.

The Landscape Concept Plan for the Development Plan area is included at **Appendix 5**.

3.4.3 Parkland and Drainage Corridor Frontage and Surveillance

The location, layout and design of subdivision and development surrounding the public open space area and the existing drainage corridors has been designed to minimise potential problems relating to personal security, property security and poor visual amenity. This will assist in achieving the provision of a high level of passive surveillance through the use of public roads and direct lot frontage interface.

The layout of the Development Plan, where possible, achieves this through houses overlooking the street and POS area as required by Liveable Neighbourhoods. Design provisions will be included for those lots which have direct frontage onto the public open space and drainage corridors, ensuring a high level surveillance and amenity.

3.5 Urban Water Management

Stormwater management measures will be implemented consistent with the drainage strategy and Local Water Management Strategy (LWMS) prepared for the subject land. The drainage collection and disposal strategy for various events has been designed to ensure the site is protected from flooding during the major events.

In relation to stormwater conveyance the drainage strategy (refer **Appendix 6**) identifies that conventional piped stormwater systems are not suited to the Pilbara Region due to the high intensity rainfall events. An overland flow strategy has therefore been adopted for the site, utilising the road carriageway as the main conveyance mechanism.

The 1 in 5 year events are to be conveyed through the road reserve and are contained within the kerbs. The 1 in 100 year event has will be contained within the road reserve.

Further details will be outlined in the Local Water Management Strategy (LWMS) which will be lodged under separate cover with the Department of Water and Town of Port Hedland for approval, consistent with the Commission's requirements detailed in Better Urban Water Management (WAPC October 2008). The LWMS details the proposed storm water management strategy, water conservation options and details regarding the landscaping and irrigation of the site.

3.6 Utilities

BCH Engineering Consultants were commissioned by JAXON to undertake a servicing investigation in relation to the availability of services for the development of the Development Plan area (refer **Appendix 7**).

3.6.1 Sewerage

- Water Corporation “As Constructed” plans indicate a number of 300mm and 150mm diameter gravity sewer reticulation pipes adjacent to and surrounding the potential development site.
- As the potential development site is within an existing waste water reticulation area, provision of a sewer service is considered achievable.
- The existing sewer reticulation passes through the three group housing lots, which will require negotiation with the Water Corporation for the relocation of existing sewer pipes and/or formation of an easement to allow strata development of the proposed lots and/or layout adjustment to minimise cost. Where possible, adjusting the layout of the lot configuration/ internal lot layout is likely to be a less expensive option than adjusting physical “live” infrastructure.
- Based on Water Corporation planning practice, the existing sewer pump station capacity should have been designed to accommodate this development area.

3.6.2 Potable Water Supply

- As the subject land is within an existing potable water reticulation area, provision of a water service is considered achievable. Water Corporation has advised that there are currently projects underway to increase the quantity of potable water available to South Hedland.
- Until a preliminary design for water supply is developed, it is unknown if the Water Corporation will require works to upgrade existing infrastructure.

3.6.3 Power

- Horizon Power has advised that existing underground Low Voltage (LV) and High Voltage (HV) electrical power infrastructure services the adjacent properties, and an extension of services to the subject land is considered achievable.
- Demands on the existing power infrastructure and costs to extend power to the site will need to be confirmed as part of the detailed design process.

3.6.4 Telecommunications

- On the basis that the communications will be designed and provided by Telstra and not contain any integrated security system, MATV, CATV, CCTV or other advanced features, provision of standard Telstra communication services to the site is considered achievable.

3.6.5 Gas

Pilbara towns are not currently provided with a reticulated gas supply network.

3.7 Implementation and Staging

Staging of the development will take into account relevant servicing considerations. At this stage it is anticipated that the general direction of development is likely to be from west to east.

The final stage layout will be confirmed at the construction stage and will be dictated by a number of different considerations, including demand of product and availability of essential services such as water and sewer.

4.0 CONCLUSION

The Development Plan, prepared on behalf of JAXON, illustrates the preferred development option for Lot 3435 Daylesford Close, Lots 3505, 3506 & 3508 Koojarra Crescent, Lot 3509 Kabbarli Loop and Lots 3570 & 3625 Captains Way, South Hedland.

The Development Plan will facilitate residential subdivision and development that will assist in meeting a demand for housing in this region.

The Development Plan has been based on a number of best-practice design principles, including climatic responsiveness, legibility, diversity and connectivity. Development will also integrate with the existing urban structure and land use.

A mix of residential densities have been proposed, encouraging a variety of lot sizes to cater for a diversity in housing options for existing and future residents of South Hedland.

The Development Plan has been prepared in accordance with the design requirements established by Liveable Neighbourhoods and approval of the Development Plan will facilitate the future subdivision and development of the subject land.

APPENDIX I

Development Plan

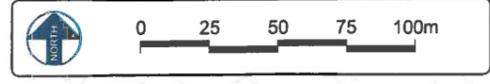
DEVELOPMENT PLAN PROVISIONS

1. Dwellings on lots fronting and/or abutting Public Open Space and/or Drainage Reserves are to be oriented to front the Public Open Space and/or Drainage Reserves and vehicular access shall be via the rear laneway.
2. Lots with dual frontage shall front the road and vehicular access shall be via the rear laneway.
3. Lots with dual frontage to a road and a laneway, shall have vehicular access restricted to the rear laneway.
4. Uniform fencing is required for lots fronting Public Open Space and/or Drainage Reserves.



LEGEND

- Development Plan Boundary
- Existing Cadastre
- R20/30 General Single Residence
- R40 Multiple / Grouped Residential
- Public Open Space
- Access Street C
- Access Street D
- Laneway - 9m
- Footpath



APPENDIX 2

Environmental Assessment Report (RPS)



ENVIRONMENTAL ASSESSMENT REPORT

**Koombana School Site, Lots 3503 to 3506
Koojarra Crescent, Lots 3625 to 3570 Captains
Way, South Hedland**

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<i>Rev0</i>	<i>Final</i>	<i>RebDaw</i>	<i>JohHal</i>	<i>22.12.11</i>			

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EXECUTIVE SUMMARY

This Environmental Assessment Report (EAR) has been prepared for Lots 3503 to 3506 Koojarra Crescent, Lots 3625 to 3570 Captains Way, Lot 3435 Dorrigo Loop and Lot 3509 Kabbarli Loop, South Hedland to support the Town Planning Scheme Amendment No 49 to the Town of Port Hedland (ToPH) Town Planning Scheme (TPS) No 5 which proposes to rezone the site from 'Community – Education', 'Residential R20' and 'Parks and Recreation' to 'Urban Development'.

The site is located in South Hedland, 1600 kilometres (km) north of Perth. The South Hedland town centre is located approximately 1 km to the north west of the site. It is surrounded by residential development and is generally bound by Captains Way to the east, Koojarra Crescent to the south, Karballi Loop to the north and a drainage swale to the west (Figure 1).

The Port Hedland Land Use Master Plan (LUMP) identifies the site as suitable for renovation and infill development. Consequently, the site has been identified as a key urban development opportunity by the State Government and was included in the Stage 1 land release by the Department of Regional Development and Lands.

The proposed concept development plan for the Koombana School Site is provided as Figure 2 and includes the following:

- 0.11 hectares of Public Open Space (POS)
- 94 traditional lots
- One duplex site
- Five grouped sites (R40).

The key environmental issues on the site which may pose a constraint to the proposed residential development and require further investigation are potential contamination and surface water.

South Hedland experiences periodic cyclonic events resulting in high volume storm water flows. Stormwater management on the site will be consistent with the objectives outlined in the Better Urban Water Management (WAPC 2008) through the implementation of a Local Water Management Strategy.

Previous land uses with the potential to contaminate ground water (fuel storage facilities) are located within 1km of the site. It is considered unlikely that these sources of potential contamination will impact the site due to the direction of flow of groundwater. Consequently, no further contamination investigations are considered necessary.

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APPENDICES

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1.0 INTRODUCTION

This EAR has been prepared to support the ToPH TPS No 5 Amendment Number 49 for the Koombana School Site in South Hedland (Figure 1).

The Koombana site consists of Lots 3503 to 3506 Koojarra Crescent, Lots 3625 to 3570 Captains Way. Lot 3435 Dorrigo Loop and Lot 3509 Kabbarli Loop, South Hedland.

1.1 Objective

The objectives of this EAR are to:

- Provide a brief environment context.
- Identify potential environmental issues associated with the residential development proposed for the site.
- Provide environmental management framework in response to the potential environmental issue, where applicable.

1.2 Planning Approval

The site was previously proposed as a site for a future Primary School (Koombana Primary School). However has since been identified as surplus to the needs of the Department of Education and is therefore no longer required as a school site. The areas zoned 'Park and Recreation' have also been identified as surplus to the requirements of the ToPH.

The Port Hedland Land Use Master Plan (LUMP) identifies the site as suitable for renovation and infill development. Consequently, the site has been identified as a key urban development opportunity by the State Government and was included in the Stage 1 land release by the Department of Regional Development and Lands.

To facilitate this proposed development, TPS Amendment 49 to the ToPHJ Town Planning Scheme 5 proposes to rezone the site from 'Community – Education', Residential R20' and 'Parks and Recreation' to 'Urban Development'. This EAR has been produced to support this amendment.

The proposed concept development plan for the Koombana School Site is provided as Figure 2 and includes the following:

- 0.11 hectares of Public Open Space (POS)
- 94 traditional lots

- One duplex site
- Five grouped sites (R40)

2.0 EXISTING ENVIRONMENT

The purpose of this section is to provide a brief environmental context of the Scheme Amendment area.

2.1 Climate

South Hedland is located within a hot, semi-arid climatic zone. Summers (October to April) are very hot with an average maximum temperature of 33.2 °C and daily maximum of up to 36.8 °C in March, the hottest month. Winter temperatures range from an average monthly minimum of 19.4 °C with a daily minimum as low as 12.3 °C in July (Bureau of Meteorology 2010).

Most of the annual rainfall occurs during the summer period from scattered thunderstorms and the occasional tropical cyclone. A secondary peak in rainfall occurs in May as a result of rainfall events caused by tropical cloud bands which intermittently affect the area.

Cyclones are most common in the South Hedland region between February and March and sometimes result in extreme rainfall events, on average the highest daily rainfall is typically recorded mid cyclone season in January.

2.2 Topography, Soils and Geology

2.2.1 Topography and Soils

Topography on the site is relatively flat at approximately 13 metres Australian Height Datum (mAHD) (Figure 3).

Soils of the South Hedland region are described as alluvial plains and sand plains of alluvial and marine deposits over rocks of the northern Pilbara Craton. They consist of red deep sandy duplexes with deep red loamy earths and some red/brown clays (Tille 2006). The soils can become very hard when dry and waterlogged when heavily watered.

The 1:250 00 Australian geological series sheet SF 5004 (third edition 2006) identifies the following geology in the area as comprising Alluvial Units (A1f) – Flood plain deposits, sand, silt, clay and gravel adjacent to main drainage channels (Figure 4).

2.2.2 Acid Sulfate Soils

The site is identified in Western Australian Planning Commission (WAPC 2003) Planning Bulletin 64 as having a “no known risk of Acid Sulfate Soil (ASS) within 3 m of the natural soil surface (or deeper)” and as such, Acid Sulfate Soils are not considered to be a constraint to the proposed development. Figure 4 shows the ASS risk mapping for the region.

2.3 Hydrogeology

The North Pilbara region consists of granite-greenstone bedrock, overlain by thin alluvial sediments in the river valleys (Department of Fisheries 2010). The most important groundwater resources are in the alluvial aquifers along the major rivers from the Ashburton to the De Grey. Groundwater is generally fresh ranging to brackish towards the coast (Department of Fisheries 2010).

The De Grey River Water Reserve, located north-east of South Hedland, provides the water supply for the ToPH. As described by Davidson (1995), the aquifer is unconfined and consists of beds of highly permeable sand and gravel separated by low permeability silt and clay (Water and Rivers Commission (WRC) 2000). The aquifer is recharged largely by freshwater from river flow and rainfall during the wet season’s high intensity rainfall events. As the aquifer is unconfined and recharge is via rainfall and river flow, it is vulnerable to contamination. Any contaminants entering the aquifer from the south could potentially affect water quality.

2.4 Hydrology

2.4.1 Groundwater

A search of the Department of Water (2011) *Groundwater Bore Database* identified two WIN groundwater bores 5 km to the north east with a groundwater depth of 11.58 mAHD and 12.8 mAHD. During the database search no water quality data was found to be available for the bores close to the site and no groundwater bore hydrographs were available for the study area.

Water quality within the De Grey River aquifer system is variable with total dissolved solids (TDS) ranging from 200 to 4000 mg/L TDS (WRC. 2000).

The water table in the De Grey River well field is approximately 6 metre (m) to 8 m below ground level. Regional groundwater flow is generally north to north-west (WRC. 2000).

2.4.2 Surface Water

Although average annual rainfall is low, the Port Hedland region is characterised by periodic cyclonic events yielding high volume storm flows. During extreme cyclonic events, stormwater may flood low lying areas and soils may become waterlogged.

GHD was commissioned by the ToPH to undertake a flood study of South Hedland 2010. The GHD scope included modelling of the 1 in 5, 1 in 10 and 1 in 100 year flood events (GHD 2010). The results from the GHD flood study show that the site is potentially impacted by the 1 in 100 year flood events (Figure 5). The 5 year flooding events are within the drainage open space areas illustrated in Figure 5.

Stormwater management on the site will be addressed in a Local Water Management Strategy to the satisfaction of the Department of Water and the Western Australian Planning Commission.

2.4.3 Drainage

Within the locality of the site, the lots have been graded to drain overland to adjacent road reserves and roads to a network of open channels. The open channels convey stormwater through culverts and small bridges to the natural drainage line immediately west of the town site.

The open drains in the area are generally trapezoidal and between 1 m to 2 m deep with a typical base width of 2 to 4 m. Longitudinal grades are very low, with the longitudinal grade for most open drains at less than 0.5% (GHD 2010).

Engineering drainage design and stormwater retention details for the site will be addressed of Water in the Local Water Management Strategy to the satisfaction of the Department.

2.5 Flora and Vegetation

Vegetation in the area is sparse and mostly representative of the semi arid northern areas of the state. A site visit and review of aerial photography of the site indicates that vegetation is degraded with an absence of any significant upper storey vegetation (Plates 1 to 3).



Plate 1: Scattered Acacia spp over mixed open shrubland



Plate 2: View north along the eastern drainage line - mixed open shrubland

2.5.1 Vegetation

Vegetation complexes on the site are mapped as “Mosaic: short bunch grassland – savanna/grass plain (Pilbarra) / Hummock grasslands, grass steppe; soft Spinifex” (Beard 1971) (Figure 6).

A search of the Department of Environment and Conservation’s (DEC) Threatened Ecological database was undertaken in May 2011 for the South Hedland area, No Threatened Ecological Communities (TEC) were identified within vicinity of the site.

2.5.2 Conservation Significant Flora

A search of the DEC's Threatened (Declared Rare) Flora database, the Western Australian Herbarium Specimen database and the Declared Rare and Priority Flora List was undertaken on 18 May 2011.

A total of seven priority species as listed by the DEC, are documented as occurring within a 10 km radius of the site. These species are the *Acacia glaucocaesia* (P3), *Euphorbia clementii* (P1), *Gomphrena pusilla* (P2), *Gomphrena cucullata* (P2) *Heliotrophium muticum* (P1), *Ptilotus appendiculatus var. minor* (P1), *Tephrosia andrewii* (P1) (Figure 7).

None of these species are identified as occurring on the site and due to the degraded nature of vegetation on the site it is considered highly unlikely that any of these species occur on site.

2.6 Fauna

A search of the Department of Sustainability, Environment, Water, Population and Communities (DSEWPC) website for matters of National Environmental Significance (NES) protected under the *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act) was undertaken for the site and showed a number of listed species that potentially utilise the site (Appendix 1).

A search of the DEC Threatened Species Database was undertaken for the South Hedland area on 16 May 2011 and identified species of conservation significance under Western Australian legislation (*Wildlife Conservation Act 1950*) that may occur within the site.

Table 1 provides the species lists produced from these searches, and discusses the likelihood of their occurrence on the site and potential impact from the proposed development.

None of the species are considered likely to inhabit the site and therefore should not be impacted by the proposed development and no further fauna investigations are considered necessary.

Table 1: Fauna Species of Conservation Significance that are Recognised to Potentially occur within the Subject Area (DEC Threatened Fauna Database)

Species	Common Name	WA Status	EPBC Status	Habitat Availability within Subject Area
Birds				
<i>Apus pacificus</i>	Fork-tailed Swift		M	The fork tailed swift mostly occurs over dry or open habitats and are also found in settled areas. Therefore, the Fork-tailed Swift may occur on the site, however as it is an aerial species, the proposed development is considered unlikely to impact it.
<i>Ardea alba</i>	Great Egret (White Egret)		M	The Great Egret is highly mobile, rendering it less susceptible to population fragmentation. The Great Egret occurs in a wide range of wetland habitats, retreating to permanent wetlands over the warmer months. It is considered unlikely to occur on the site due to the lack of wetlands.
<i>Ardea ibis</i>	Cattle Egret		M	The Cattle Egret typically occurs in temperate and tropical grasslands, wooded areas and terrestrial wetlands, very rarely occurring in arid and semi arid areas. Therefore it is considered highly unlikely that the Cattle Egret occur on the site.
<i>Haliaeetus leucogaster</i>	White bellied Sea Eagle		M	The white bellied sea eagle is found in coastal habitats, tending to occur in dunes, tidal flats, woodlands forests and grasslands generally in areas with large bodies of water. Consequently, due to the lack of open water, it is unlikely that the white bellied sea eagle would inhabit or utilise the site.
<i>Ardeotis australis</i>	Australian Bustard	P 4		Occurs on dry plains, grasslands and open woodlands. Due to the degraded and isolated nature of the site, it is not considered likely to provide significant habitat for the Australian Bustard.
<i>Falco peregrinus</i>	Peregrine Falcon	S 4		Occurs from woodlands to open grasslands and coastal cliffs. The site is not considered likely to provide significant habitat for the Peregrine Falcon.
<i>Hirundo rustica</i>	Barn Swallow		M	The Barn Swallow prefers open areas with low vegetation. However, as there are no perching or roosting areas present on the site, the proposed development is not considered likely to impact the swallow.
<i>Merops ornatus</i>	Rainbow Bee-eater		M	The Rainbow Bee eater occurs mainly in open forest and woodlands, shrublands and semi cleared habitats that are often located in close proximity to water. The Rainbow Bee-eater may infrequently visit the site, however due to the lack of vegetation (including perching habitat) and isolated nature of the site, it is unlikely that the proposed development will impact this species.

Species	Common Name	WA Status	EPBC Status	Habitat Availability within Subject Area
<i>Charadrius veredus</i>	Oriental Plover (Oriental Dotterel)		M	Although the Oriental Plover occurs in both coastal and inland areas. Habitat favoured by the Plover is not considered likely to occur on the site.
<i>Glareola maldivarum</i>	Oriental Pranticole		M	The Oriental Pranticole is considered unlikely to inhabit the site as although widespread across Northern Australia, it only occurs infrequently inland.
<i>Numenius madagascariensis</i>	Eastern Curlew	P4	M	The Eastern Curlew has a primarily coastal distribution in Australia and is therefore considered unlikely to inhabit the site.
Mammals				
<i>Dasyurus hallucatus</i>	Northern Quoll	E (S 1)	E	The Northern Quoll prefers rocky areas and Eucalypt forests, therefore the site is considered unsuitable habitat.
<i>Macrotis lagotis</i>	Greater Bilby	V (S 1)	V	The Greater Bilby inhabits sandy desert areas with Spinifex grasslands. It is considered unlikely to occur on site due to the isolated nature of the site and the degraded and sparse vegetation.
<i>Rhinonicteris aurantia</i>	Pilbara Leaf-nosed Bat	S 1	V	The Pilbara leaf-nosed bat roosts in mine sites or caves. Therefore there is no habitat suitable for the bat on site.
<i>Dasyercus cristicauda</i>	Crest-tailed Mulgara	S 1	V	The crest tailed mulgara shelters in burrows and prefers vegetated sand dune habitats. It is considered unlikely that there is suitable habitat present on site.
<i>Dasyercus blythi</i>	Brush tailed Mulgara	P 4		The brush tailed mulgara occurs in Spinifex grasslands. Due to the degraded vegetation and isolated nature of the site it is considered unlikely that this species occurs on site.

Schedule 1 = Rare or likely to become
Schedule 4 = Other specially protected fauna
P4 = Priority 4 (taxa in need of monitoring)
P5 = Priority 5 (taxa that are conservation dependent)
V = Vulnerable
E = Endangered
M = Migratory

2.7 Aboriginal Heritage

A search of the Department of Indigenous Affairs (DIA) Database on 22 November 2011 showed no registered Aboriginal sites of significance within the subject area (Figure 8). The results of the Department of Indigenous Affairs Aboriginal Heritage Enquiry System search are presented as Appendix 2.

2.8 Contamination

A search of the DEC's Contaminated Sites Database was undertaken on 23 November 2011, no registered contaminated sites were identified on, or within vicinity of the site. Historical aerials from 1949 to 2009 also identified no potentially contaminating previous land uses on or adjacent to the site. Historical aerials are provided as Appendix 3.

Surrounding land uses and potential contamination are depicted in Figure 9 and include:

- South Hedland Waste Water Treatment Plant approximately 2 km to the west.
- South Hedland landfill approximately 2 km to the east.
- A previous fuel storage facility located approximately 500 m north west
- A previous fuel storage facility located approximately 1 km north west

3.0 POTENTIAL IMPACTS AND MANAGEMENT

In response to the environmental values of the site mentioned in Section 3, the following section outlines the likely impacts and subsequent management measures to minimise and mitigate any impacts to the environment resulting from development of the site.

3.1 Acid Sulfate Soils

According to existing DEC mapping, there is no known risk of ASS occurring within the site. Based on this, it is not considered that any further works in regard to ASS will be required.

3.2 Water Management

Stormwater is likely to be the only hydrological constraint to the development due to potential flooding likely to occur during storms and cyclone events. A Local Water Management Strategy will be undertaken as part of the structure plan approval process to address surface water issues.

3.3 Flora and Vegetation

As outlined in Section 3.6, native vegetation on the site is mapped as “Mosaic: short bunch grassland – savannah/grass plain (Pilbarra) / Hummock grasslands, grass steppe; soft Spinifex” (Beard 1971).

Shepherd, Beeston and Hopkins (2002) gives an estimate of the percentage of each of Beard’s vegetation associations that remains compared to its pre-European settlement extent, so an estimate of the scarcity of each vegetation association can be determined. For the vegetation association above, it is estimated that near 100% of the pre-European settlement extent remains (Shepherd et al. 2002). Therefore, development of 8.16 hectares of this vegetation association will not have a significant environmental impact.

This vegetation is typical of that in the region and it is not considered likely that the proposed development will impact any significant vegetation on site. No further investigations into flora and vegetation on the site is considered necessary.

3.4 Fauna

As outlined previously, the vegetation on site is degraded with no over storey. As a result it is considered highly unlikely that the site contains any significant fauna habitat.

A search of the EPBC Protected Matters and the DEC Threatened and Priority Fauna databases produced a list of species of conservation significance listed under state and/or federal legislation that potentially occur on the site (Appendix 1). Based on this search, it is considered unlikely that the site provides significant habitat for any of these species and the proposed development will not impact on any significant fauna species.

3.5 Potential Contamination

A search of the DEC's Contaminated Sites Database revealed no registered contaminated sites on or near the site.

4.0 CONCLUSION

Following review of environmental characteristics and values across the site, the likely impacts resulting from development of the site and the subsequent management commitments are summarised below.

Table 2: Potential Constraints and Management Recommendations

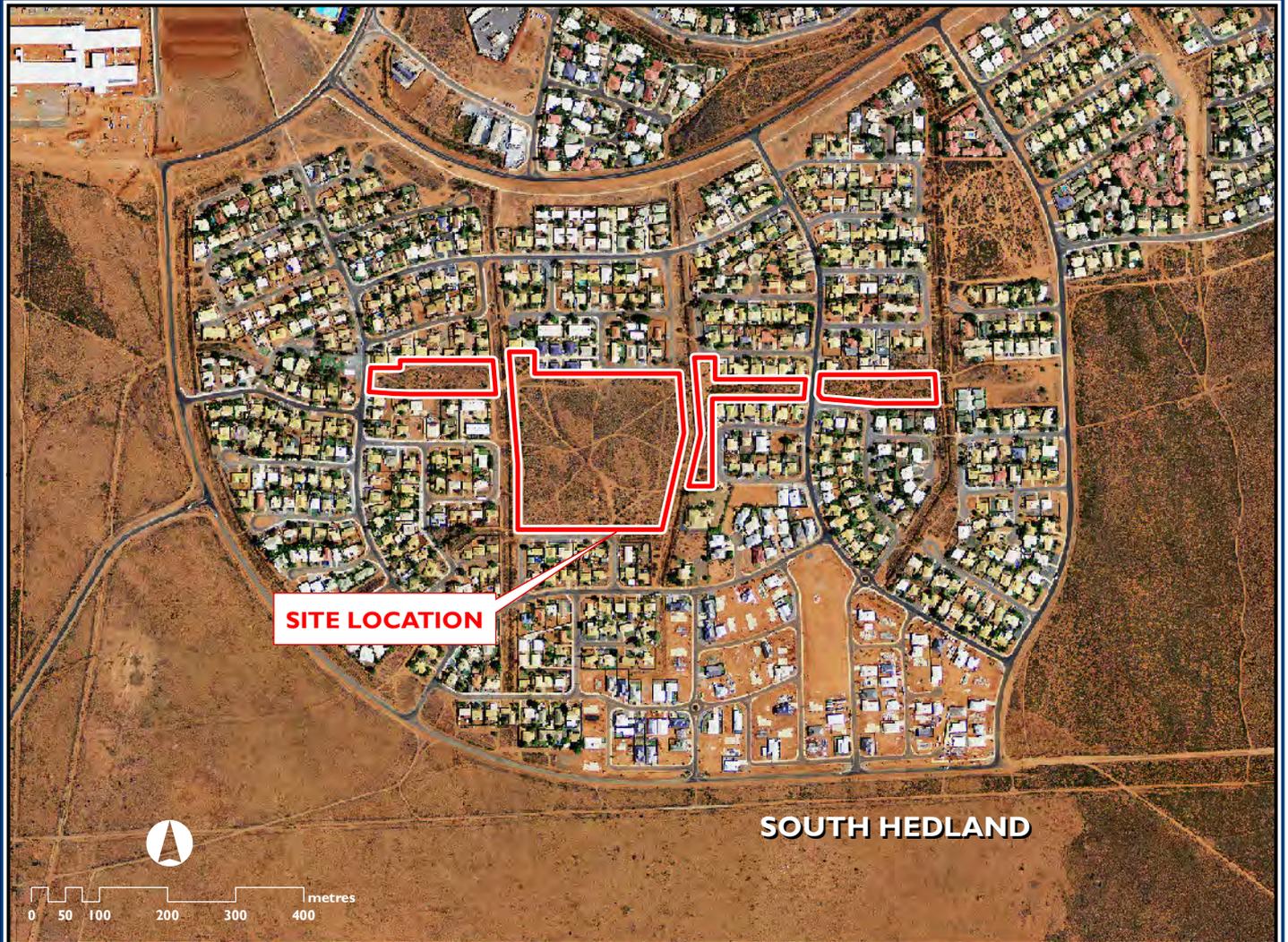
	Objective	Potential Impact	Management Recommendations
Wetlands	To maintain the integrity, ecological functions and environmental values of wetlands	There have been no wetlands identified within vicinity of the site. Therefore the proposed development will have no impact on wetlands.	No further work is considered necessary.
Acid Sulfate Soils	To ensure that ASS are not disturbed during earthworks and construction activities.	According to regional DEC mapping, it is unlikely that ASS will be encountered during ground disturbing activities.	No ASS investigations are considered necessary due to the DEC mapping over the site.
Surface water	To maintain the quantity and quality of water so that existing and potential environmental values, including ecosystem function, are protected.	There are no ecologically sensitive ecosystems or wetlands within vicinity of the site that may be impacted by changes in the hydrological regime as a result of from development. Stormwater within the development will require management.	A LWMS will be prepared at appropriate planning and development stages in accordance with <i>Better Urban Water Management Guidelines</i> (WAPC 2008). This plan will provide further detail in respect to surface and ground water management relevant to detailed planning and engineering of the development design.
Vegetation	To maintain the abundance, diversity, geographic distribution and productivity of flora at species and ecosystem levels through the avoidance or management of adverse impacts and improvement in knowledge.	Potential impacts to vegetation on site are minimal as vegetation on site is degraded and well represented with the region.	Vegetation is not considered likely to pose a constraint on the proposed development and no further assessments are considered necessary.
Surrounding Land Uses	To ensure surrounding land uses do not impact future development of the site.	Surrounding land uses that may potentially impact the site are decommissioned fuel storage facilities located approximately 1km away from the site. Noise and dust during construction may also impact neighbouring residences.	Noise and dust management during construction will have to be undertaken to protect neighbouring residential land. This should be addressed in a Construction Management Plan for the site

	Objective	Potential Impact	Management Recommendations
Site Contamination	To ensure previous land uses within and surrounding the site do not impact on proposed development of the site.	The DEC contaminated sites database shows no contaminated sites within vicinity of the site.	No previous land uses on site are considered likely to have contaminated soil or groundwater.
Fauna	To maintain the abundance, diversity, geographic distribution and productivity of native fauna at the species and ecosystem levels.	The site is not considered likely to contain important habitat for any significant fauna	No fauna species are considered likely to constrain the proposed development and no further work is considered necessary.

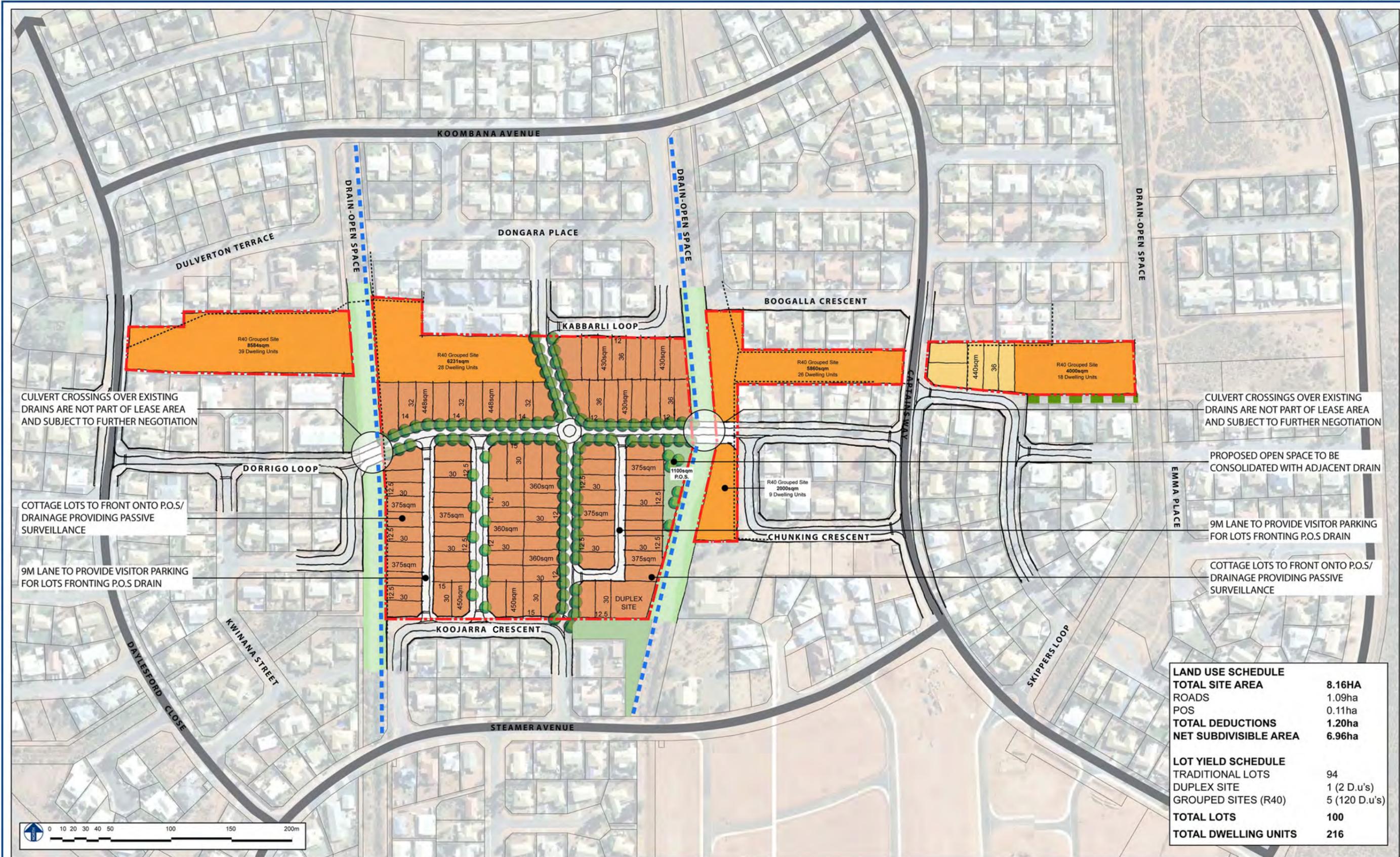
5.0 REFERENCES

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FIGURES



Job Number: L11357
 Date: 23.11.11
 Revision: A
 Scale: Close Up 1:10000, Location Map: 1:500000@A4
 Drafted by: HT
 Source: Landgate 2009.



LEGEND

	SITE BOUNDARY		R40 RESIDENTIAL
	PEDESTRIAN LINKS		R30 RESIDENTIAL
	EXISTING SERVICES IMPACTING ON DEVELOPMENT LOTS		R20 RESIDENTIAL
	PRINCIPLE CONNECTOR ROADS		POS/DRAINAGE

NOTES

Areas and dimensions shown are subject to final survey calculations.
 All carriageways are shown for illustrative purposes only and are subject to detailed engineering design.

LAND USE SCHEDULE	
TOTAL SITE AREA	8.16HA
ROADS	1.09ha
POS	0.11ha
TOTAL DEDUCTIONS	1.20ha
NET SUBDIVISIBLE AREA	6.96ha
LOT YIELD SCHEDULE	
TRADITIONAL LOTS	94
DUPLEX SITE	1 (2 D.u's)
GROUPED SITES (R40)	5 (120 D.u's)
TOTAL LOTS	100
TOTAL DWELLING UNITS	216

Job Number: L11357
 Date: 23.11.11
 Scale: NTS @ A3
 Revision: A
 Drafted by: HT
 Source: RPS 17.10.2011



Figure 2
Subdivision Concept



LEGEND

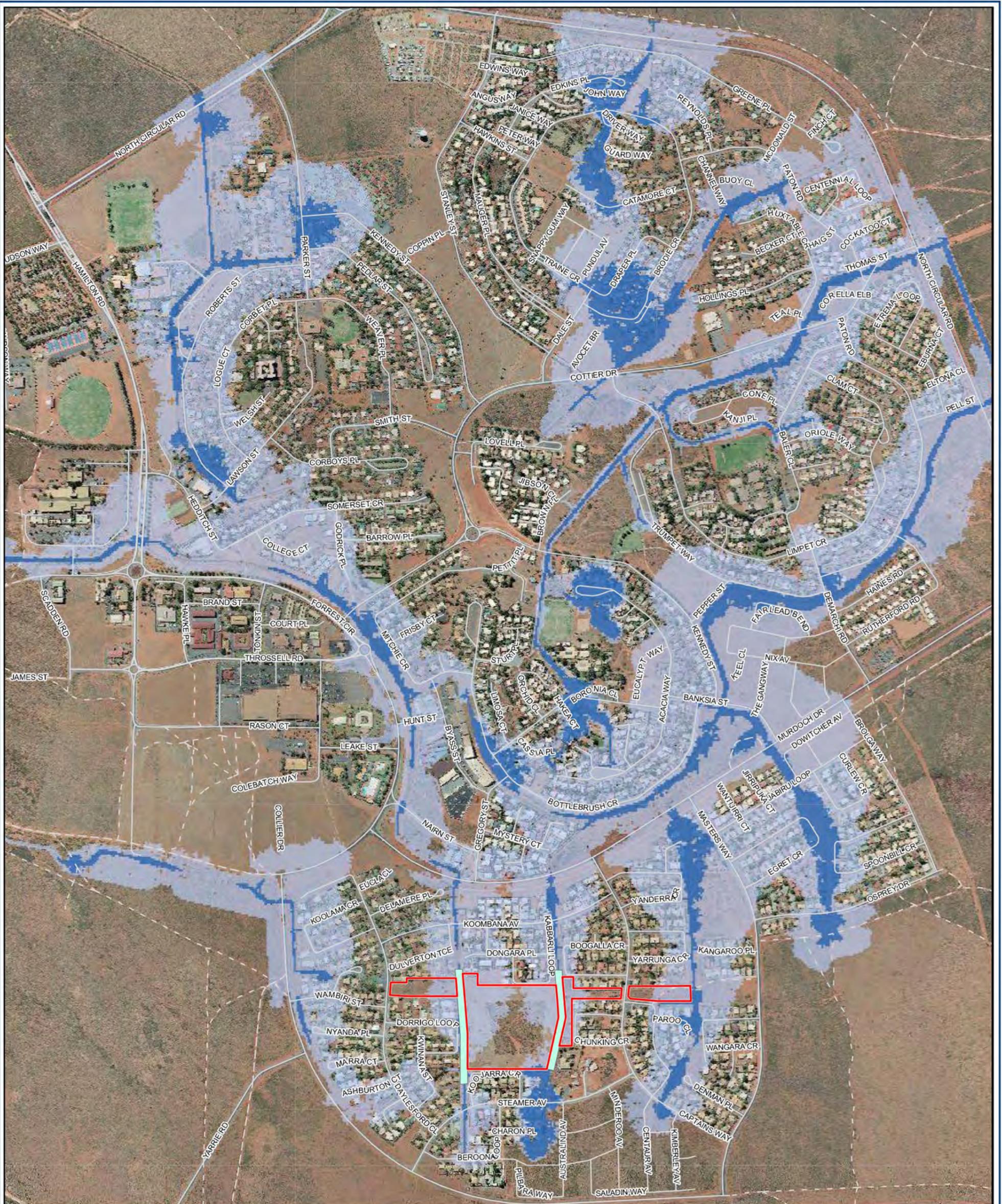
- Site boundary
- Cadastre

Acid Sulfate Soil Risk Category

- High to moderate ASS disturbance risk (<3m from surface)
- Moderate to low ASS disturbance risk (<3m from surface)

Geology

- _A1f, Floodplain deposits; sand, silt, clay, and gravel adjacent to main drainage channels
- _A1i, Mixed floodplain deposits; sand, silt, and clay adjacent to main drainage channels; numerous small claypans
- _Tf, Tidal flat deposits; silt and mud in intertidal and supratidal flats and lagoons
- _Tm, Coastal (tide-dominated) mud and silt on mangrove flats



LEGEND	
	Site boundary
	5 Year Expected Flood Extents
	100 Year Expected Flood Extents
	Drainage
Roads	
	Track
	Minor Unsealed Road
	Minor Sealed Road
	Main Road



LEGEND

- Site Boundary
- Cadastre
- Significant Flora**
- Tephrosia rosea var. venulosa* (Conservation Code I)

Job Number: L11357
Date: 23.11.11
Scale: 1:25,000 @ A3
Revision: A
Drafted by: HT
Source: Orthophoto, Cadastre, - Landgate, 2009, 2011 Threatened Flora - DEC 2010.

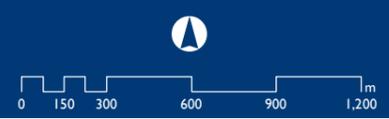


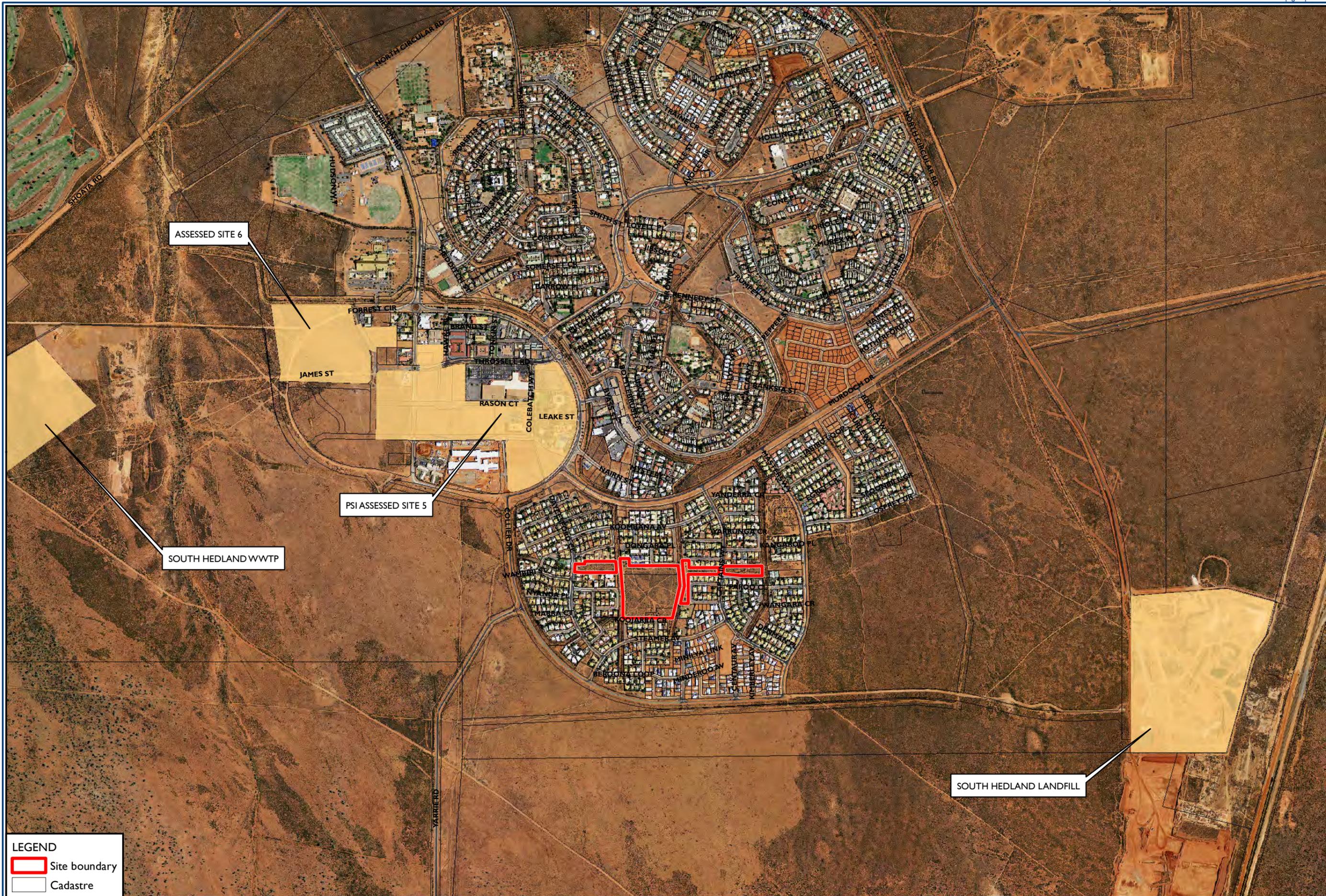
Figure 7

Significant Flora



LEGEND

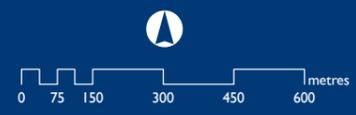
- Site boundary
- Cadastre
- Aboriginal Heritage Site
- Registered Site
- Other Heritage Place



LEGEND

- Site boundary
- Cadastre

Job Number: L11357
 Date: 23.11.11
 Scale: 1:15000 @ A3
 Revision: A
 Drafted by: HT
 Source: Orthophoto, Cadastre - Landgate, 2009, 2011.



RPS

Figure 9

Contaminated Sites

APPENDIX I

Protected Matters Search Results (EPBC Act)



EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

Information about the EPBC Act including significance guidelines, forms and application process details can be found at <http://www.environment.gov.au/epbc/assessmentsapprovals/index.html>

Report created: 24/11/11 10:13:32

[Summary](#)

[Details](#)

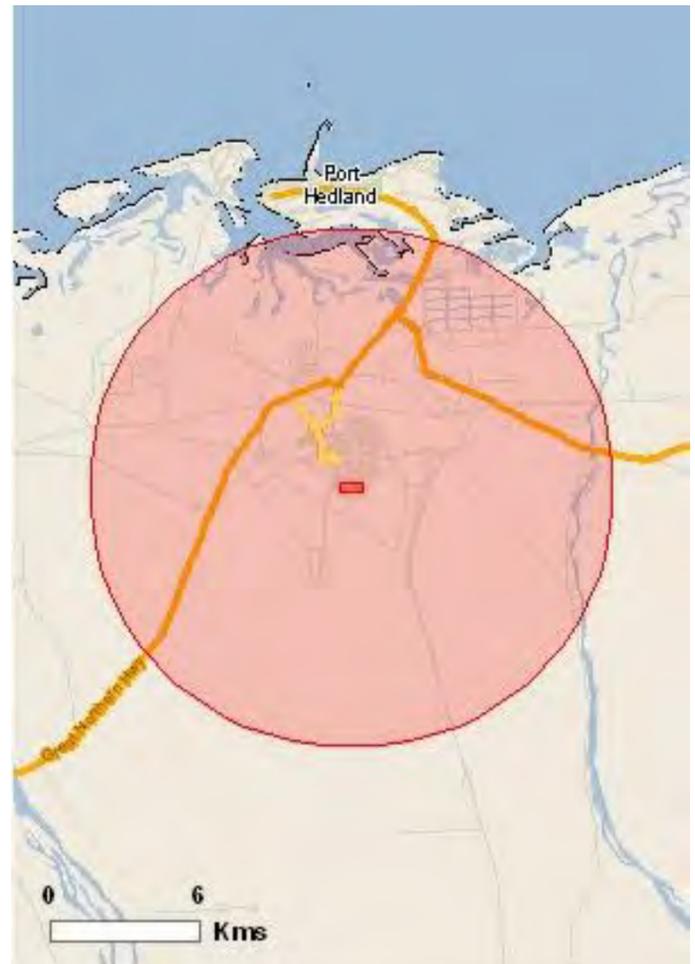
[Matters of NES](#)

[Other Matters Protected by the EPBC Act](#)

[Extra Information](#)

[Caveat](#)

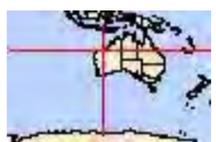
[Acknowledgements](#)



This map may contain data which are ©Commonwealth of Australia (Geoscience Australia), ©PSMA 2010

[Coordinates](#)

[Buffer: 10.0Km](#)



Summary

Matters of National Environment Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the Administrative Guidelines on Significance - see <http://www.environment.gov.au/epbc/assessmentsapprovals/guidelines/index.html>

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Areas:	None
Threatened Ecological Communities:	None
Threatened Species:	14
Migratory Species:	22

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place and the heritage values of a place on the Register of the National Estate. Information on the new heritage laws can be found at <http://www.environment.gov.au/heritage/index.html>

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

A permit may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species. Information on EPBC Act permit requirements and application forms can be found at <http://www.environment.gov>.

Commonwealth Lands:	1
Commonwealth Heritage Places:	None
Listed Marine Species:	57
Whales and Other Cetaceans:	11
Critical Habitats:	None
Commonwealth Reserves:	None

Extra Information

This part of the report provides information that may also be relevant to the area you have

Place on the RNE:	2
State and Territory Reserves:	None
Regional Forest Agreements:	None
Invasive Species:	4
Nationally Important Wetlands:	None

Details

Matters of National Environmental Significance

Threatened Species		[Resource Information]
Name	Status	Type of Presence
BIRDS		
Macronectes giganteus Southern Giant-Petrel [1060]	Endangered	Species or species habitat may occur within area

Name	Status	Type of Presence
MAMMALS		
Dasycercus cristicauda Mulgara [328]	Vulnerable	Species or species habitat likely to occur within area
Dasyurus hallucatus Northern Quoll [331]	Endangered	Species or species habitat likely to occur within area
Macrotis lagotis Greater Bilby [282]	Vulnerable	Species or species habitat likely to occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Species or species habitat known to occur within area
Rhinonictoris aurantia (Pilbara form) Pilbara Leaf-nosed Bat [82790]	Vulnerable	Species or species habitat likely to occur within area
REPTILES		
Aipysurus apraefrontalis Short-nosed Seasnake [1115]	Critically Endangered	Species or species habitat likely to occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Species or species habitat likely to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Species or species habitat likely to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat likely to occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Species or species habitat likely to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Breeding known to occur within area
SHARKS		
Pristis clavata Dwarf Sawfish, Queensland Sawfish [68447]	Vulnerable	Species or species habitat may occur within area
Rhincodon typus Whale Shark [66680]	Vulnerable	Species or species habitat may occur within area
Migratory Species		[Resource Information]
* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.		
Name	Threatened	Type of Presence
Migratory Marine Birds		
Apus pacificus Fork-tailed Swift [678]		Species or species habitat may occur within area
Ardea alba Great Egret, White Egret [59541]		Species or species habitat may occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
Macronectes giganteus Southern Giant-Petrel [1060]	Endangered	Species or species habitat may occur within area
Migratory Marine Species		
Balaenoptera edeni Bryde's Whale [35]		Species or species habitat may occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Species or species habitat likely to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Species or species habitat likely to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat likely to occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Species or species habitat likely to occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Species or species habitat known to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Breeding known to occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area
Rhincodon typus Whale Shark [66680]	Vulnerable	Species or species habitat may occur within area
Sousa chinensis Indo-Pacific Humpback Dolphin [50]		Species or species habitat may occur within area
Tursiops aduncus (Arafura/Timor Sea populations) Spotted Bottlenose Dolphin (Arafura/Timor Sea populations) [78900]		Species or species habitat likely to occur within area
Migratory Terrestrial Species		
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat likely to occur within area
Hirundo rustica Barn Swallow [662]		Species or species habitat may occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Migratory Wetlands Species		
Ardea alba Great Egret, White Egret [59541]		Species or species habitat may occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within area
Charadrius veredus Oriental Plover, Oriental Dotterel [882]		Species or species habitat may occur within

Name	Threatened	Type of Presence area
Glareola maldivarum Oriental Pratincole [840]		Species or species habitat may occur within area

Other Matters Protected by the EPBC Act

Commonwealth Lands [\[Resource Information \]](#)

The Commonwealth area listed below may indicate the presence of Commonwealth land in this vicinity. Due to the unreliability of the data source, all proposals should be checked as to whether it impacts on a Commonwealth area, before making a definitive decision. Contact the State or Territory government land department for further information.

Name
Commonwealth Land -

Listed Marine Species [\[Resource Information \]](#)

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Birds		
Apus pacificus Fork-tailed Swift [678]		Species or species habitat may occur within area
Ardea alba Great Egret, White Egret [59541]		Species or species habitat may occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within area
Charadrius veredus Oriental Plover, Oriental Dotterel [882]		Species or species habitat may occur within area
Glareola maldivarum Oriental Pratincole [840]		Species or species habitat may occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat likely to occur within area
Hirundo rustica Barn Swallow [662]		Species or species habitat may occur within area
Macronectes giganteus Southern Giant-Petrel [1060]	Endangered	Species or species habitat may occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Fish		
Bulbonaricus brauni Braun's Pughead Pipefish, Pug-headed Pipefish [66189]		Species or species habitat may occur within area
Campichthys tricarinatus Three-keel Pipefish [66192]		Species or species habitat may occur within area
Choeroichthys brachysoma Pacific Short-bodied Pipefish, Short-bodied Pipefish [66194]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
Choeroichthys suillus Pig-snouted Pipefish [66198]		Species or species habitat may occur within area
Doryramphus janssi Cleaner Pipefish, Janss' Pipefish [66212]		Species or species habitat may occur within area
Doryramphus negrosensis Flagtail Pipefish, Masthead Island Pipefish [66213]		Species or species habitat may occur within area
Festucalex scalaris Ladder Pipefish [66216]		Species or species habitat may occur within area
Filicampus tigris Tiger Pipefish [66217]		Species or species habitat may occur within area
Halicampus brocki Brock's Pipefish [66219]		Species or species habitat may occur within area
Halicampus grayi Mud Pipefish, Gray's Pipefish [66221]		Species or species habitat may occur within area
Halicampus nitidus Glittering Pipefish [66224]		Species or species habitat may occur within area
Halicampus spirostris Spiny-snout Pipefish [66225]		Species or species habitat may occur within area
Haliichthys taeniophorus Ribboned Pipehorse, Ribboned Seadragon [66226]		Species or species habitat may occur within area
Hippichthys penicillus Beady Pipefish, Steep-nosed Pipefish [66231]		Species or species habitat may occur within area
Hippocampus angustus Western Spiny Seahorse, Narrow-bellied Seahorse [66234]		Species or species habitat may occur within area
Hippocampus histrix Spiny Seahorse, Thorny Seahorse [66236]		Species or species habitat may occur within area
Hippocampus kuda Spotted Seahorse, Yellow Seahorse [66237]		Species or species habitat may occur within area
Hippocampus planifrons Flat-face Seahorse [66238]		Species or species habitat may occur within area
Micrognathus micronotopterus Tidepool Pipefish [66255]		Species or species habitat may occur within area
Solegnathus hardwickii Pallid Pipehorse, Hardwick's Pipehorse [66272]		Species or species habitat may occur within area
Solegnathus lettiensis Gunther's Pipehorse, Indonesian Pipefish [66273]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
Solenostomus cyanopterus Robust Ghostpipefish, Blue-finned Ghost Pipefish, [66183]		Species or species habitat may occur within area
Solenostomus paegnius Rough-snout Ghost Pipefish [68425]		Species or species habitat may occur within area
Syngnathoides biaculeatus Double-end Pipehorse, Double-ended Pipehorse, Alligator Pipefish [66279]		Species or species habitat may occur within area
Trachyrhamphus bicoarctatus Bentstick Pipefish, Bend Stick Pipefish, Short-tailed Pipefish [66280]		Species or species habitat may occur within area
Trachyrhamphus longirostris Straightstick Pipefish, Long-nosed Pipefish, Straight Stick Pipefish [66281]		Species or species habitat may occur within area
Reptiles		
Acalyptophis peronii Horned Seasnake [1114]		Species or species habitat may occur within area
Aipysurus apraefrontalis Short-nosed Seasnake [1115]	Critically Endangered	Species or species habitat likely to occur within area
Aipysurus duboisii Dubois' Seasnake [1116]		Species or species habitat may occur within area
Aipysurus eydouxii Spine-tailed Seasnake [1117]		Species or species habitat may occur within area
Aipysurus laevis Olive Seasnake [1120]		Species or species habitat may occur within area
Aipysurus tenuis Brown-lined Seasnake [1121]		Species or species habitat may occur within area
Astrotia stokesii Stokes' Seasnake [1122]		Species or species habitat may occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Species or species habitat likely to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Species or species habitat likely to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat likely to occur within area
Disteira kingii Spectacled Seasnake [1123]		Species or species habitat may occur within area
Disteira major Olive-headed Seasnake [1124]		Species or species habitat may occur within area
Emydocephalus annulatus Turtle-headed Seasnake [1125]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
Ephalophis greyi North-western Mangrove Seasnake [1127]		Species or species habitat may occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Species or species habitat likely to occur within area
Hydrelaps darwiniensis Black-ringed Seasnake [1100]		Species or species habitat may occur within area
Hydrophis czebukovi Fine-spined Seasnake [59233]		Species or species habitat may occur within area
Hydrophis elegans Elegant Seasnake [1104]		Species or species habitat may occur within area
Hydrophis mcdowellii null [25926]		Species or species habitat may occur within area
Hydrophis ornatus a seasnake [1111]		Species or species habitat may occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Breeding known to occur within area
Pelamis platurus Yellow-bellied Seasnake [1091]		Species or species habitat may occur within area

Whales and other Cetaceans [[Resource Information](#)]

Name	Status	Type of Presence
Mammals		
Balaenoptera acutorostrata Minke Whale [33]		Species or species habitat may occur within area
Balaenoptera edeni Bryde's Whale [35]		Species or species habitat may occur within area
Delphinus delphis Common Dolphin, Short-beaked Common Dolphin [60]		Species or species habitat may occur within area
Grampus griseus Risso's Dolphin, Grampus [64]		Species or species habitat may occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Species or species habitat known to occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area
Sousa chinensis Indo-Pacific Humpback Dolphin [50]		Species or species habitat may occur within area
Stenella attenuata Spotted Dolphin, Pantropical Spotted Dolphin [51]		Species or species habitat may occur within area
Tursiops aduncus Indian Ocean Bottlenose Dolphin, Spotted		Species or species

Name	Status	Type of Presence
Bottlenose Dolphin [68418]		habitat likely to occur within area
Tursiops aduncus (Arafura/Timor Sea populations)		
Spotted Bottlenose Dolphin (Arafura/Timor Sea populations) [78900]		Species or species habitat likely to occur within area
Tursiops truncatus s. str.		
Bottlenose Dolphin [68417]		Species or species habitat may occur within area

Extra Information

Places on the RNE [\[Resource Information \]](#)

Note that not all Indigenous sites may be listed.

Name	State	Status
Natural		
Coastal Margin Cape Preston to Cape Keraudren	WA	Indicative Place
Historic		
Pippingarra Station Homestead Group	WA	Indicative Place

Invasive Species [\[Resource Information \]](#)

Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resources Audit,

Name	Status	Type of Presence
Mammals		
Felis catus		
Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Sus scrofa		
Pig [6]		Species or species habitat likely to occur within area
Vulpes vulpes		
Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Cenchrus ciliaris		
Buffel-grass, Black Buffel-grass [20213]		Species or species habitat likely to occur within area

Coordinates

-20.41717 118.60307,-20.41717 118.61091,-20.42113 118.61091,-20.42113 118.60307,
-20.41717 118.60307

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World Heritage and Register of National Estate properties, Wetlands of International Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

For species where the distributions are well known, maps are digitised from sources such as recovery plans and detailed habitat studies. Where appropriate, core breeding, foraging and roosting areas are indicated under 'type of presence'. For species whose distributions are less well known, point locations are collated from government wildlife authorities, museums, and non-government organisations; bioclimatic distribution models are generated and these validated by experts. In some cases, the distribution maps are based solely on expert knowledge.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

The following groups have been mapped, but may not cover the complete distribution of the species:

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

Such breeding sites may be important for the protection of the Commonwealth Marine environment.

Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

- [-Department of Environment, Climate Change and Water, New South Wales](#)
- [-Department of Sustainability and Environment, Victoria](#)
- [-Department of Primary Industries, Parks, Water and Environment, Tasmania](#)
- [-Department of Environment and Natural Resources, South Australia](#)
- [-Parks and Wildlife Service NT, NT Dept of Natural Resources, Environment and the Arts](#)
- [-Environmental and Resource Management, Queensland](#)
- [-Department of Environment and Conservation, Western Australia](#)
- [-Department of the Environment, Climate Change, Energy and Water](#)
- [-Birds Australia](#)
- [-Australian Bird and Bat Banding Scheme](#)
- [-Australian National Wildlife Collection](#)
- Natural history museums of Australia
- [-Museum Victoria](#)
- [-Australian Museum](#)
- [-SA Museum](#)
- [-Queensland Museum](#)
- [-Online Zoological Collections of Australian Museums](#)
- [-Queensland Herbarium](#)
- [-National Herbarium of NSW](#)
- [-Royal Botanic Gardens and National Herbarium of Victoria](#)
- [-Tasmanian Herbarium](#)
- [-State Herbarium of South Australia](#)
- [-Northern Territory Herbarium](#)
- [-Western Australian Herbarium](#)
- [-Australian National Herbarium, Atherton and Canberra](#)
- [-University of New England](#)
- [-Ocean Biogeographic Information System](#)
- [-Australian Government, Department of Defence](#)
- [-State Forests of NSW](#)
- Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

[Please feel free to provide feedback via the Contact Us page.](#)

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APPENDIX 2

**Department of Indigenous
Affairs Aboriginal Heritage
Inquiry System Search**



Search Criteria

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

MGA Zone 50	
Northing	Easting
7740891	666862
7741938	668308



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.

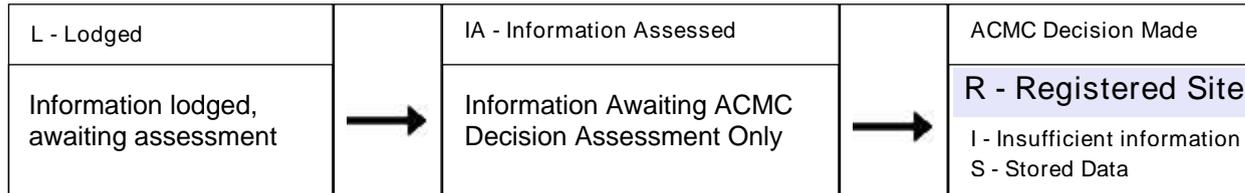
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Legend

Restriction	Access	Coordinate Accuracy
N No restriction	C Closed	Accuracy is shown as a code in brackets following the site coordinates.
M Male access only	O Open	[Reliable] The spatial information recorded in the site file is deemed to be reliable, due to methods of capture.
F Female access	V Vulnerable	[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



*Explanation of Assessment

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

Final assessment and decisions 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.

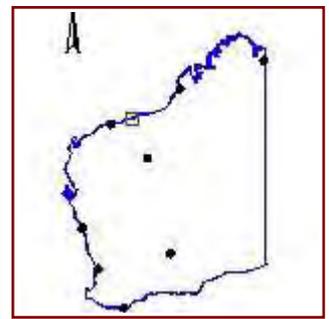
Sites Shown on Maps

Site boundaries may not appear on maps at low zoom levels



List of Registered Aboriginal Sites with Map

No results



Legend

- Selected Heritage Sites
 - Registered Sites
 - Town
 - Map Area
 - Search Area

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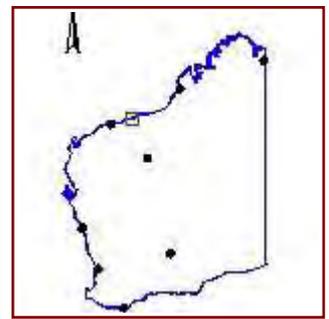
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List of Other Heritage Places with Map

No results



Legend

- Selected Heritage Sites
- Other Heritage Places
- Town
- Map Area
- Search Area

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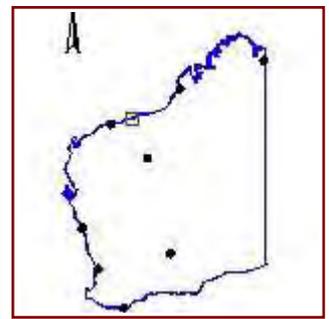
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Map Showing Registered Aboriginal Sites and Other Heritage Places



Legend

- Selected Heritage Sites
 - Registered Sites
 - Other Heritage Places
 - Town
 - Map Area
 - Search Area

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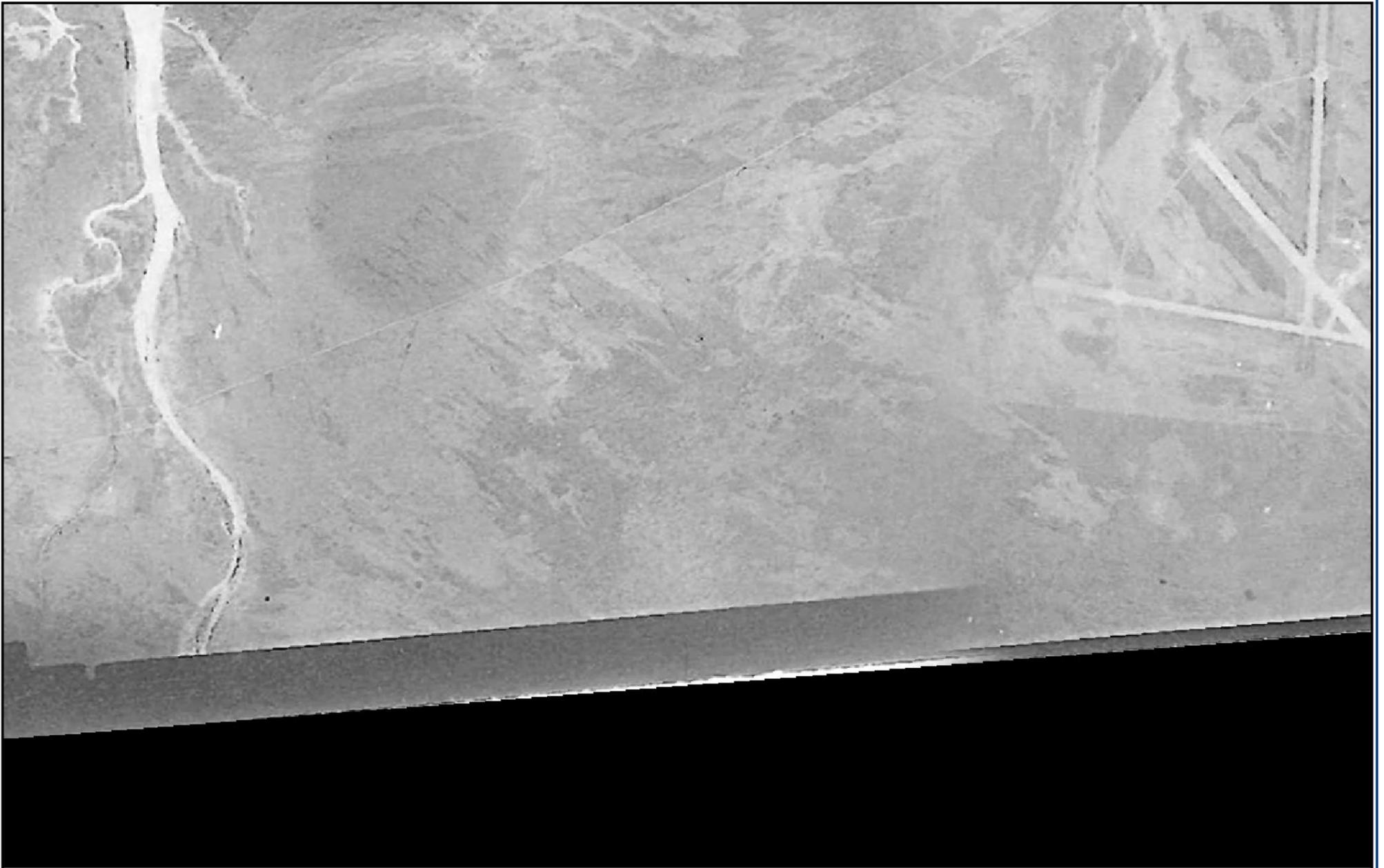
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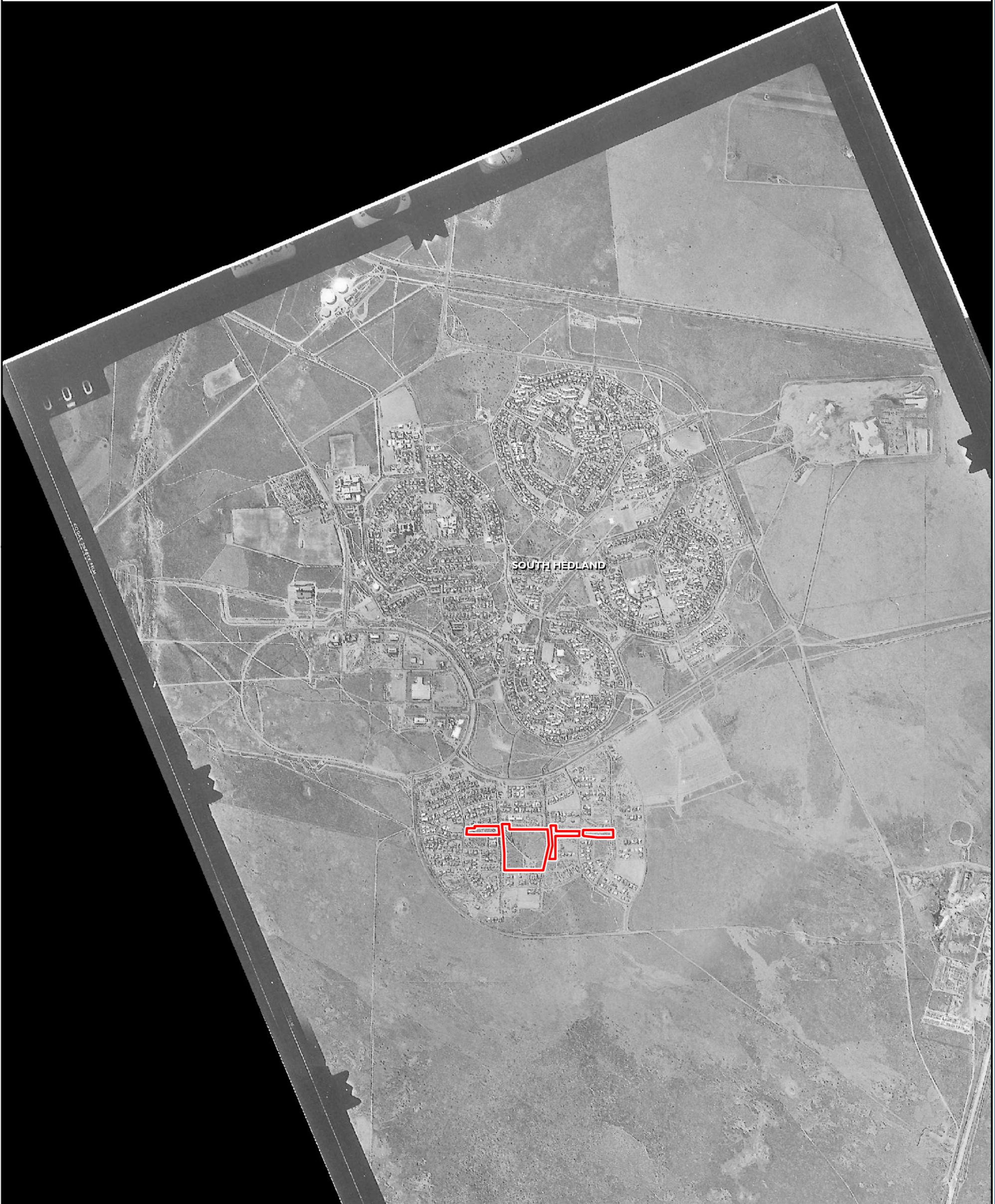
APPENDIX 3

Historical Aerial Photographs



SOUTH HEDLAND







SOUTH HEDLAND







SOUTH HEDLAND







SOUTH HEDLAND



APPENDIX 3

Simon Youngleson Built Form Vision

JAXON's vision for Former Koombana School Site

VISION FOR BUILT FORM

" through research and analysis of the elements which combine to make up many of the most successful traditional and contemporary residential neighbourhoods, we can extract and incorporate concepts into a methodology to create a built form with a vibrant sense of place and belonging "

a

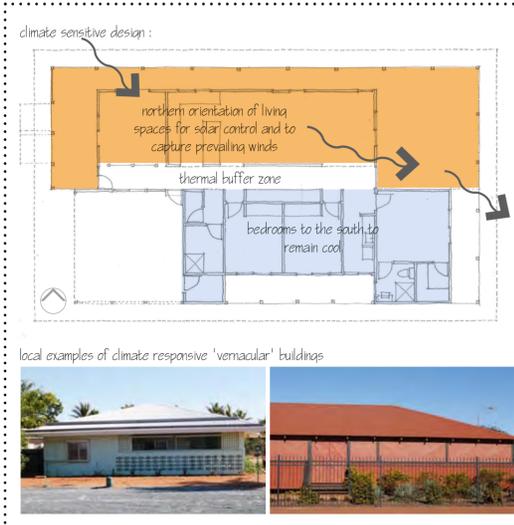


an appropriate aesthetic

It is important for a common architectural language to extend through new neighbourhoods to create coherency across the built form. This coherency is important to the identity of a place and consequently becomes a foundation for developing a sense of belonging amongst the residents.

By extracting a materiality and colour palette from both vernacular buildings and the natural landscape, we can begin to create a common language that develops a 'sense of place' in new housing developments. A controlled materials and colour palette is therefore important to create belonging within a new community.

b



climate sensitive design

Living spaces shall be orientated to the north for control of sun penetration (western and eastern sun is low in the sky and more difficult to shade compared to northern sun) and to capture the north-westerly winds. This also allows sleeping areas to be located at the south so they can be left closed during the day to remain cool for nighttime sleeping.

Shallow floor plans are ideal for capturing NW winds for cross ventilation. By orientating living spaces to the north and by providing louvred openings you have the flexibility to open or close the facade to the cooling breezes when the internal temperature is warmer than the outside.

c



a diversity of housing types

A fundamental driver of the creation of community in new developments is the creation of a diversity of housing types and sizes.

Housing types appropriate for the site range from single and double storey typical front loaded houses with double garages, to rear loaded cottages, and double storey villas. This diversity of housing brings a variety of densities, streetscape characters and a diversity of demographic groups.

d

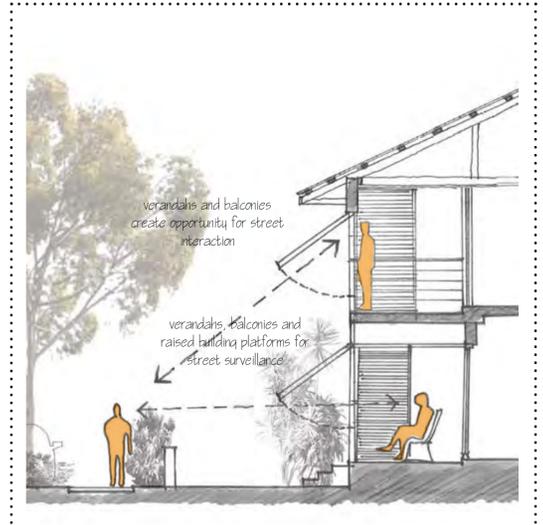


walkable streetscapes

The pedestrian is the most important factor when designing neighbourhoods and communities - streetscapes need to be pleasant and inviting for the pedestrian to walk to local amenities (parks, shops, beaches, etc.).

Shade and scale is crucial for walkability. The built form and street trees provide shade and vertical scale to create an enjoyable experience for the pedestrian.

e



design for community interaction

Front verandahs and upper floor balconies facing the street are effective design tools to encourage community interaction and provide security through passive surveillance of the street.

Well designed housing is developed with the streetscape in mind. For example, the setback of housing is important to achieve an intimate, human scale across the streetscape.

a vision for the streetscape & built form typologies



Disclaimer:

This display is for information purposes only. All information is preliminary and subject to approval by relevant authorities and market conditions.

APPENDIX 4

Transport Assessment Report (Shawmac)



CONSULTING CIVIL & TRAFFIC ENGINEERS, RISK MANAGERS



Civil Engineering



Traffic Engineering



Risk Management

Project: Transport Statement
Koombana Development Plan, South Hedland

Client: Jaxon

Author: Tony Shaw. BSc Dip Eng Surv Grad Dip Bus MIPWEA RABQSA

Signature:

Date: 21st December 2011

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Document Status

Ver No.	Author	Reviewed by	Date	Issued for	Signature	Date
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2	T Shaw	G Miles	21/12/11	Client Review		21/12/11

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1 Summary

This report provides a transport statement for the proposed development of property formerly designated for recreation and education purposes in South Hedland. The development comprises R 40 zoning with proposed group dwellings and R 30 single residential lots.

The report was commissioned by the project Planners, RPS on behalf of Jaxon the developer of the site and was prepared by Shawmac Pty Ltd.

The key transport focus is on how the development caters for the different transport methods as well as the interaction of the traffic generated by this use of the land into the existing transport network.

The transport statement concluded that:

- While there would be an increase in vehicular traffic on network roads, the increase is well within the capacity of the existing road network and no upgrades are required.
- Existing pedestrian facilities along Koombana Avenue, Captains Way, Steamer Avenue and Daylesford Close are satisfactory for pedestrian use.
- Off road cycle facilities are not provided; however the existing roads provide a safe riding environment and are considered satisfactory for cyclist use.
- Pedestrian links within the development area should be provided together with links to the existing path network.
- Bus services exist within easy walking distance from the development site.

2 Introduction and Background

The statement considers the impact that the development of residential dwellings in South Hedland will have on the road network through increased traffic.

The report is prepared in response to a request from RPS on behalf of Jaxon as the developer of the property.

The development site is shown on Figure 1. It is located centrally within the town site of South Hedland and is located in an existing residential area.



Figure 1 - General Development Location

The site is in an area identified by the Town of Port Hedland Planning Scheme (TPS) 5 as recreation and community purposes and is shown on Figure 3.

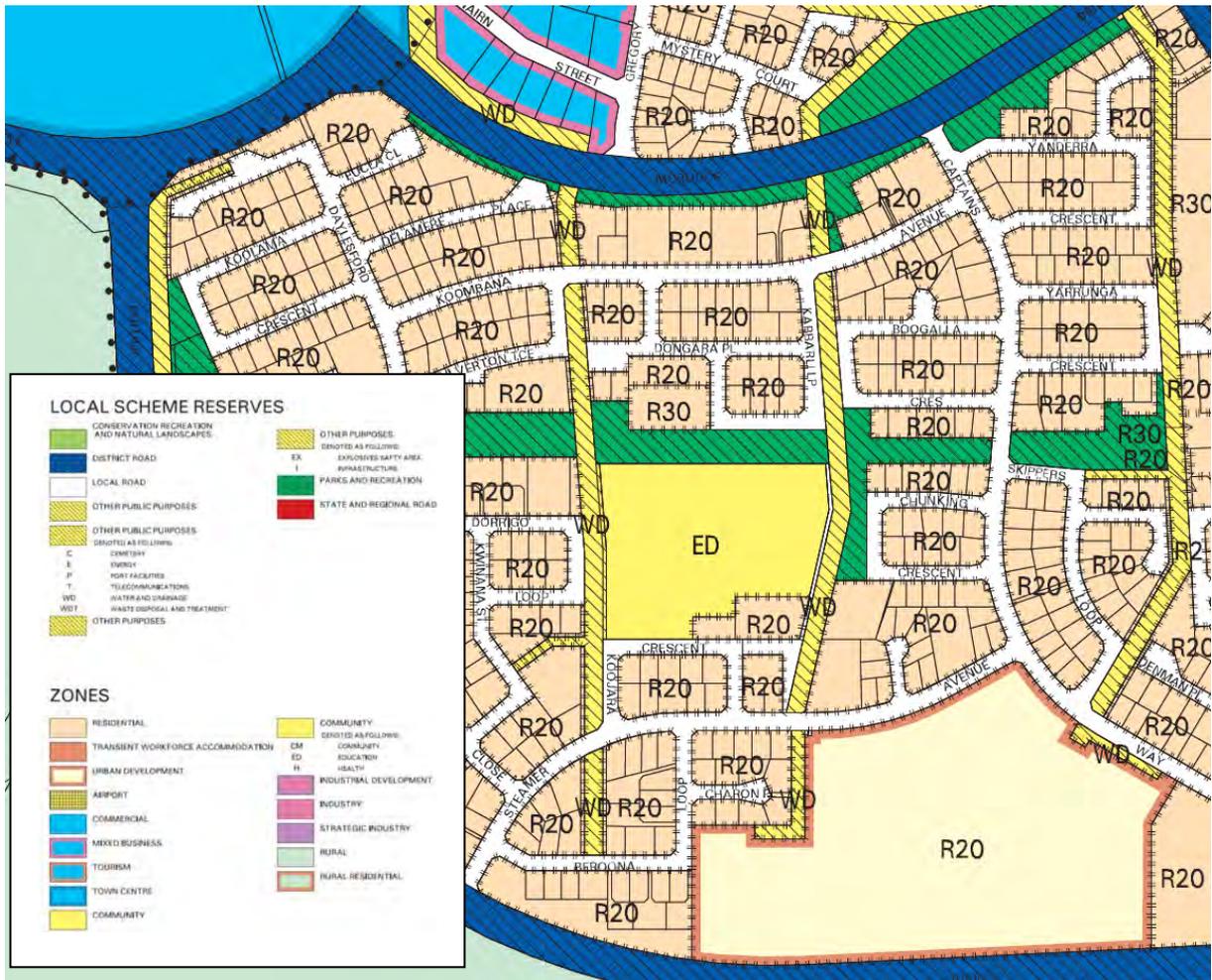


Figure 2 - Town Planning Zoning



Figure 3 - Aerial photograph of general area

The major traffic routes are along Koombana Avenue, Steamer Avenue, Murdoch Drive and Forrest Circle. Vehicular access is unrestricted within the existing road network.

This statement's purpose is to identify specific transport issues with respect to this site and is not to access the overall transport impacts generated by the other land uses close to this property.

3 Proposed Development

The proposed development plan incorporates both R 40 multiple dwellings and R30 single residential lots.

The general development concept is shown in Figure 4.

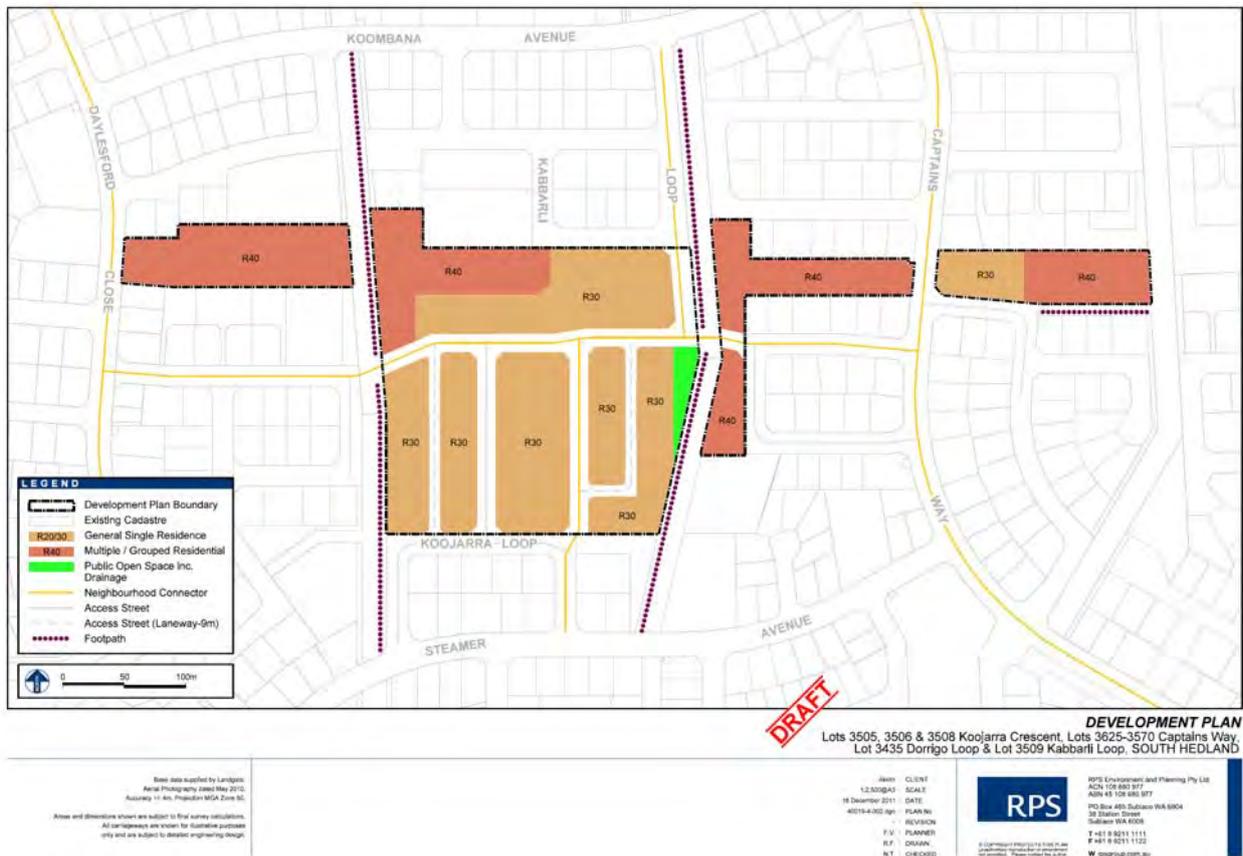


Figure 4 - Proposed Redevelopment

The site is currently undeveloped and there is little vegetation remaining on the site.

4 Existing situation

4.1 Road Network

The existing road network within the subdivision is generally classified as “access roads” with Forrest Circle, Murdoch Drive, Masters Way and Collier Drive classified as Local Distributors.



Figure 5 - Network Classification



Figure 6 - Western end of the site from Daylesford Close



Figure 7 - Site looking North from Koojarra Loop



Figure 8 - East end of Site from Captains Way



Figure 9 - Existing Cycle Network.

Bus services are provided along Daylesford Close, Koombana Avenue, Steamer Avenue and Captains Way and bus stops are located within easy walking distance from the site. Paths are provided on Daylesford Close, Koombana Avenue, Steamer Avenue and Captains Way.

4.2 Traffic management on the frontage streets

Road infrastructure adjoining the site is shown below on Table 1.

Road	Carriageways	Paths	Parking	Zoned speed limit	Intersection details
Koombana Avenue	Kerbed single carriageway 2 X 3.5 m lanes.	One side	No restrictions	50 km/h	All intersections unchannelised T junctions.
Steamer Avenue	Kerbed single carriageway 2 X 3.5 m lanes.	One side	No restrictions	50 km/h	All intersections unchannelised T junctions.
Koojarra Loop	Kerbed single carriageway 2 X 3.5 m lanes.	None	No restrictions	50 km/h	All intersections unchannelised T junctions.

Table 1. Existing Network.

Existing count data on the network roads is limited and as such the potential generating capability of the cell including the proposed development was modelled using the QRS II software and adopting a

generation rate of 10 trips per dwelling. In assigning the traffic it was assumed that 80% would move to and from the South Hedland commercial centre with 20% moving to and from Port Hedland via Murdoch Drive and the North Circular Road. Modelled flows are shown on Figure 10.



Figure 10 - Modelled Flows

5 Proposed internal transport networks

Figure 11 below indicates proposed internal transport routes and is based on the existing road hierarchy and the predicted flows on new roads. While the traffic volumes indicate that Road 1 can operate as an Access D road, the completion of the link between Daylesford Close and Captains Way creates a logical network that warrants a review of the cell hierarchy, with Road 1, Daylesford Close and Captains Way forming Access Road C. The reserve width of Road 1 is suitable for the classification at the proposed 15.0 metres.

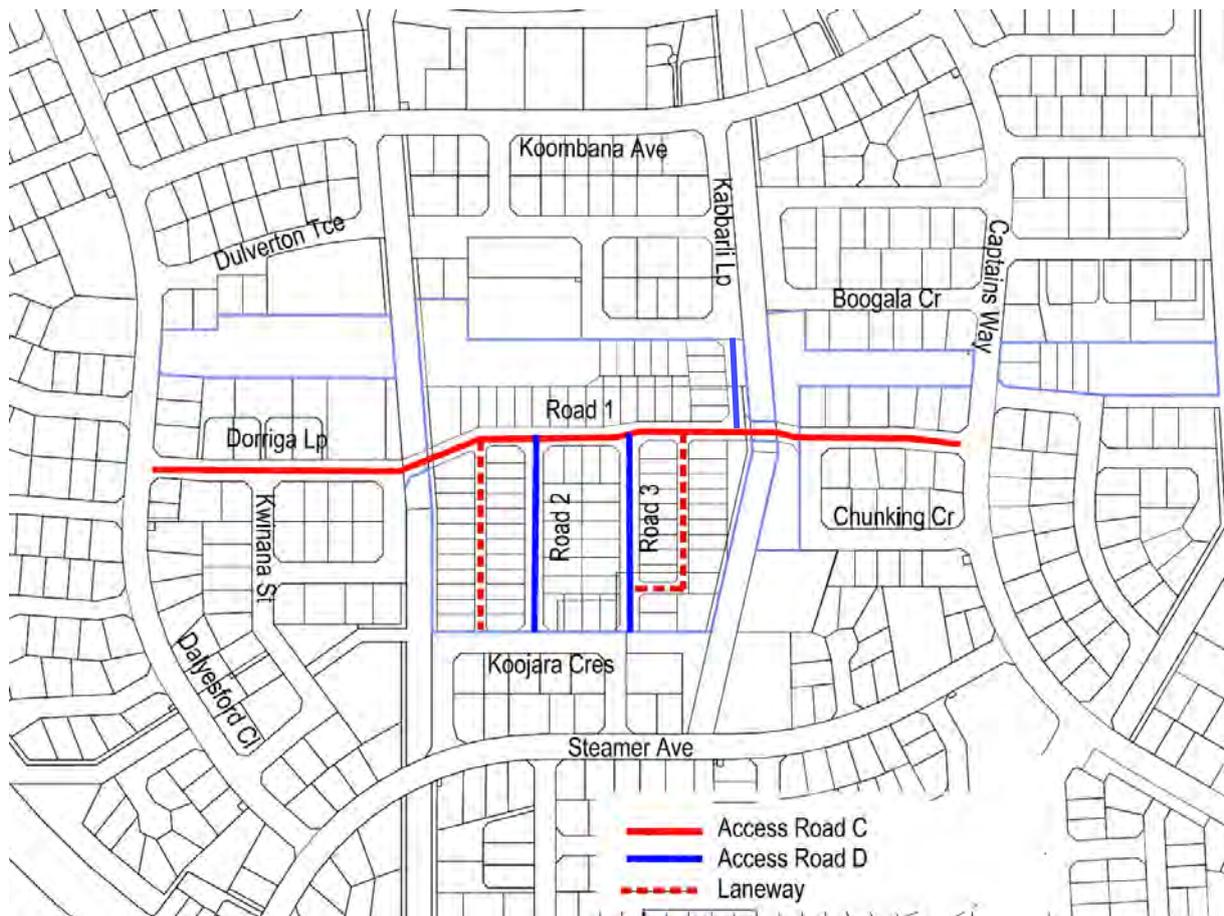


Figure 11 - Proposed Infrastructure.

6 Changes to external transport networks

There are no known planned changes to the external transport networks that would impact on the proposal.

7 Integration with surrounding area

7.1 Major attractors and generators

Key attractors are likely to be:

- South Hedland commercial centre, sporting facilities and schools;
- Port Hedland Town Centre and BHB Billiton site;
- Wedgefield;
- Airport.

7.2 Major changes to land uses

There are no major changes to land use external to the site identified.

7.3 Gap analysis.

Assessment was carried out to determine whether or not the existing transport networks, plus any proposed changes, would adequately match predicted desire lines, particularly for pedestrians, cyclists and public transport. No deficiencies were identified.

8 Analysis of transport networks

8.1 Assessment years

Assessment is based on the full development of the site.

8.2 Time periods for assessment

The assessment is based on analysis of the following peaks:

PM peak period(s) on the surrounding road network;

PM peak period(s) for the subdivision.

9 Analysis of internal transport networks

9.1 Assessment parameters

Assessment is based on the following assumptions:

- Residential developments will generate 10 trips per day;
- External – External traffic will account for 90% of all generated traffic.

9.2 Subdivision generated traffic

Vehicle trip generation rates are based on the following recognised land use traffic generation databases:

- Land Use Traffic Generation Guidelines, March 1987 - Director General of Transport, South Australia;
- Guide to Traffic Generating Developments Version 2.2, October 2002 – Roads and Traffic Authority, New South Wales; and
- Trip Generation 7th edition, 2003 - Institute of Transportation Engineers, Washington, USA.

Assessed generation was modelled using QRS II and output is shown on Figure 12.

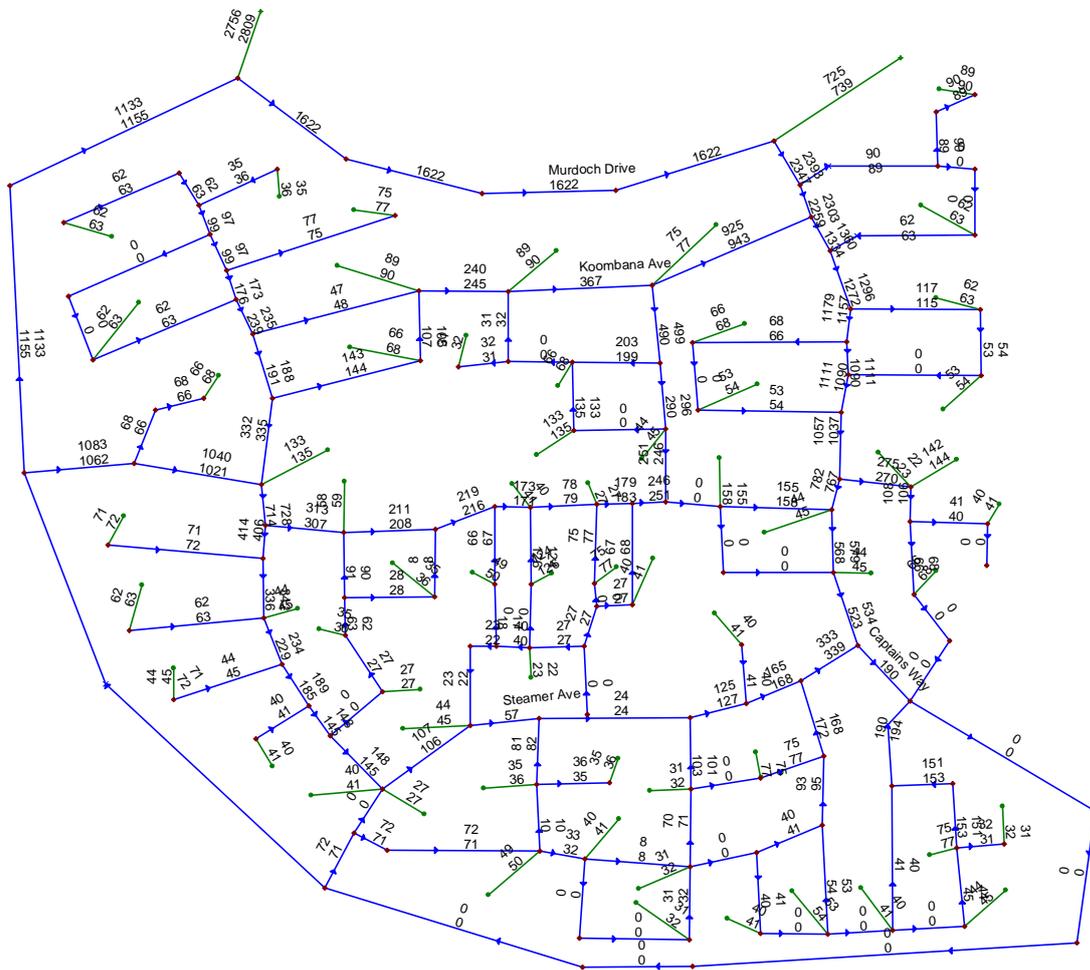


Figure 12 - Estimated Daily Traffic.

9.3 Non subdivision traffic

Non subdivision traffic has been included in the model.

9.4 Roads and intersections

9.4.1 Mid Block Cross Sections

Requirements for road cross sections have been generally based on recommendations contained within Liveable Neighborhoods and the Austroads Guide to Traffic Engineering Practice with the following exceptions:

- The road reserve width of the Kabbarli Loop extension is reduced due its position adjoining the reserve.

- Laneways are set at 9m to enable embayed parking and lighting on the basis that the laneways will function as the primary street frontage in most instances.

Liveable Neighbourhoods requirements are shown below.

Indicative volume.	Route type / name.	Indicative Reserve Width.	Indicative Carriageway Width.
50,000.	Primary Distributor.		Determined by Main Roads WA
35,000.	Primary Distributor.		Determined by Main Roads WA
15,000 to 35,000.	Integrator Arterial A (District Distributor A).	50.6 – 52.6 metres.	2 X 8.2 metre carriageways including bike lane and 2 X 5.5 metre service roads containing parking.
<25,000	Integrator Arterial A (District Distributor A).	35.6 metres.	2 X 10.7 metre carriageways including combined on street parking and bike lane.
7,000 to 15,000.	Integrator Arterial B (District Distributor B).	29.2 metres.	2 X 7.5 metre carriageways with on street parking and bike lane.
15,000.	Integrator Arterial B (District Distributor B).	25.2 metres.	2 X 7.5 metre carriageways with on street parking.
7,000.	Neighborhood Connector A.	24.4 metres	2 X 7.1 metres including parking, on street bike lane, median plus shared path on one verge.
3,000.	Neighborhood Connector B.	19.4 metres	11.2 metres including parking plus shared path on one verge.
3,000.	Access Street A (Avenue).	20 - 24 metres.	2 x 3.5 metre lanes plus indented parking.
3,000.	Access Street B (Wider street).	16.5 - 18 metres.	9.7 metre lane.
3,000.	Access Street C (Yield or give way street).	15.4 - 16 metres.	7.2 (7.0 – 7.5) metre lane.
1,000.	Access Street D (Narrow yield or give way street).	14.2 metres.	5.5 – 6.0 metre lane.
150	Access Street D (Narrow yield or give way street).	14.2 metres.	3.5 metre lane plus parking indents.
3,000.	Access Street D (Wider street).	16.5 - 18 metres.	9.7 metre lane.
300	Laneways Provide access to the side or rear of lots principally for access to garages.	6 ¹ - 6.4	6 typical 3-6.4 (range)

Table 2. Road Hierarchy Criteria.

Based on these criteria, road requirements are as shown on Table 2.

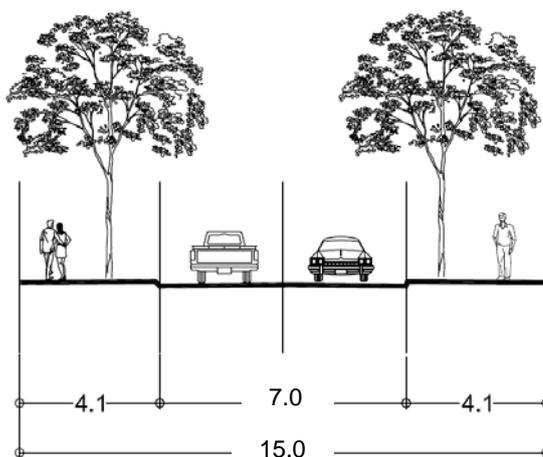
¹ Lesser reserves and road pavement widths may be applied over limited lengths where performance can be justified, such as at laneway entrances.

Road ²	Predicted Volume (vpd).	Reserve Requirement.	Carriageway Requirement.
Road 1	Up to 500	Access Street C. 15.0 metres.	7.0 metre lane.
Kabbarli Loop extension	Up to 1000	Access Street D (Narrow yield or give way street). 14.2 metres.	5.5 – 6.0 metre lane.
Road 2	Up to 250	Access Street D (Narrow yield or give way street). 14.2 metres.	5.5 – 6.0 metre lane.
Road 3	Up to 150	Access Street D (Narrow yield or give way street). 14.2 metres.	5.5 – 6.0 metre lane.
Lane 1	Up to 100	Laneway. 6.0 metres.	6.0 metres.
Lane 2	Up to 80	Laneway. 6.0 metres.	6.0 metres.

Table 3. Road Cross Sections.

9.4.2 Road Cross Sections.

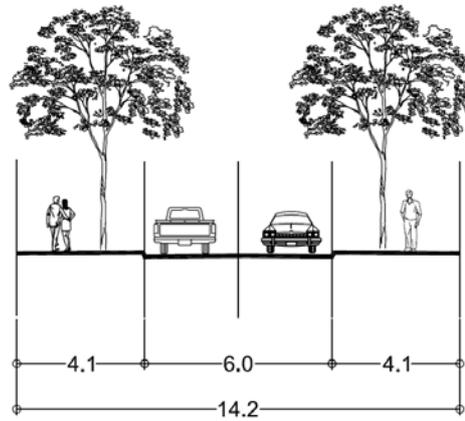
Diagrammatic details of the road types planned for the subdivision are shown on Figures 13, 14 and 15.



Access Street C - yield (or give way) street target speed 40 km/h (<3,000 vpd)

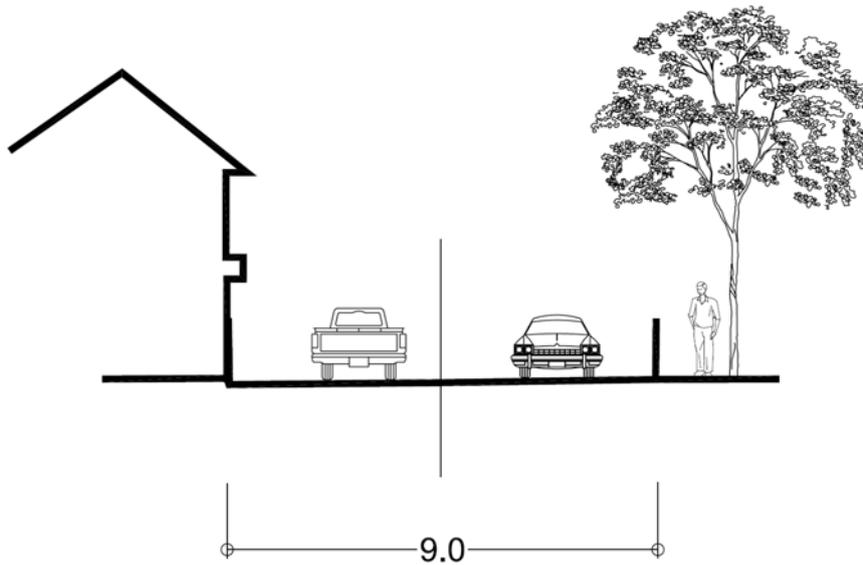
Figure 13 - Design Cross Section

² Road designations as shown on figure 4.



Access Street D - narrow yield (or give way) street target speed 30 km/h (<1,000 vpd)

Figure 14 - Design Cross Section



Modified laneway target speed 15 km/h

Figure 15 - Design Cross Section

9.4.3 Intersections

Internal peak hour traffic volumes within the subdivision are generally small and as such negligible impacts are predicted. Practical absorption capacity for the intersections was calculated from major flow and compared to predicted minor flow.

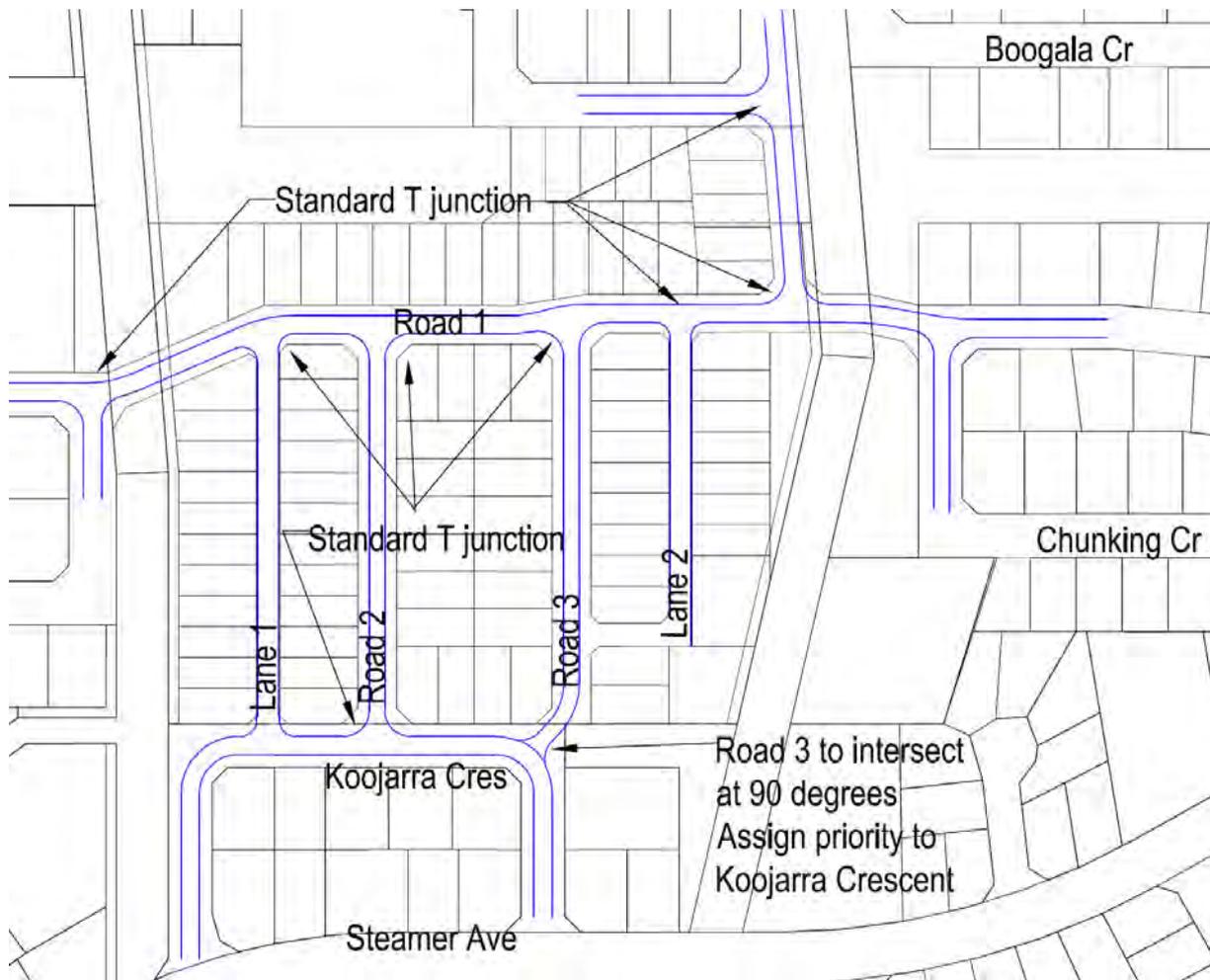


Figure 17 - Road Interface

9.5 Pedestrian / cycle networks

In keeping with the recommendations of Liveable Neighbourhoods it is recommended that the following paths be provided:

Road 1: Principal Shared Path north side;

Road 2 and 3: Footpaths west side;

Concurrent with this the Town of Port Hedland should consider connecting these paths generally as shown on Figure 18.

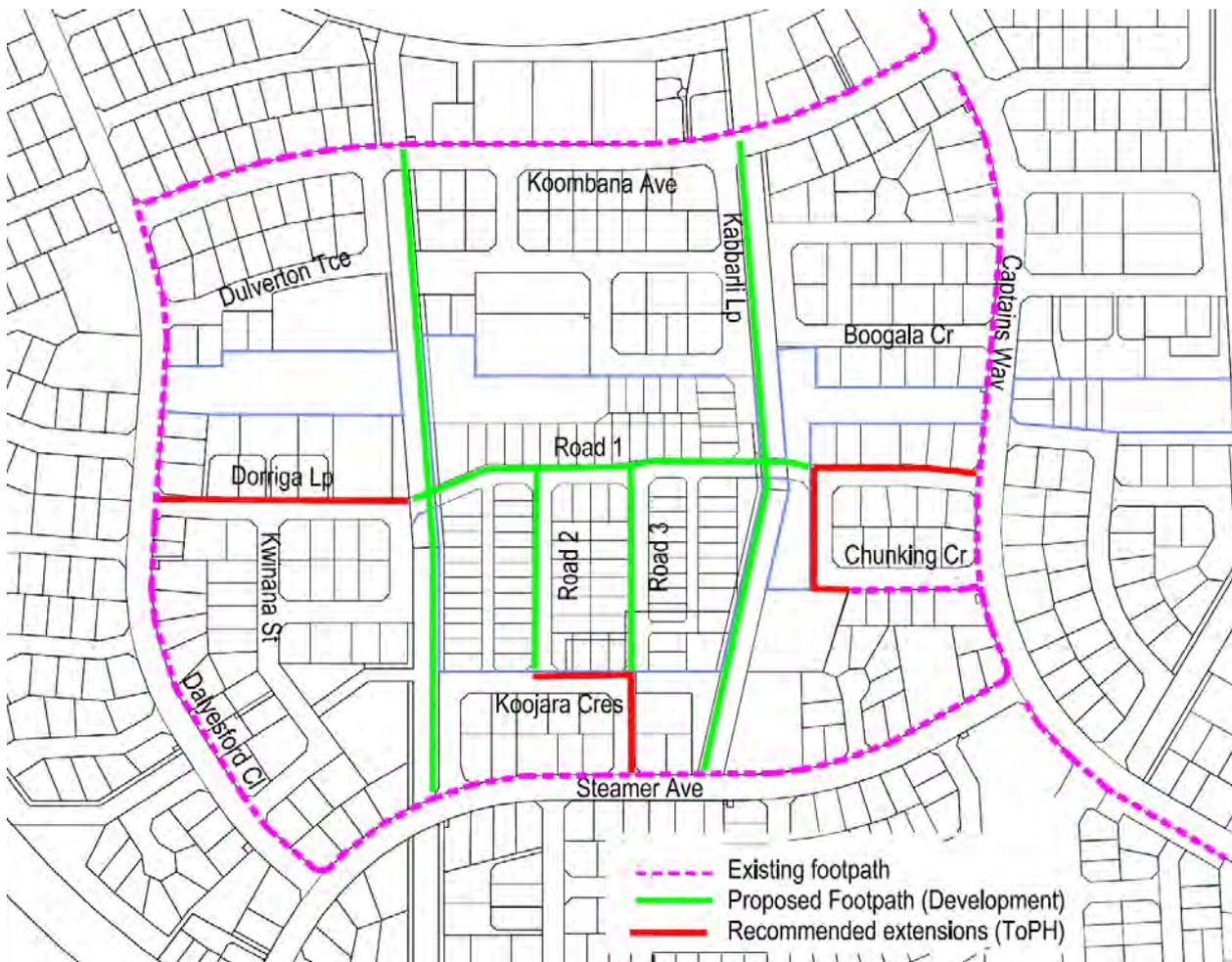


Figure 18 - Recommended Path System

9.6 Access to public transport

There are no known planned changes to public transport.

10 Analysis of external transport networks

10.1 Design traffic flows on external road network

Design traffic flows on the external network as affected by the proposal are covered in section 9.

10.2 Impact on external roads

The impacts of design traffic flows on the external network as affected by the proposal are covered in section 9.

10.3 Impact on external intersections

The impacts of design traffic flows on external intersections as affected by the proposal are covered in section 9.

10.4 Pedestrian / cycle networks

The impacts of design traffic flows on external pedestrian and cycle networks as affected by the proposal are covered in section 9.

11 Safety issues

A review of the overall transport proposals for the subdivision did not identify any specific issues that present unacceptable risks to the road user or that cannot be managed through appropriate design protocols.

Road hazards are typically present at intersections and may be manifest through inadequate sight distance, inappropriate geometry or substandard capacity that promotes undesirable and potentially hazardous movements.

For new roads, the allocation of adequate road reservation width and truncation of corners will allow sight distance requirements to be accommodated in the detailed design phase of the project. Geometric standards prescribed by Austroads and Main Roads WA guidelines will ensure that no unacceptable risk is introduced into the road environment. Assessment of the operational performance of intersections undertaken in this study prescribes appropriate geometry and lane allocation to minimise delay and optimise performance.

Pedestrian and cyclist movements are provided for by on road and off road facilities, thereby addressing potential safety issues.

12 Conclusions

On the basis of the assessment undertaken, it is concluded that the proposed street network will provide an acceptable range of choices for travel and ensure that traffic volumes on individual streets can be kept below threshold levels to ensure the amenity of the area is preserved and safe movement options exist for pedestrians, cyclists and local traffic.

APPENDIX 5

Landscape Concept Plan (RPS)

THE FORMER KOOMBANA SCHOOL SITE SUBDIVISION

proposed landscape strategy



new footpaths and eucalyptus tree plantings to drains to improve amenity including management works undertaken on drains as required to improve surveillance

koombana POS perspective below

large transplant signature tree

Public Open Space with turfed recreation area, amenity and seating

new street trees to provide shade to footpaths

new footpaths and eucalyptus tree plantings to drains to improve amenity including management works undertaken on drains as required to improve surveillance

PROPOSED PLANT SCHEDULE		
CODE	SPECIES	POTSIZE
PUBLIC OPEN SPACE		
FIC mac	FICUS macrophylla	TRANSPLANT
EUC vic	EUCALYPTUS victrix	100L
HIB rub	HIBISCUS tiliaceus 'Rubra'	100L
DAM div	DAMPIERA diversifolia	140mm
DIA LR	DIANELLA 'Little Rev' PBR	140mm
DIA LJ	DIANELLA 'Little Jess' PBR	140mm
DIA rev	DIANELLA revoluta	140mm
DIA 'SS'	DIANELLA 'Silver Streak'	140mm
ERE gla	EREMOPHILA glabra compactum	140mm
ERE LG	EREMOPHILA lime gold	140mm
ERE MP	EREMOPHILA Minnie Pink	140mm
GRE sup	GREVILLEA superb	140mm
GRE GGG	GREVILLEA 'Gin Gin Gem'	140mm
LOM nya	LOMANDRA longifolia 'Nyalla'	140mm
PEN naf	PENNESETUM nafray 'Rubra'	140mm
SWA for	SWAINSONA formosa	140mm
STREET TREES		
EUC vic	EUCALYPTUS victrix	100L
HIB rub	HIBISCUS tiliaceus 'Rubra'	100L
DEL reg	DELONIX reginae	100L
EUC vic	EUCALYPTUS victrix	100L
DRAIN TREES		
EUC vic	EUCALYPTUS victrix	100L



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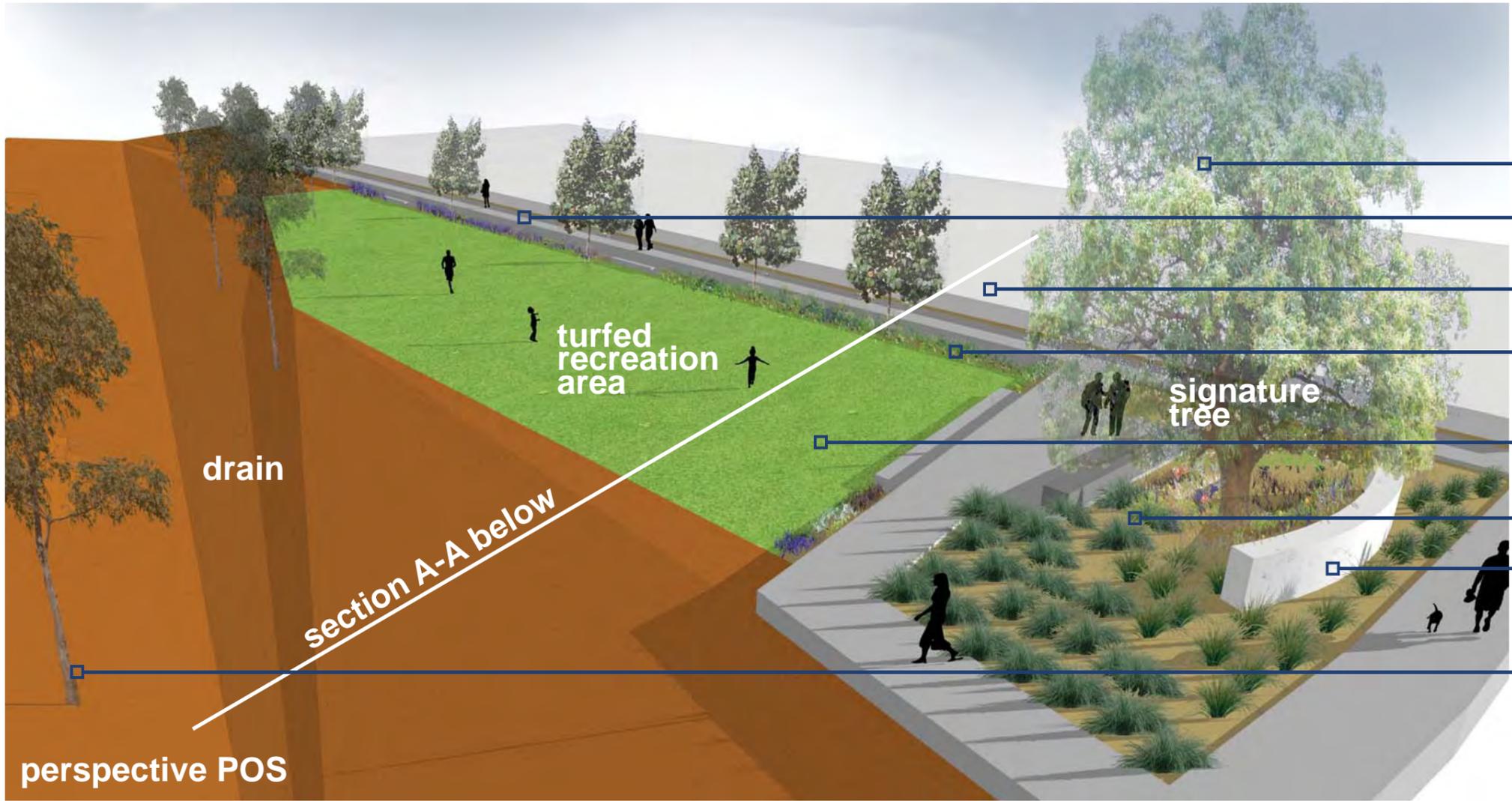
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THE FORMER KOOMBANA SCHOOL SITE SUBDIVISION proposed landscape strategy



- large transplant signature tree
- footpath connecting through POS and to new drainage footpaths
- adjacent development lots
- rain gardens providing extra water storage during large rainfall events
- turfed area lowered to act as extra storage basin during large rainfall events
- amenity planting with seating area under tree
- entry statement and wayfinding
- new footpaths and eucalyptus tree plantings to drains to improve amenity including management works undertaken on drains as required to improve surveillance



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APPENDIX 6

Drainage Strategy (BCH)

Koombana School Site Redevelopment Drainage Strategy

Prepared for
Jaxon Pty Ltd

10112-R-001-A



MARINE ● MINING ● OIL & GAS ● STRUCTURAL ● CIVIL

PERTH

KARRATHA

BUSSELTON

REVISION STATUS

REVISIONS							
Rev	Date	Description	Prepared By		Reviewed By		Approval
			Name	Sig	Name	Sig	
A	13/12/11	Issue for Client Approval	J Kitchen				



Prepared by:
BCH Engineering Consultants Services Pty Ltd

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File Location:

J:\10112 Jaxon Koombana School Site ESR\Technical\Reports\10112-R-001A Local water management plan - stormwater (CH).doc

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APPENDICES

- Appendix A: Development concept plan
- Appendix B: Pre-development Catchment plan
- Appendix C: Post-development Stormwater Strategy - Plans and cross sections
- Appendix D: Proposed water reticulation network

1 INTRODUCTION

1.1 BACKGROUND

This drainage strategy report has been prepared by BCH Engineering Consultants (BCH) on behalf of Jaxon Pty Ltd for the proposed development at the Koombana School site located in South Hedland. It has been prepared to support the rezoning application to the Western Australian Planning Commission (WAPC).

1.2 PROPOSED DEVELOPMENT

1.2.1 Site Context

The development is located at the southern end of South Hedland. There are 4 distinct parcels of land that form the basis for this development. These parcels are –

- Lot 3435 on Daylesford Close
- Lots 3509, 3505, 3506, 3508 between Kalbarri Loop and Koojarra Cres
- Lot 3570 on Chunking Cres
- Lot 3625 on Captains Way.

The main parcel is located on the old Koombana School site that was to be developed as a school. The development will comprise of a mix of mainly R30 lots with the exception being some R20 and R40 lots.

The proposed development is located in an existing residential area with extensive existing infrastructure currently surrounding the development. It is directly adjacent to 3 open drains into which it is proposed to discharge stormwater runoff.

Figure 1.1 indicates the extent and locality of the site.



1.2.2 Planning Approval

The development is under consideration for development approval from WAPC.

1.3 PRE DEVELOPMENT ENVIRONMENT

1.3.1 Topography

The existing sites are currently undeveloped. The existing topography of the development sites are gently sloping towards the adjacent open drains, with levels between 13.5mAHD and 14.7mAHD. Currently the sites have sparse vegetation and access tracks that transverse the site and the open drains.

An existing predevelopment catchment plan is included in Appendix B.

1.3.2 Soils

Based on available local geotechnical information, the site soil conditions are characterised by pindan material with low permeability, which would restrict or eliminate the use of infiltration structural features. Pindan is classified as either silty sand (SM) or clayey sand (SC) and typically soaked CBR tests on disturbed materials yield results in the range CBR 3% to 7%.

Pindan soils are easily mobilised when saturated, making steep batter scour prone and pipes and culverts prone to sedimentation.

1.3.3 Environmental features

The land surrounding the development has been extensively developed, and there is little of the existing environment in its natural state remain. There are 2 main drains that run through the site which have been engineered to convey water from the surrounding development. These drains discharge downstream into a coastal receiving environment.

1.3.4 Flood systems

The GHD study indicates that there would be some minor flooding on the sites in the 1 in 5 year event, and significant flooding in the 1 in 100 year event. These flood levels are based on information available at the time of the report. A recent detailed topographic survey has been completed by Vekta surveying for the development area, and the levels from this survey indicates there is in fact currently no flooding of the any of the sites in the 1 in 5 year flood events. There are however areas adjacent to the open drains that flood in the 1 in 100 year events. The extent of flooding is indicated on the pre development plan in Appendix B.

1.3.5 Groundwater

No geotechnical or groundwater investigations have been completed for the site, however it is unlikely that high ground water will be encountered during construction. The site is adjacent to deep drains, and recent inspections of the site have seen no ground water in the invert of these drains.

2 STORMWATER MANAGEMENT

2.1 DESIGN CRITERIA AND OBJECTIVES

2.1.1 Regional water management strategy

There is no existing regional water management strategy in place for South Hedland. A flood study was produced by GHD in 2008 that addressed the flooding issues for South Hedland, and the maintenance measures that are required to improve the sites proneness to flooding. This flood data set is the best data available and has been used as the basis for setting the levels in the site.

2.1.2 Local water management strategy

There is no existing local water management strategy in place for South Hedland. The stormwater strategy has been developed to minimise the impact on the surrounding area.

2.1.3 Adopted design criteria

2.1.3.1 *Protect property in severe storm events*

The 1 in 100 year storm levels are to be used to set the finished floor levels and therefore the finished lot levels. Finished lot levels are determined by the 1 in 100 year flood level as defined in the GHD flood study report.

2.1.3.2 *Provide overland flow paths for drains*

The roads have been designed to pass flood waters through the road network out to the open drains. The 1 in 5 year event will be contained within the kerb system, and the 1 in 100 year event is contained within the road reserve. The roads are designed to have longitudinal grades of 0.33% to ensure low velocities.

2.1.3.3 *Protect the existing drains from scouring or siltation*

The local pindan sand is easily mobilised when saturated. All outlets into the existing drains and are to be stabilised through the use of mortared rock pitching. The longitudinal grades on the roads have been kept to a minimum to minimise the velocities.

2.1.4 Rainfall analysis

Australian Rainfall and Runoff (ARR) state the preferred methods of runoff prediction for the Pilbara is the Rational Method (RM) and the Flood Index Method (FIM). The FIM is not suited to these small catchments, and so the Rational Method has been used for all flood events from the 1 year ARI event through to the 1 in 100 year ARI event. The procedures outlined in ARR have been used for the pre development condition, however it has been slightly modified for the post development condition to allow for impermeable surfaces.

2.1.5 Runoff parameters

The preliminary subdivision concept plan dated 22 November 2011 was used to define the catchment areas. The roads are proposed to have a carriageway width of 6m and a corridor of 15m, and the laneways have a corridor width of 9 m and a seal width of 4.5m.

The proposed development contains a mix of R20 lots, R30 lots and R40 grouped lots. The runoff coefficients proposed for these land uses in the GHD report and the Residential Design Codes are 40%, 55% and 55% respectively. These values have been combined with the C values for permeable areas outlined in ARR to give a composite C value for the catchments.

2.2 PROPOSED STORMWATER STRATEGY

The stormwater design objectives are to be met by utilising the following strategies. Plans and cross sections for the stormwater strategy are included in Appendix C.

2.2.1 Flood protection

The Local Government Guidelines for Subdivisional Development state that -

- The minimum habitable floor levels of 0.5m above the adjacent 100 year ARI flood level is required for new developments on adjacent to flood prone land
- In all other parts of the catchment, development can have a minimum floor level of 0.30m above the 100 year ARI event level.

Allowing for 100mm floor slab, the finished lot levels have been designed to be 0.40m and 0.20m above the flood levels respectively. The 100 year ARI flood levels from the 'Report for South Hedland Flood study – December 2010' has been used to define the flood levels adjacent to the sites.

The filling is required on the flood fringes which will reduce the storage capacity the site has for the 1 in 100 year flood. It is proposed that some areas within the public open space are lowered to compensate for any lost storage. In this way the development shall have minimal impact on the flood plain levels.

The flood levels for the western drain adjacent to the main site are 13.12mAHD and 13.59mAHD (unmaintained) for the 1 in 5 year ARI event and the 1 in 100 Year ARI events respectively. The site stores 450 m3 of flood water during the 1 in 100 year ARI event on the eastern side of the drain, and 52 m3 on the western side of the drain. This loss of flood water can potentially be compensated by lowering the western bank by about 400mm to create 500m3 of additional storage. This can be landscaped to provide an additional amenity area.

The flood levels for the drain on the eastern side of the main site are 12.95mAHD (unmaintained) and 13.62mAHD (unmaintained) for the 1 in 5 year ARI event and the and 1 in 100 Year ARI event respectively. The 100 year ARI event flood stores 230m3 of flood water on the western side of the drain and 145 m3 on the eastern side of the drain. This flood storage can be compensated for by setting the level of the reserve to RL = 13.35mAHD to create 500m3 of storage. The level of the reserve currently is about 13.9mAHD. A water corporation easement is located

The flood levels for the drain running adjacent to the most eastern block are 13.07mAHD (unmaintained) and 13.54mAHD (unmaintained) for the 1 in 5 year ARI event and the and 1 in 100 Year ARI event respectively. The site currently stores 25 m3 of flood water during the 100 year ARI event, which can still be compensated for with a proposed rain garden.

2.2.2 Stormwater Conveyance

Conventional piped stormwater systems are not suited to the Pilbara Region due to the high intensity rainfall events. Therefore an overland flow strategy has been adopted for the site, which utilizes the road carriageway as the main conveyance mechanism.

The roads have been graded to match the predevelopment conditions as closely as possible. The grades have been kept to a minimum of 1 in 300 (0.3%) where practical to ensure low velocities and slow the time of entry into the open drains.

In all cases the 1 in 5 year events are to be conveyed through the road reserve and are contained within the kerbs. The 1 in 100 year event has will be contained within the road reserve.

2.2.3 Protect the existing drains from scouring or siltation

Areas where high velocities are unavoidable such as discharges into the adjacent drains and junctions will have erosion and scour protection in the form of mortared rock pitching.

As Pindan sands are highly mobilised when saturated and scouring is a major issue on steep slopes, all constructed batters will be kept to a maximum grade of 1 in 4.

Significant earthworks will be required at the site during construction due to stripping and filling operations. Sediment and erosion control shall be closely monitored to ensure minimal impact on neighbouring properties and downstream environments. Bunds, silt fences, detention basins and water carts shall be utilised to reduce and minimise dust and sedimentation to the extent practical. Soil will only be exposed during construction when absolutely necessary.

2.2.4 Water balance

Due to the high intensity rainfall events and the impermeable nature of the local soils, it is impractical to maintain post development peak flows to pre development levels. However, it is proposed that the lots have internal landscaping to capture where possible, the regular rainfall events up to 15mm. All the lots are designed to grade towards the road reserves, so any excess water not captured by the landscaping elements will flow into the road reserve. This measure along with the storage in the road reserve will minimise the impact of any increase in peak flows due to the development. Detailed stormwater runoff calculations have been completed for the site to confirm the practicality of detention, and confirm the conveyance capacity of the road network.

2.2.5 Road Crossings

The 2 road crossings are proposed to consist of two rows of 900 x 900 box culverts. The road invert above the box culverts will be approximately equal to the 100 year flood event level. This is made up of the height of the box culverts, and roughly 300mm pavement thickness.

3 WASTEWATER MANAGEMENT

Each lot within the development is to be serviced by a Water Corporation operated gravity system network. In the main development area, 150mm reticulation mains are to be installed to convey the wastewater to the existing 300mm diameter main on the western side of the block. All other lots have existing mains adjacent to them, so can be connected directly.

The wastewater will then be discharged into Pump station 39 on Koombana Ave, and Pump Station 12 on Yangarra Place. These pump stations ultimately discharge into the South Hedland Treatment Plant located to the west of South Hedland.

It is anticipated that the developer will promote and encourage the final lot owners to integrate the use of water efficient appliances and fittings into their living areas to minimise the amount of wastewater produced. This will help minimise the impacts on the downstream infrastructure.

4 WATER RETICULATION MANAGEMENT

Each lot within the development is to be serviced by the Water Corporation operated water reticulation network. The proposed network is included in Appendix D, which is subject to approval by the Water Corporation. Some lots have water mains running adjacent, which will only require a connection, while a majority of the new lots will be connected to a new reticulation system.

It is anticipated that the developer will promote and encourage the future lot owners to integrate the use of water wise appliances and fittings into their living areas to reduce potable water demand.

5 REFERENCES

The following documents have been referred to :

Stormwater Management Manual for Western Australia (Department of Water, 2007)

Better Urban Water Management

Pilbara regional water management plan

WA water management plan

Australian rainfall and runoff - a guide to flood estimation, 2001, Engineers Australia.

Local government guidelines for subdivisional development edition 2 – 2009 (IPWEA)

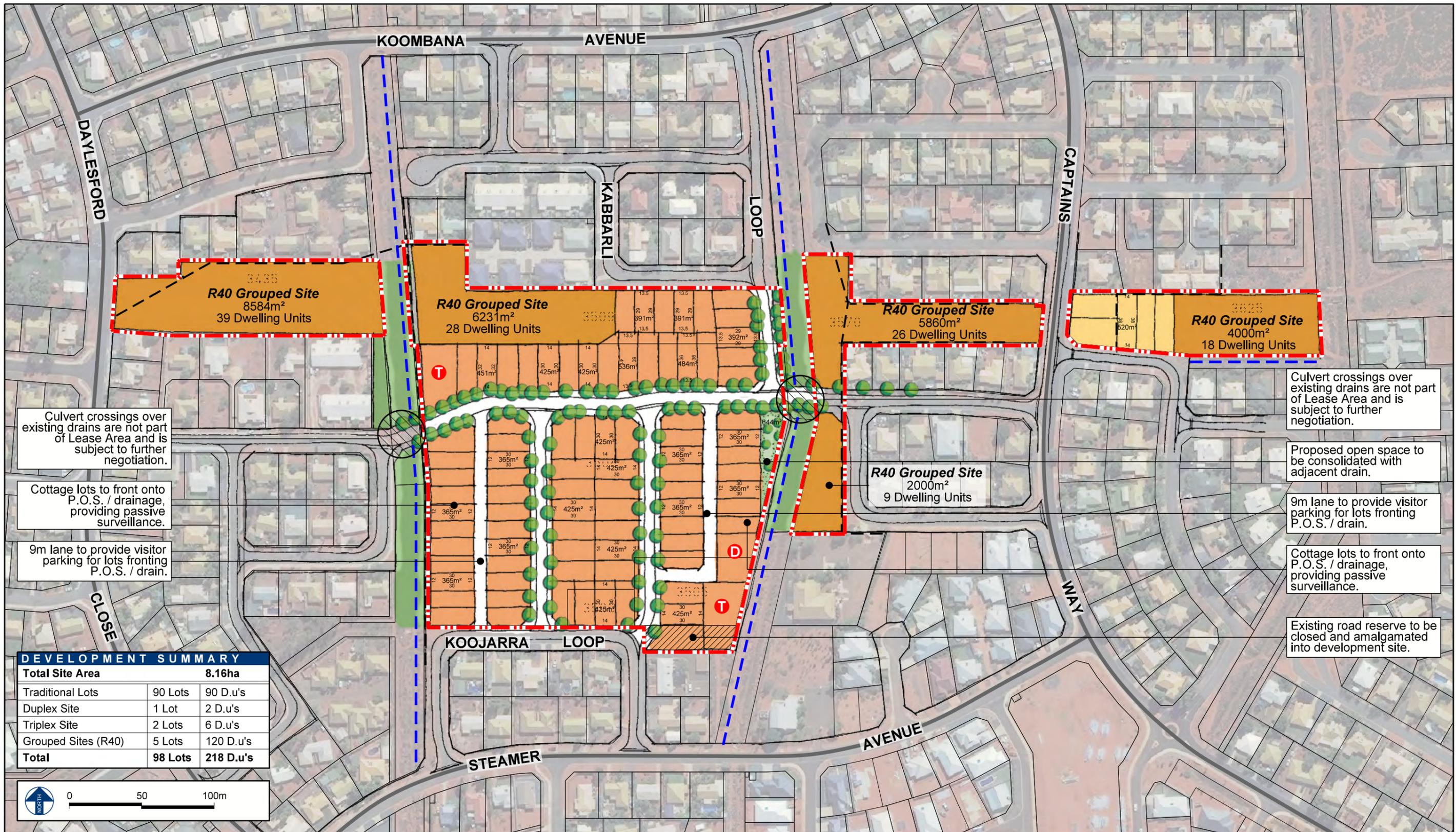
Port Hedland infrastructure standards (draft)

Bureau of Meteorology (BOM) IFD Data

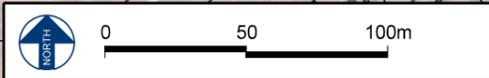
SAND-CLAY PINDAN MATERIAL IN PAVEMENTS AS A
STRUCTURAL LAYER, Emery, S J, Masterson, S and Caplehorn, M W

Appendix A

Development concept plan



DEVELOPMENT SUMMARY		
Total Site Area	8.16ha	
Traditional Lots	90 Lots	90 D.u's
Duplex Site	1 Lot	2 D.u's
Triplex Site	2 Lots	6 D.u's
Grouped Sites (R40)	5 Lots	120 D.u's
Total	98 Lots	218 D.u's



Culvert crossings over existing drains are not part of Lease Area and is subject to further negotiation.

Proposed open space to be consolidated with adjacent drain.

9m lane to provide visitor parking for lots fronting P.O.S. / drain.

Cottage lots to front onto P.O.S. / drainage, providing passive surveillance.

Existing road reserve to be closed and amalgamated into development site.

PRELIMINARY SUBDIVISION CONCEPT

Lots 3505, 3506 & 3508 Koojarra Crescent, Lots 3625-3570 Captains Way, Lot 3435 Dorrigo Loop & Lot 3509 Kabbarli Loop, SOUTH HEDLAND

LEGEND

- - - Site Boundary
- - - Pedestrian Link
- - - Existing Services
- - - Principal Connector Road
- D Duplex Lot
- T Triplex Lot
- Proposed Road Closure
- R40 Residential
- R30 Residential
- R20 Residential
- P.O.S. / Drainage

Base data supplied by Landgate. Aerial Photography dated May 2010. Accuracy +/- 4m. Projection MGA Zone 50.

Areas and dimensions shown are subject to final survey calculations. All carriageways are shown for illustrative purposes only and are subject to detailed engineering design.

Jaxon : CLIENT
 1:2,500@A3 : SCALE
 22 November 2011 : DATE
 40019-3-001.dgn : PLAN No
 - : REVISION
 N.T. : PLANNER
 L.W. : DRAWN
 N.T. : CHECKED



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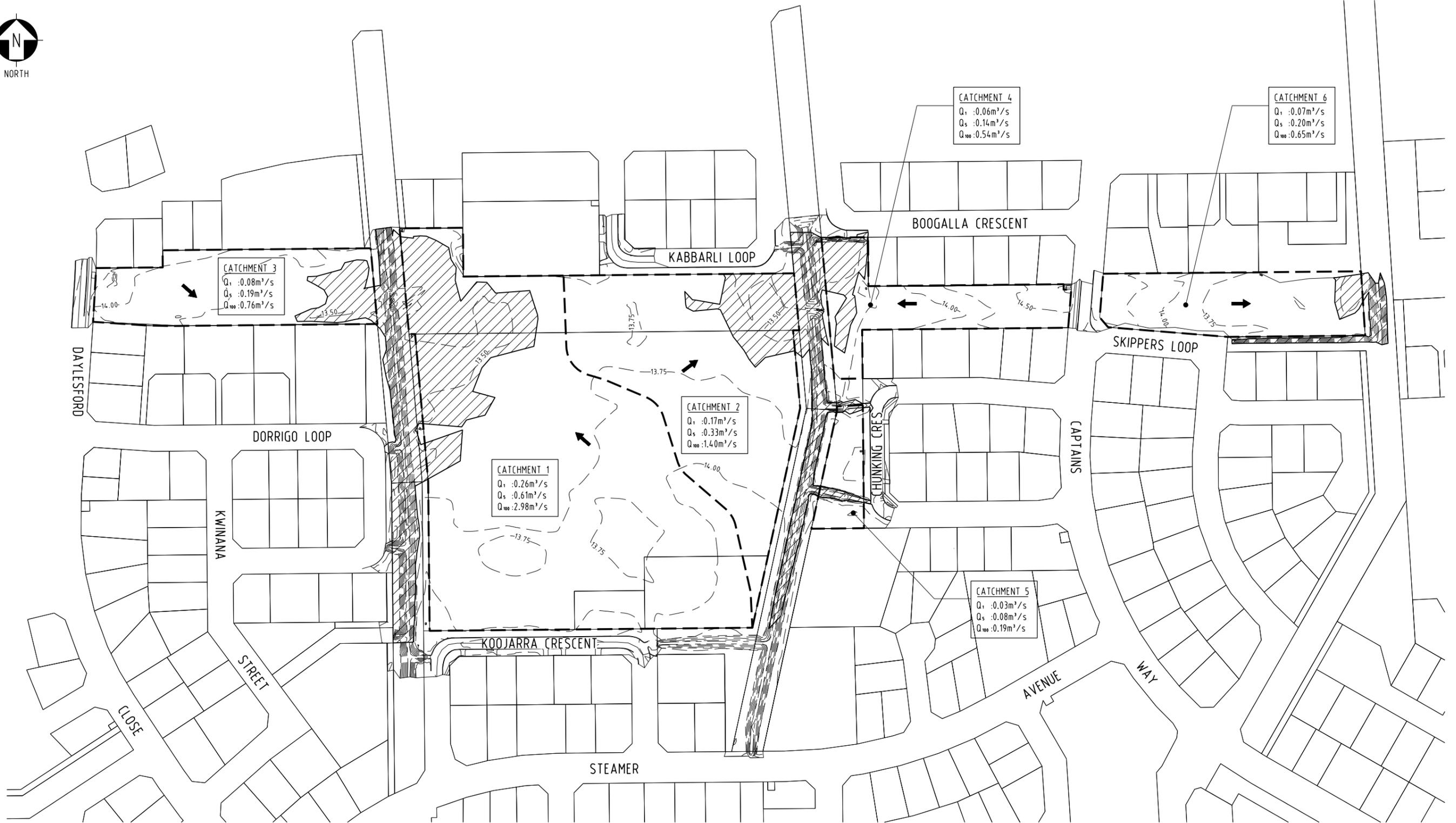
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Appendix B

Pre-development Catchment plan



NORTH



LEGEND

- 1:100 FLOOD AREA
- DIRECTION FLOW
- EXTENT OF EXISTING CATCHMENT AREA
- EXISTING CONTOURS



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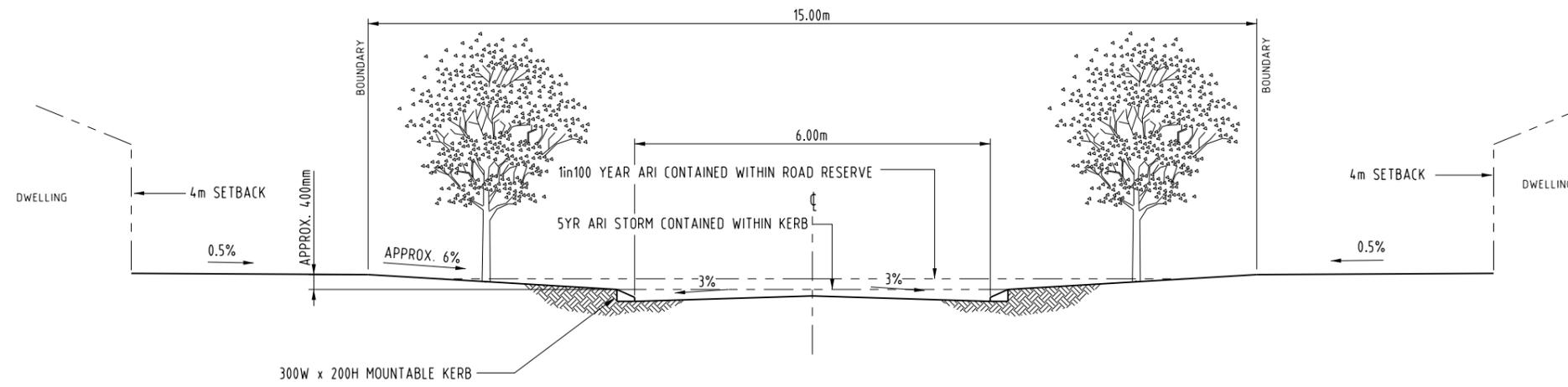
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TITLE	KOOMBANA CONCEPT PRE-DEVELOPMENT STORMWATER CATCHMENT PLAN	
ORIGINAL SHEET SIZE	BCH JOB NO.	DRG No.
A1	10112	10112-C-007
FILE NAME		REVISION
		A

Appendix C

Post-development Stormwater Strategy - Plans and cross sections

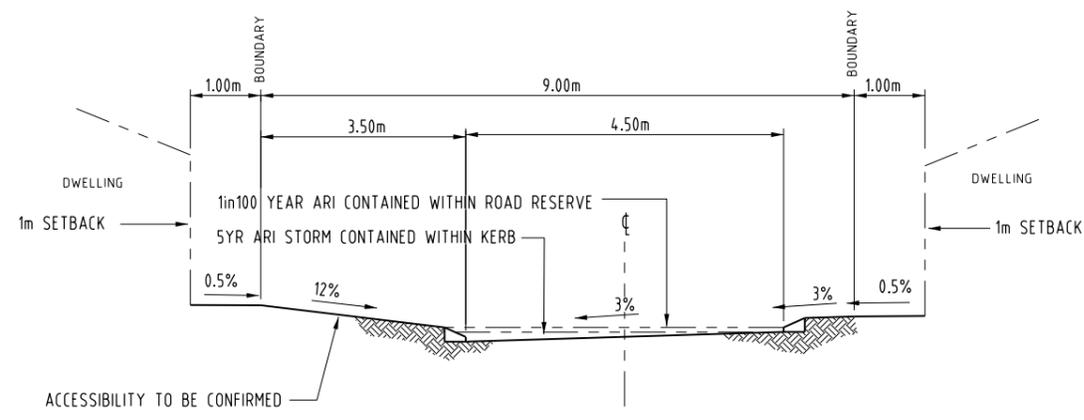
NOTES:

1. FLOOD LEVELS SHOWN ARE FOR WORST CASE SCENARIO ONLY



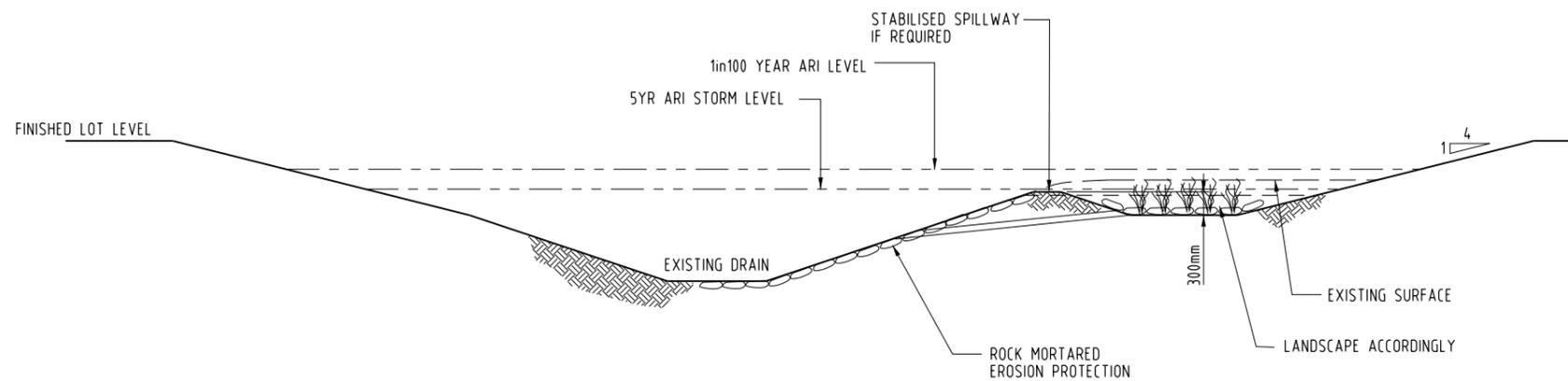
TYPICAL ROAD CROSS SECTIONS

SCALE 1:50(A1)



TYPICAL LANE CROSS SECTIONS

SCALE 1:50(A1)



DETAIL A - EXAMPLE LANDSCAPING AND EROSION CONTROL

SCALE 1:50(A1)

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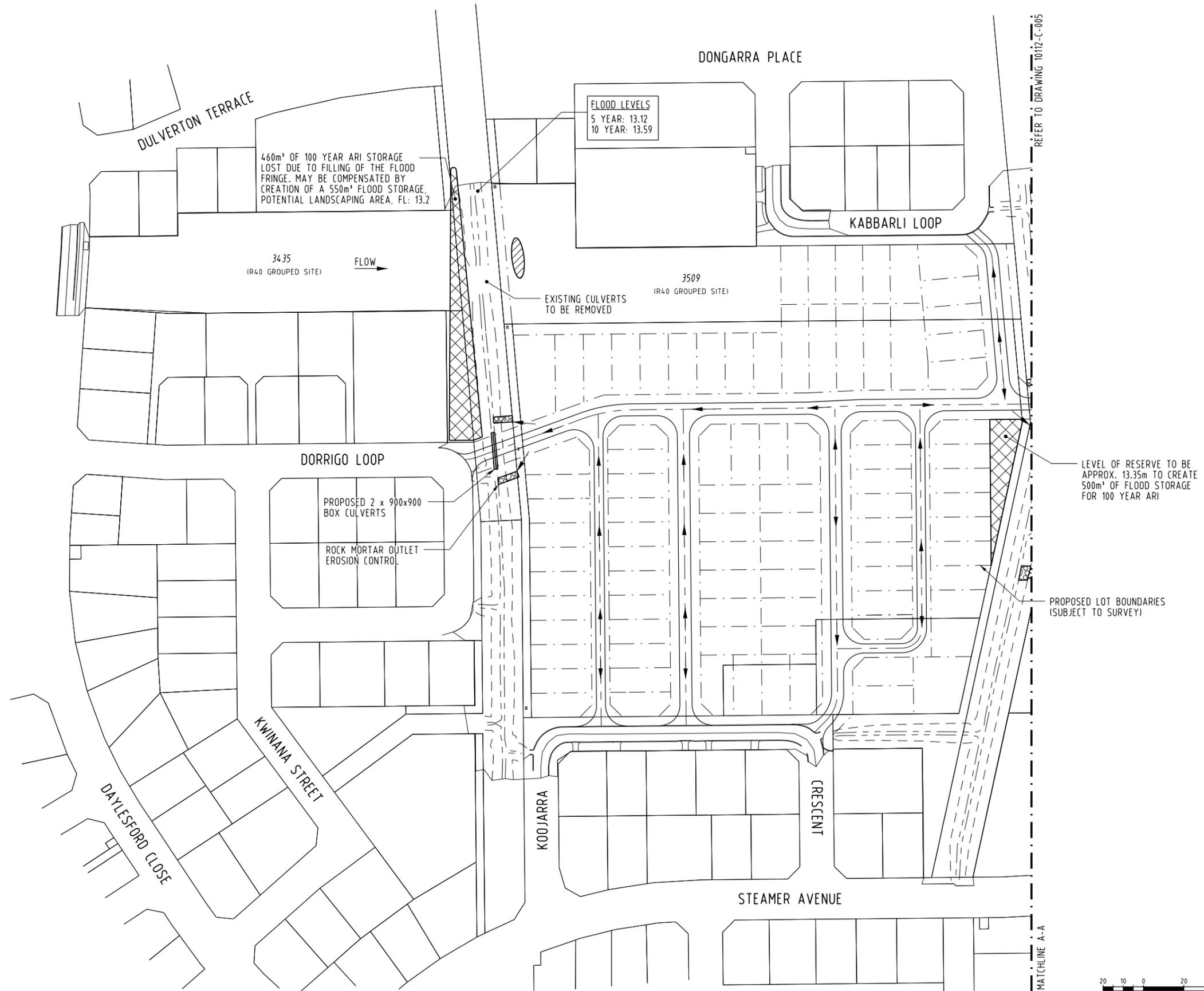
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A	07.12.11	EC	EC	ISSUED FOR INFORMATION	JK

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J.KITCHEN	06.12.2011		
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		1:1000	
APPROVED FOR CONSTRUCTION	DATE		

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ORIGINAL SHEET SIZE	A1
BCH JOB NO.	10112
DRG No.	10112-C-008
REVISION	B



NOTES:
1. ALL LEVELS ARE IN METRES TO AHD



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TITLE **KOOMBANA PROPOSED STORMWATER CONCEPT PLAN SHEET 2 OF 2**

ORIGINAL SHEET SIZE **A1** | BCH JOB NO. **10112** | DRG No. **10112-C-006** | REVISION **B**



NOTES:
1. ALL LEVELS ARE IN METRES TO AHD

REFER TO DRAWING 10112-C-006

FLOOD LEVELS
5 YEAR: 12.95
10 YEAR: 13.62

FLOOD LEVELS
5 YEAR: 13.07
100 YEAR: 13.54

BOOGALLA CRESCENT

PROPOSED LOT BOUNDARIES
(SUBJECT TO SURVEY)

25m³ OF STORAGE VOLUME
REQUIRED TO RETAIN FLOOD
STORAGE. TO BE LANDSCAPED
AS A RAINGARDEN OR SIMILAR

FL: 13.82

3570
(R40 GROUPED SITE)

← FLOW

FLOW →

3625
(R40 GROUPED SITE)

FL: 13.74

PROPOSED 2 x 900x900
BOX CULVERTS.
ROAD CREST LEVEL 13.6m AHD

ROCK MORTAR OUTLET
EROSION CONTROL

ROCK MORTAR OUTLET
EROSION CONTROL

RE-ALIGN EXISTING CHANNEL
AND LOCATE WITHIN NEW
DRAINAGE EASEMENT

(R40 GROUPED SITE)

FL: 13.82

CHUNKING CRESCENT

CAPTAINS WAY

STEAMER AVENUE

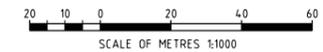
MATCHLINE A-A

LEGEND

-  PROPOSED LANDSCAPING AND EROSION CONTROL. REFER DETAIL A 10112-C-008
-  OVERLAND FLOW PATHS
- FL FINISHED LEVEL

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ORIGINAL SHEET SIZE	A1
BCH JOB NO.	10112
DRG No.	10112-C-005
REVISION	B

Appendix D

Proposed water reticulation network



NOTES:

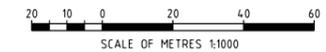
1. REFER TO 10112-C-003 FOR NOTES

LEGEND

- EXISTING MAINS ---
- PROPOSED MAINS ---
- PROPOSED VALVES X
- PROPOSED HYDRANTS ●
- LOCATION OF SINGLE/DUAL LONG SERVICE ---
- SERVICE LOCATION 'FL' OR 'FR'
- CHANGE OF PIPE SIZE AND/OR MATERIALS AND/OR ALIGNMENT |
- DEFERRED SERVICE 0
- NON-STANDARD ALIGNMENT (1.8)
- PROPOSED SLUICE VALVE X
- PROPOSED WORKS BOUNDARY ---

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APPROVED FOR CONSTRUCTION		DATE				

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ORIGINAL SHEET SIZE	BCH JOB NO.	DRG No.	REVISION
A1	10112	10112-C-004	A



REFER TO DRAWING 10112-C-004

MATCHLINE A-A

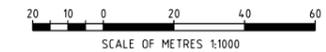


NOTES:

1. ALL WATER MAINS SHALL BE INSTALLED ON 2.1m ALIGNMENT EXCEPT AS OTHERWISE AGREED
2. ALL CHAINAGES SHALL BE IN METRES AND PIPE DIAMETERS IN DESIGNATED DN SIZE
3. WHERE NO PIPELINE BENDS ARE SHOWN, PIPES MAY BE DEFLECTED AT ELASTOMERIC JOINTS
4. FL & FR (FULLY PRELAI LEFT & RIGHT) SHALL INDICATE THE SIDE OF THE LOT THAT IS SELECTED FOR THE METER LOCATION, WHEN VIEWED FROM THE ROAD FRONTAGE
5. THE LOCATIONS AND DETAILS OF FULLY PRELAI SERVICES SHALL BE IN ACCORDANCE WITH THE STANDARD DRAWINGS (SERIES BD62-8)
6. SINGLE AND DUAL LONG SERVICES ACROSS ROADS SHALL BE 25mm AND 32mm PE INSTALLED PRIOR TO ROAD CONSTRUCTION
7. ALL SHORT AND LONG SINGLE AND DUAL SERVICES SHALL BE PRELAI INTO THE LOTS FOLLOWING THE ROAD CROSSING INSTALLATION WORK
8. No. OF NEW SERVICES:
 SHORT SINGLE-0
 SHORT DUAL-0
 DEFERRED SERVICES-0
 LONG SINGLE-4
 LONG DUAL-17
 LOTS SERVED-98
9. WHEREVER PRACTICABLE, RETICULATION MAINS SHALL EXTEND ACROSS THE FULL FRONTAGE OF LOTS SUBJECT TO THE SUBDIVISION AGREEMENT
10. DESIGN AND CONSTRUCTION OF RETICULATION MAINS SHALL BE LIMITED TO A DISTANCE OF NO LESS THAN 6m AND NO MORE THAN 12m BEYOND THE CONDITIONAL APPROVAL BOUNDARY

LEGEND

- EXISTING MAINS
- PROPOSED MAINS
- PROPOSED VALVES
- PROPOSED HYDRANTS
- LOCATION OF SINGLE/DUAL LONG SERVICE
- SERVICE LOCATION 'FL' OR 'FR'
- CHANGE OF PIPE SIZE AND/OR MATERIALS AND/OR ALIGNMENT
- DEFERRED SERVICE
- NON-STANDARD ALIGNMENT (1.8)
- PROPOSED SLUICE VALVE
- PROPOSED WORKS BOUNDARY



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A1	10112	10112-C-003	A

APPENDIX 7

Engineering Servicing Report (BCH)

SOUTH HEDLAND

**CIVIL ENGINEERING SERVICES REPORT AND
COST ESTIMATE – JUNE 2011**

**RESIDENTIAL DEVELOPMENT
Koombana School Site – South Hedland**

Prepared for:

Jaxon Pty Ltd c/o RPS Group



Prepared by:

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Report No. 10112-ESR-RC01 Rev B

REVISION STATUS

REVISIONS							
Rev	Date	Description	Prepared By		Reviewed By		Approval
			Name	Sig	Name	Sig	
B	June 2011	Issue for Client comment	J.Kitchen		D.Kelly		



Report Parameters	
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Referencing	NR
Text File	J:\RPS Group\10112 Koombana School Site ESR\Technical\Reports\Revised engineering servicing report following RPS revision of concept plan\10112 Engineering Services Report-RC01 rev B.docx
Figures	

Checking Status	
Text	
Figures	
Tabulations	
Calculations	
Statistics	

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APPENDICES

- Appendix A: Existing Services Information
- Appendix B: Preliminary Engineering Servicing Concept Plans
- Appendix C: Potential development staging options

PRELIMINARY INVESTIGATION AND COST ESTIMATE – JULY 2011 RESIDENTIAL DEVELOPMENT SITE AT KOOMBANA SCHOOL SITE - SOUTH HEDLAND

EXECUTIVE SUMMARY

In order for Jaxon Pty Ltd c/o RPS Group to determine whether to progress towards development of the Koombana School site for residential use, BCH Engineering Consultants have been requested to undertake a Civil Engineering review of the potential development sites, which considers:

- the Civil Engineering services which exist,
- the Civil Engineering services which are required and,
- issues which may impact upon the development site.

The Civil Engineering review should be considered in conjunction with other relevant aspects (e.g. environmental, geotechnical, marketing potential, unit yield, off site water and sewerage capacity etc) before making a decision relating to development of the site.

Earthworks will be required to accommodate development levels and overland stormwater drainage requirements. There is likely to be a requirement to import fill, but quantities of fill required cannot be confirmed without detailed design and level survey. Geotechnical investigation should be undertaken to confirm soil profile, characteristics at depth, and engineering properties to accommodate urban development. Retaining walls on boundaries to existing properties may be required depending on the final concept plan. Some deleterious material and topsoil will need to be cleared prior to earthworks commencing.

The existing sewer system has been assessed for serviceability and no adverse issues were identified within the site boundaries. The proposed sewer reticulation network can be connected to the existing system. Capacity of the existing pump station(s) and offsite pipework will need to be assessed by formal request to Water Corporation. We understand that Water Corporation are currently in the process of upgrading sewer infrastructure in Port Hedland.

There are existing sewer lines located within the three grouped housing lots. The sewer within these lots could potentially be realigned, or the proposed structures designed taking these services into consideration. An odour buffer to the existing sewer pump station (Yarrunga Cres) may place some restrictions on the development potential of the adjacent group housing lot. An easement will be required over all public infrastructure within these lots.

The stormwater system will consist of overland flow to adjacent road reserves which in turn will overland flow to the existing open drains. The potential group housing site will need to make allowance for potential overland flow from Chunking Crescent.

Bridge culverts across the open channel may be required. These may be designed using off the shelf components to reduce costs, however if required they will add significantly to the overall cost of the development.

The existing water reticulation network should cater for extension to service proposed lots. Based on conversation with staff from the Water Corporation regional offices, we understand that limited water supply sources may impact on development. This issue should be resolved formally before proceeding to ensure cash flows are not adversely affected by the inability to obtain clearances (due to lack of distribution mains and supply source). We understand that Water Corporation are currently in the process of upgrading water infrastructure in Port Hedland.

The proposed road network is achievable from an engineering perspective. It is currently anticipated the road network will be utilised to direct surface runoff to the open drains.

Footpaths within the current road reserves may need to be extended into the development to provide pedestrian connectivity.

Some fencing may be required adjacent reserves and public open spaces. Discussion with local authorities will be required to confirm this in the development conditions.

Power is currently reticulated throughout the adjacent existing residential area and as such servicing the proposed development is not considered to be unachievable. Some upgrade works to existing infrastructure may be required although it is unclear this early in the project.

Communications are currently reticulated throughout the adjacent existing residential area, and as such servicing the proposed development is not considered to be unachievable. Some upgrade works to existing infrastructure may be required although it is unclear this early in the project.

PRELIMINARY INVESTIGATION AND COST ESTIMATE – JUNE 2011 RESIDENTIAL DEVELOPMENT SITE AT KOOMBANA SCHOOL SITE - SOUTH HEDLAND

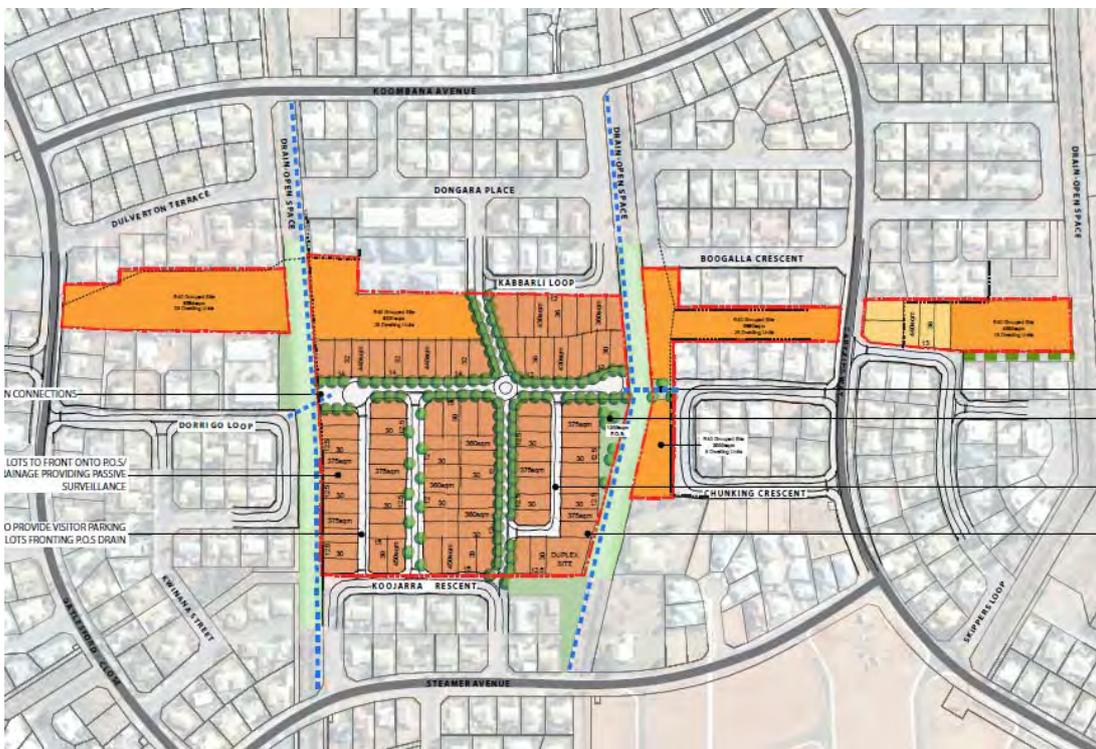
1 INTRODUCTION

In order for Jaxon Pty Ltd c/o RPS Group to determine whether to progress towards development of the subject site for residential use, BCH Engineering Consultants at the request of the RPS Group have undertaken a Civil Engineering review of the potential development site, and considered:

- the Civil Engineering services which exist,
- the Civil Engineering services which are required,
- issues which may impact upon the development site, and
- provided a development cost estimate for the required Civil Engineering infrastructure.

The Civil Engineering review should be considered in conjunction with other relevant aspects (e.g. environmental, geotechnical, marketing potential, unit yield, etc) before making a decision relating to development of the potential site.

2 POTENTIAL DEVELOPMENT SITE REVIEW



DEVELOPMENT CONCEPT – KOOMBANA SCHOOL SITE - SOUTH HEDLAND

This urban infill site has the following characteristics:

2.1 EARTHWORKS

- Clearing of deleterious material and topsoil stripping will be required prior to earthworks commencing.
- Total area = approximately 81,600m²
- Based on inspection of other similar sites in the area, the soil would consist of pindan sand/gravel however geotechnical investigation should be undertaken to confirm soil profile, characteristics at depth, confirm imported fill requirements and engineering properties to accommodate urban development.
- The characteristics of potential fill material will have an influence on building costs. e.g. highly expansive water sensitive soils will require more expensive footing systems, impermeable sands may require additional drainage consideration.
- As the development site is surrounded by and adjacent to a number of existing residential lots, finish ground levels will need to take into consideration existing lot levels so as not to affect drainage, fencing and amenities. It may be required that retaining walls be constructed to specific fill heights within the proposed development.
- Ideally, earthworks will be minimised and a “cut to fill balance” will be the design philosophy, however initial indications are that there is a significant fill deficit.
- The existing ground level is roughly 13.40m, and the 100 year flood level is roughly 13.7m (South Hedland flood study, December 2010). Based on these levels it is likely that 0.5 – 1.2m of fill is likely to be required across the site to meet drainage and freeboard requirements, requiring roughly 55,000m³ of fill material.
- Earthworks is the most significant cost. A survey and basic 3d design should be undertaken to give more certainty around quantities.

2.2 SEWER RETICULATION

- Water Corporation “As Constructed” plans indicate a number of 300mm and 150mm diameter gravity sewer reticulation pipes adjacent to and surrounding the potential development site.
- As the potential development site is within an existing waste water reticulation area, provision of a sewer service is considered achievable, however Water Corporation have not provided a response in relation to our enquiry regarding head-works capacity for the proposed development.
- Existing sewer pipes pass through the three group housing lots which will require negotiation with the Water Corporation for the relocation of existing sewer pipes and/or formation of an easement to allow strata development of the proposed lots and/or layout adjustment to avoid issues. Where possible, adjusting the layout of the lot configuration/internal lot layout is likely to be a less expensive option than adjusting physical “live” infrastructure.
- Based on Water Corporation planning practice, the existing sewer pump station capacity should have been designed to accommodate this development area, and Water Corporation have not yet been able to respond to our request for advice at the time of issuing this report.
- As waste water pump stations usually have a 30m - 40m odour buffer around the wet well, the existing waste water pump station may impact upon the development of the adjacent lot.

- Until a formal submission is made and a preliminary design for waste water developed it is not known if the Water Corporation will require works to upgrade the existing sewer main or pump station infrastructure in the vicinity.
- Initial indications are that the sewer reticulation network can discharge into a manhole opposite Dorrigo Loop, which leads directly to the nearest pump station.

2.3 STORMWATER DRAINAGE

- On the basis that roof runoff will be directed onto the landscaping and pavements of the proposed lots, earthworks and complimentary road design will be required to direct overland flow towards the existing open drains.
- Although rainfall events are infrequent, the intensity and the impermeable nature of the soils require appropriate design to minimise the potential for inundation of residential development. (e.g. even 3mm of water above a floor level is likely to cause significant issues for the property owner and ultimately the developer if appropriate design standards have not been utilised).
- A nominal amount has been made for Water Sensitive Urban Design (WSUD) throughout the site. The figure allows for the construction of physical components but excludes landscaping. Design considerations should be provided during the conceptual planning phase.
- The development may require the installation of two bridges/ culverts to allow for roadways and services to be installed across the existing open drains. These will need to be of sufficient size as to not restrict the flow through the open drains.
- Chunking Crescent flood routing may adversely affect the proposed group housing site between Chunking Crescent and the open drain. A drainage channel may need to be provided within this group housing lot to address this
- Some sections of the proposed roads would need to direct stormwater out to the existing roads. These roads will need to be checked for capacity to ensure they can accept additional flow from the development. It may also need to be checked that these roads adequately discharge into the open drains. Some modifications may be required in the existing roads and adjacent reserves if this is not the case.

2.4 BRIDGE CULVERTS

- Bridge culverts across the open channel may be required. These may be designed using off the shelf components to reduce cost, but will still add significantly to the overall cost of the development.
- They may require scour protection works and safety barriers.
- It is unclear whether these will be required, so have been included for completeness.

2.5 POTABLE WATER SUPPLY

- As the potential development site is within an existing potable water reticulation area, provision of a water service is considered achievable. Water Corporation have not provided a response in relation to our enquiry regarding headworks capacity for the proposed development, although there are currently projects underway to increase the quantity of potable water available to South Hedland.
- If “built form” development of proposed ‘group housing precincts’ is to be undertaken then additional internal lot water infrastructure and development charges will apply at this stage.
- Until a preliminary design for water supply can be developed it is unknown if the Water Corporation will require works to upgrade existing infrastructure.

2.6 ROADS

- The existing local authority roads are in fair to good condition, sealed and kerbed.
- Roadways are assumed to be 6 metres wide between mountable kerbs constructed to the requirements of the local authority. Lane ways are assumed to be 4m wide.
- Proposed roads have been assumed to be of a similar style to the existing roads.
- Adjustment of the road concept plan has been completed to give a higher yield. It is not anticipated that there will be any issues with this road network from an engineering perspective.
- Two culverts may be required to provide an east-west link through the development. This will add a significant cost to the infrastructure. This is currently under negotiation with the local authority.

2.7 FOOTPATHS AND FENCING

- It is anticipated that footpaths will be required beside all roads on one side only, but not on laneways.
- There are no apparent issues that would have an impact on footpath design or construction.
- Fencing has been assumed adjacent reserves and public open spaces. This will require consultation with local authorities to confirm their requirements.

2.8 COMMUNICATIONS

- On the basis that the communications will be designed and provided by Telstra and not contain any integrated security system, MATV, CATV, CCTV or other advanced features, provision of standard Telstra communication services to the site is considered achievable.
- Plans were not provided from Telstra at the time of this report but it can be assumed that development within the surrounding area indicates that communications services exist within the adjacent road reserve and as such servicing is not considered obstructive to development of this site.
- Network adjustment may be necessary and a nominal estimate has been noted for this work.

2.9 UNDERGROUND POWER

- Based on information from Horizon Power, the site has existing underground Low Voltage (LV) and High Voltage (HV) electrical power infrastructure servicing the adjacent properties and as such a service to the potential development site is considered achievable.
- Demands on the existing power infrastructure and costs to extend power to the site will need to be confirmed as part of the detailed design process.
- A nominal allowance of \$16,000/Lot has been allowed to accommodate underground power reticulation plus \$200,000 to accommodate upgrades to the HV network.

2.10 STAGING

- Staging of the development is possible with the proposed infrastructure layout.
- The general direction of staging is from west to east, as this is against the flow of the sewer network, hence construction should start at the bottom of the catchment.
- Appendix C contains the different possible options of development staging. The final stage layout may be dictated by a number of different issues e.g. demand of product, or water/sewerage supply constraints, or cashflow.

- It is likely that the more stages that there are, the higher the final project cost will be due to fixed costs such as tendering, approval processes, contractors establishment costs etc.

3 KEY CONSIDERATIONS

- Confirmation of geotechnical characteristics of the site is required to confirm suitability for residential development.
- A detailed level and feature survey is required to allow more accurate determination of earthworks quantities and requirements.
- Confirm electrical details of existing system to increase accuracy of project budgets.
- The location of existing services within some proposed lots will require consideration (lot layout or infrastructure alteration) to Water Corporation services. Architectural consultation may give more confidence around this issue.
- A buffer around the existing waste water pump station will require resolution, through consultation with Water Corporation.
- Road crossings of the open drains will add considerable cost to the development, and should be avoided if possible.
- The potential group housing site between Chunking Crescent and the open drain may interfere with the existing overland flow drainage function of the Chunking Crescent road reserve. Stormwater may be integrated into landscape features, eg WSUD may allow consolidation of stormwater and landscaping in order to reduce costs.
- The capacity of the existing waste water pump station should be assessed formally through Water Corporation to ensure additional inflow can be accommodated.
- The capacity of the water supply system should be assessed formally through Water Corporation to ensure the required development flow can be accommodated in the time frame required.
- Staging will need to be confirmed prior to detailed design, and will need to be agreed with Local authorities.

4 COST ESTIMATE

It should be noted that the Civil Engineering portion of the Construction Cost Estimate does not take into account:

- Land acquisition or holding costs.
- Financing or interest costs.
- Environmental offsets or rehabilitation costs.
- Internal servicing of grouped housing lots.
- Other aspects which may affect the accuracy of the estimate
- Any expenditure to date.
- Marketing or any other consultant expenses.
- Project Management

Estimates have been made for the following items -

- Landscaping,
- Planning,
- Engineering,

- Surveying,
- Geotechnical investigation.

These are for indicative purposes only and require consultation with the relevant consultant to improve the accuracy further.

Due to the preliminary nature of this project and the limited timeframe in which to obtain information from Government Utilities (Water Corporation, Horizon Power, Telstra, Town of Port Hedland), some assumptions regarding requirements have been made by the investigating Engineers. These assumptions are based on past experience dealing with the relevant authorities on similar projects as well as local knowledge of strategic infrastructure issues. If the development options are to be progressed, it is strongly recommended that further detailed investigation is undertaken to confirm upgrade requirements for “off site” strategic infrastructure, assess development cost estimates based on more detailed information as well as confirmation of abnormal developer contributions expected from the supply authorities.

All prices are excluding GST.

Description	Comments	Cost Estimate
Preliminaries, establishment and clearing.	<ul style="list-style-type: none"> • Based on 5 stages. 	\$900,000
Earthworks (excluding retaining walls)	<ul style="list-style-type: none"> • Without accurate level and feature survey, this is difficult to assess earthworks volumes accurately and as such we have assumed importing and placing of between 0.5 and 1.2m of fill across the site. 	\$3,600,000
Sewer Reticulation	<ul style="list-style-type: none"> • This figure does not include any off site upgrade works, includes a standard gravity system only connecting into existing sewer main. 	\$930,000
Stormwater Drainage	<ul style="list-style-type: none"> • Assumes stormwater reticulation via surface drainage with some erosion protection at the open drains. • includes a nominal allowance to accommodate Water Sensitive Urban Design (WSUD) and minor pipe drainage 	\$860,000
Bridge culverts	<ul style="list-style-type: none"> • Allows for the construction of 2 standard off the shelf culverts including safety rails and erosion protection. 	\$1,000,000
Water Reticulation	<ul style="list-style-type: none"> • This allows for onsite water reticulation only. Due to the uncertain nature of water availability/headworks required, communication with Water Corporation is require to confirm timeframe and requirements for serviceability. • This figure does not include any off-site headworks upgrade works. 	\$610,000

Description	Comments	Cost Estimate
Road Works	<ul style="list-style-type: none"> Roads assumed to be 6m wide asphaltic concrete seals on approx 300 rock base course with mountable kerbing. Lanes assumed to be 5m wide asphaltic concrete seals on approx 300 rock base course with mountable kerbing. Allowance made for crossing of two culverts. 	\$1,350,000
Footpaths and Fencing	<ul style="list-style-type: none"> Footpaths have been assumed on one side of road throughout and extension of existing footpaths into site. Fencing has been assumed adjacent reserves and public open spaces. 	\$700,000
Common services installation	<ul style="list-style-type: none"> Includes trenching and installation of street lighting, cables and ducts only. Design and supply of reticulation networks by services providers below. 	\$1,250,000
Communications	<ul style="list-style-type: none"> Existing adjacent communications infrastructure information was unavailable however, given that the development is within an area which is currently serviced by Telstra, servicing the development with communications is not considered a constraint to development. It has been assumed that some Telstra network adjustment may be necessary. 	\$300,000
Underground Power Reticulation	<ul style="list-style-type: none"> Existing adjacent power infrastructure information was available and given that the development is within an area which is currently serviced by Horizon Power, servicing the development with underground power reticulation is not considered a constraint to development. It has been assumed that some High Voltage network adjustment/upgrades may be necessary. Based on 16,000/lot. 	\$1,600,000
Reserves	<ul style="list-style-type: none"> Nominal allowance made for one reserve including some landscaping, paths and basic furniture. 	\$250,000
Construction subtotal		\$13,350,000
Consultants fees -		
Engineering	Includes detailed design of water, sewerage, roading, drainage, earthworks, liaison with local authorities.	\$450,000
Electrical	Includes design of electrical reticulation	\$60,000
Communications	Design of communications reticulation by service provider	\$0

Description	Comments	Cost Estimate
Surveying	Detailed topographic survey, boundary survey and titling	\$150,000
Planning/landscaping	All planning aspects, landscape design	\$400,000
Geotechnical	Geotechnical investigation and reporting, completion reporting.	\$100,000
Consultants subtotal		\$960,000
Local Authority fees		
Water Corp	Planning and Connection Fees	\$35,000
Water Corp	Sewer Headworks contribution	\$15,000
Water Corp	Water Headworks contribution	\$450,000
Shire of Port Hedland	2% Supervision fee for Earthworks, Roads, footpaths, fencing and drainage.	\$170,000
Shire of Port Hedland	clearance fee \$200.00/lot	\$20,000
Local Authority subtotal		\$690,000
"Order of Magnitude" total		\$15,200,000

It should be noted that the information within this report has been prepared based on preliminary information without development conditions, survey, detailed design, detailed investigation or authority approvals. As such the 'Order of Magnitude' estimate could vary by up to 25%.

Use of this information is on the basis that the user understands the limitations, the risks and accepts the consequences of using the information within this report.

5 EXISTING AND PROPOSED SITE INFRASTRUCTURE

Appendix A contains the existing services information which has been provided to date for the site.

Appendix B contains preliminary engineering servicing concepts.

6 LIMITATIONS

In addition to limitations or assumptions noted within other documents which form part of this report, the preparation of concept designs and construction cost estimates are also subject to the limitations noted below.

- Due to the limited time frame and scope requested for this report, some "As Constructed" information has been obtained however, detailed formal submission to authorities has not been undertaken and information relating to development conditions and strategic infrastructure planning has not been obtained from the supply or approving Authorities but has been determined from local knowledge, public information (design standards where available) informal conversation, assumptions based on past experience on similar projects and common practice associated with land development in Western Australian.

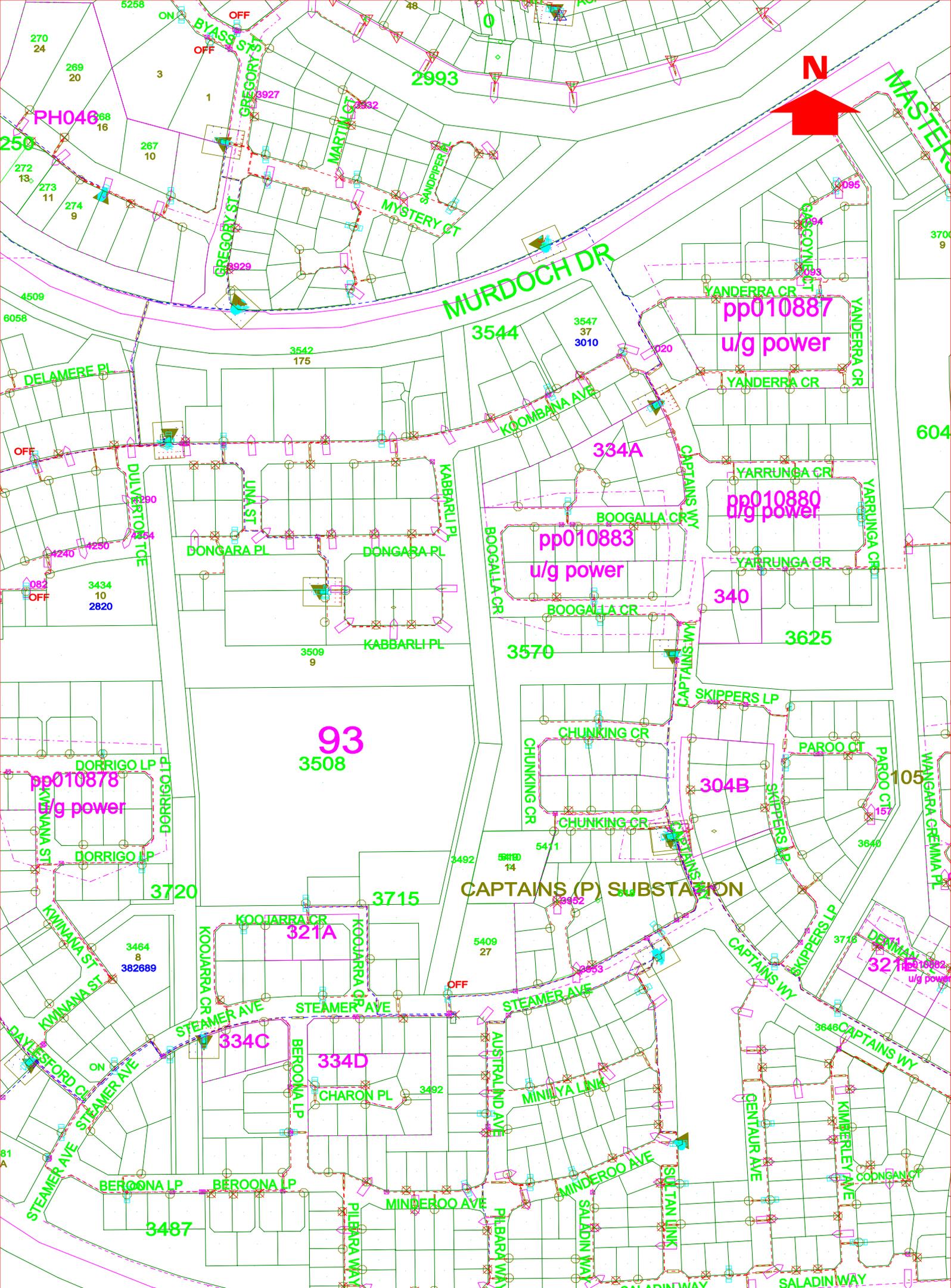
- The construction cost estimates do not include allowances for:
 - Geotechnical issues and costs associated with existing ground improvement.
 - Buildings or structures not associated with civil infrastructure that is needed to service the sites.
 - Land acquisition, holding, or financing costs.
 - Landscaping over and above one reserve.
 - Off site infrastructure requirements such as new power stations or water treatment plants.

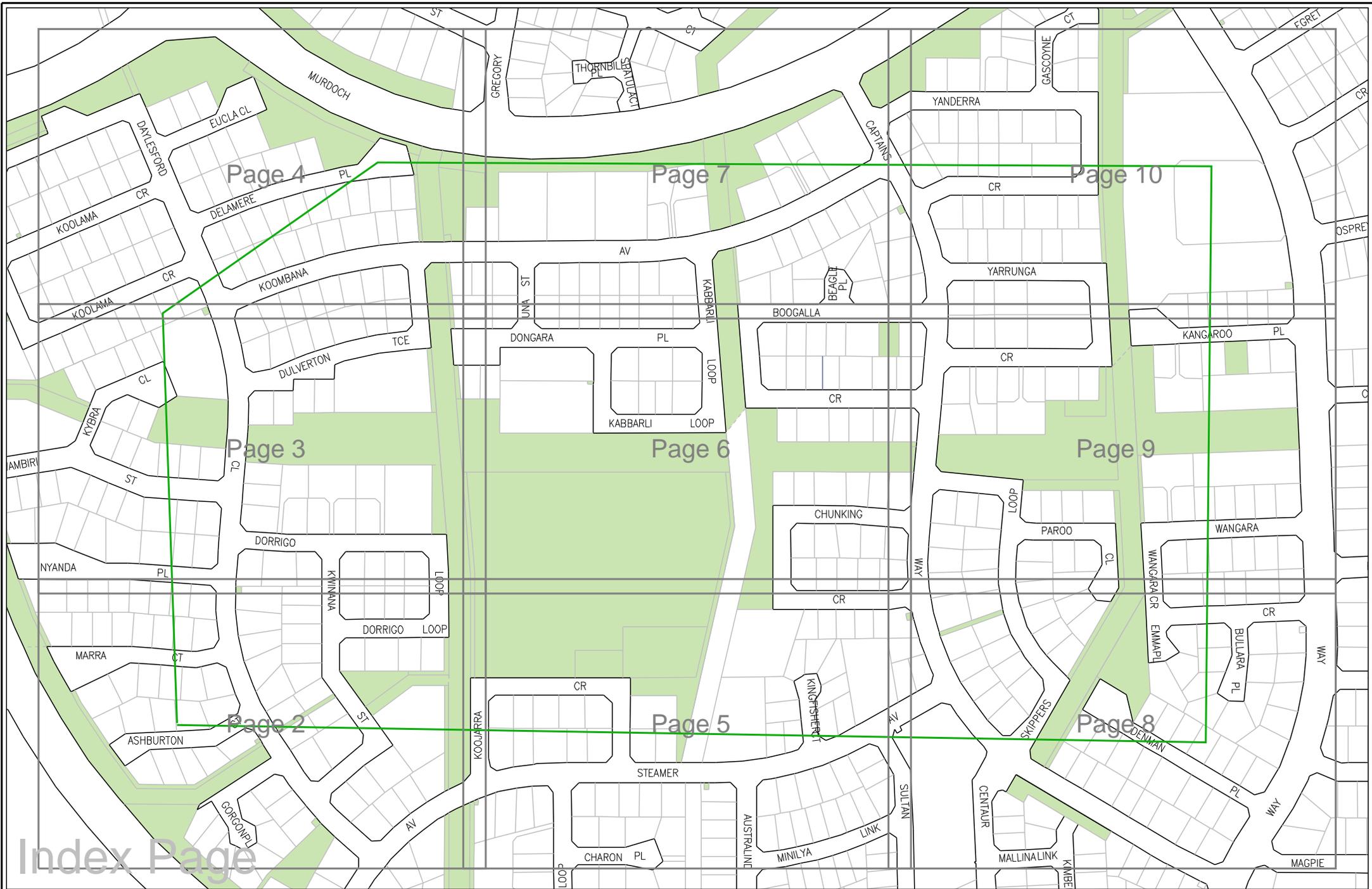
- The construction cost estimates are approximate and are subject to potential inaccuracy due to a number of issues such as:
 - Detailed Hydro-geological information relating to soil and ground water behaviour.
 - Detailed accurate survey.
 - Detailed geotechnical investigation results which determine engineering design parameters.
 - Detailed environmental considerations which may influence engineering.
 - Fill soil.
 - Site layout and interaction.
 - Land Tenure.
 - Detailed engineering design.
 - Authority instigated development conditions and approval process.
 - Final scheme design and pre-calculation plan.
 - Potential interaction with adjacent land development projects.
 - Labour supply and demand influence on construction rates.
 - Materials supply and demand on construction rates.
 - Existence and application of Water Management Planning.

- The estimates provide an “Order of Magnitude”. Further detailed investigation, design and reduction of the variables involved in preparing the estimate (as noted above) would be required to increase the accuracy of the estimate.

Appendix A

Existing Services Information





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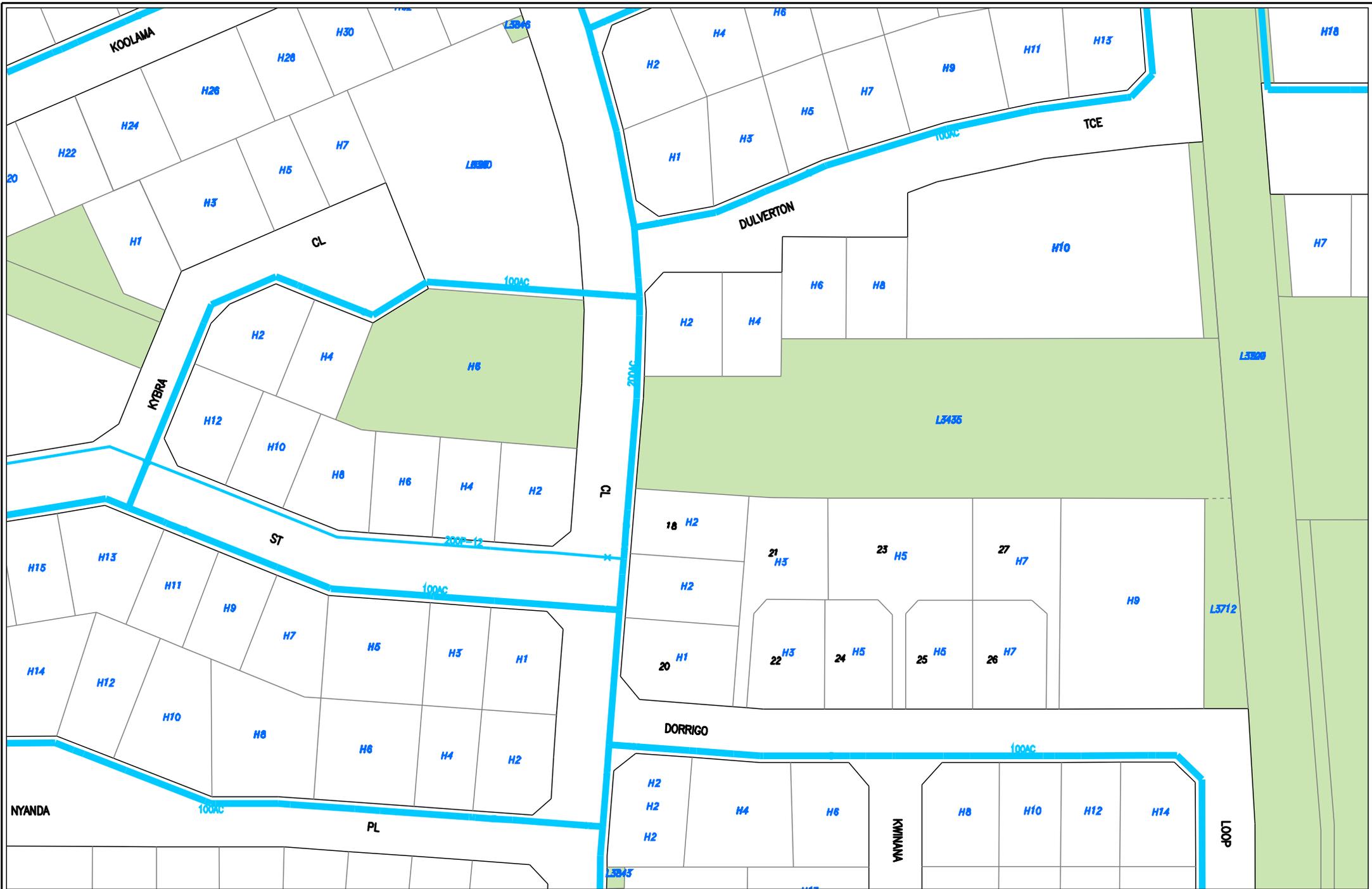
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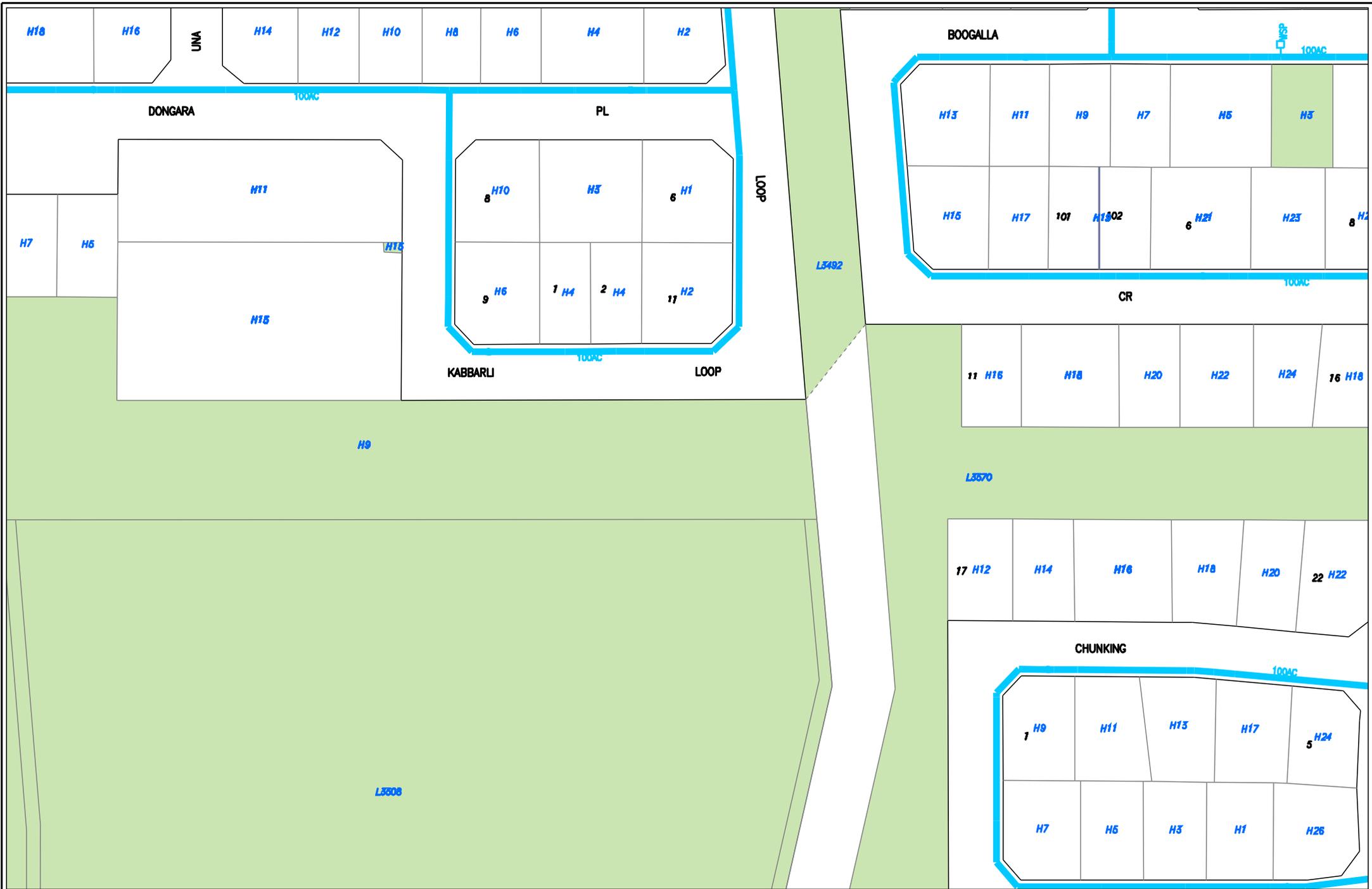
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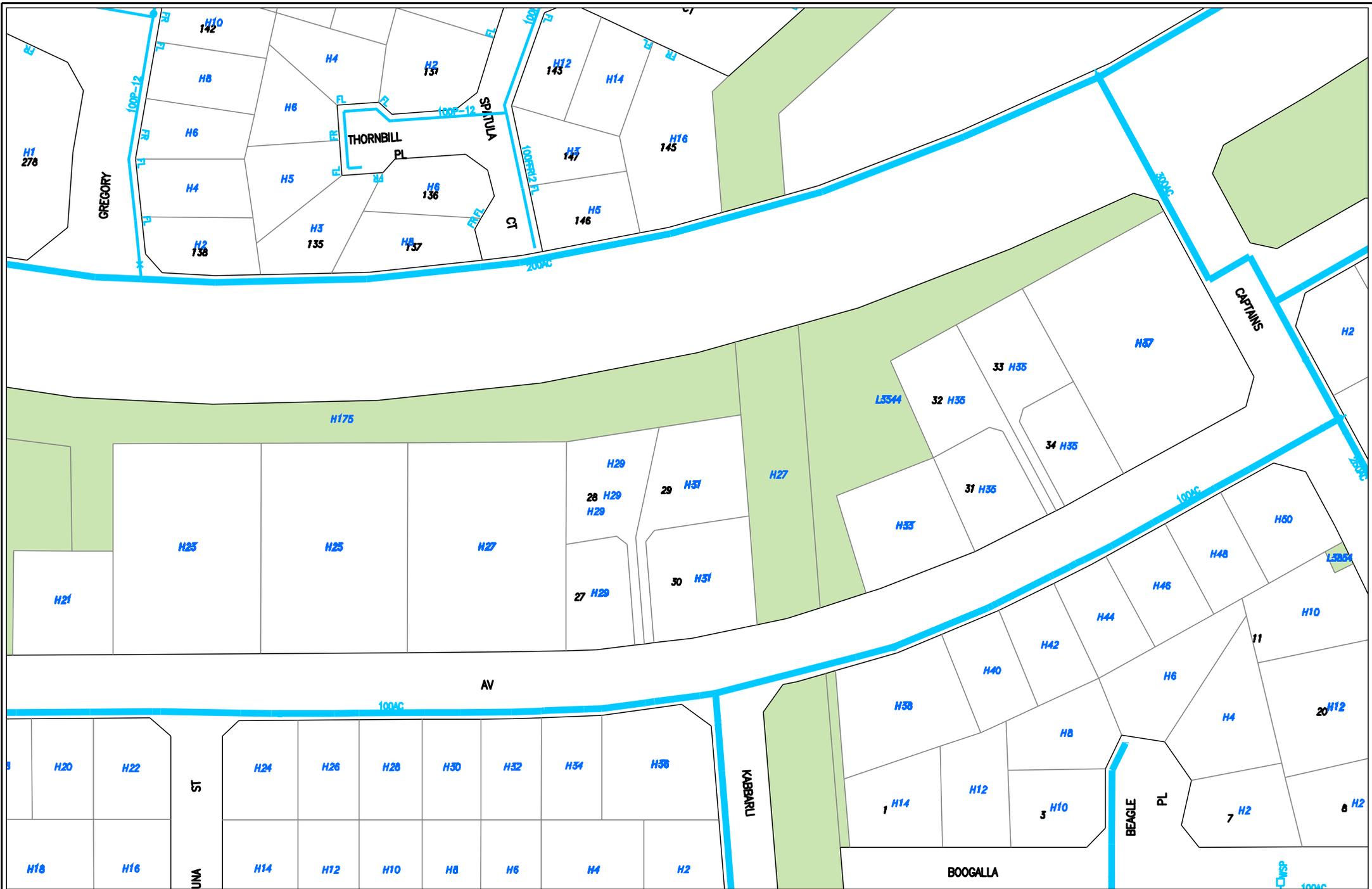
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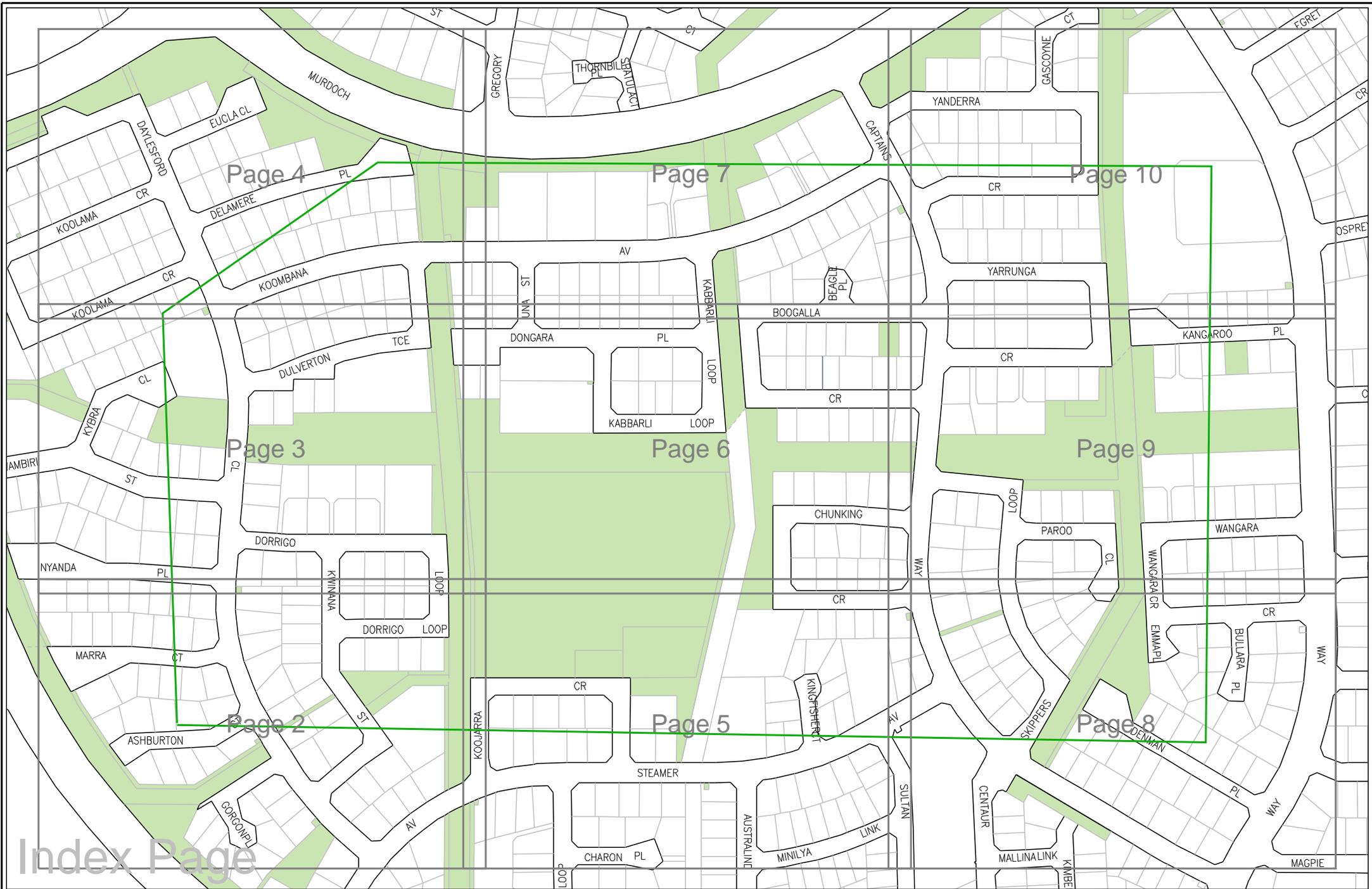


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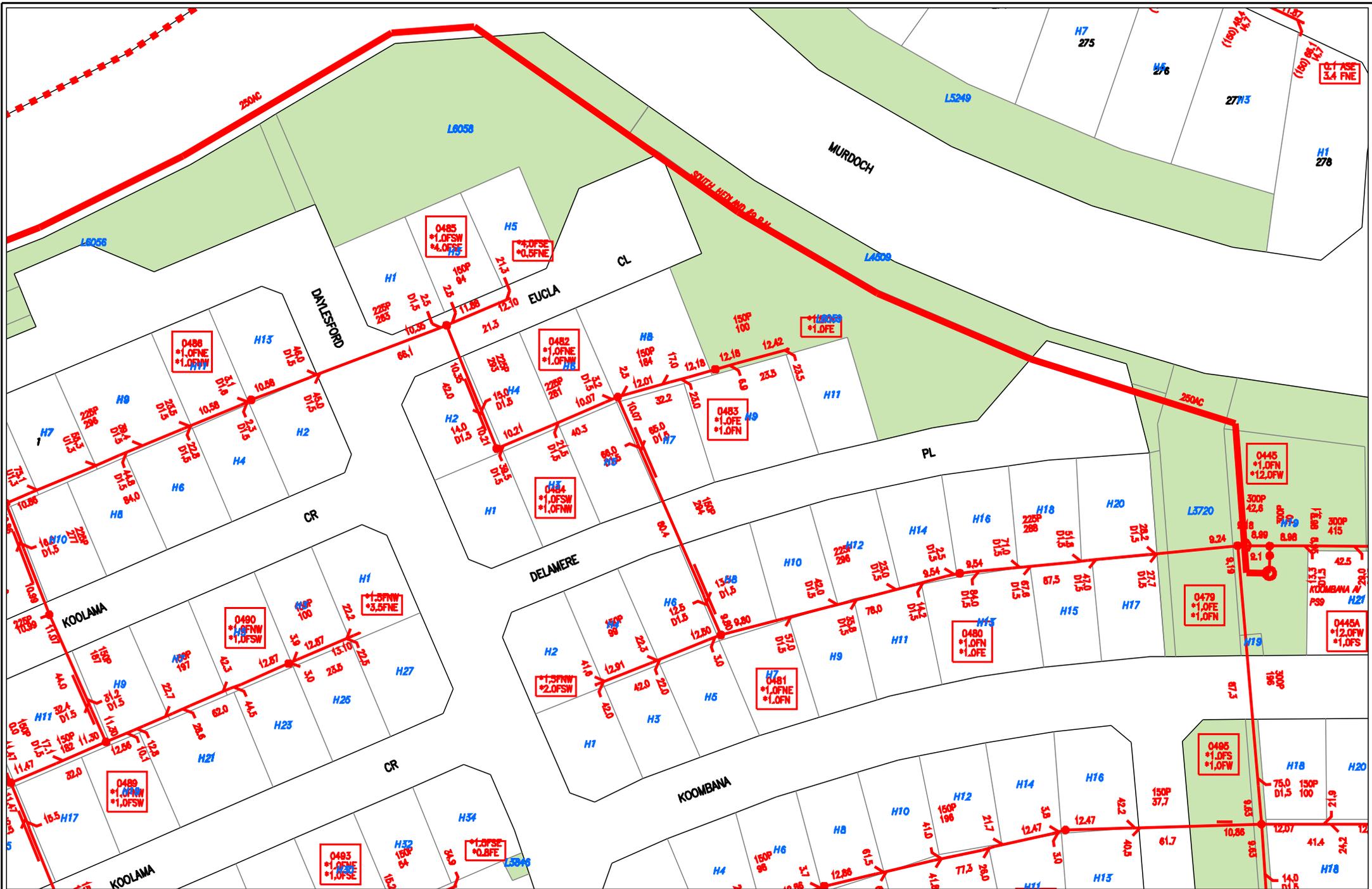
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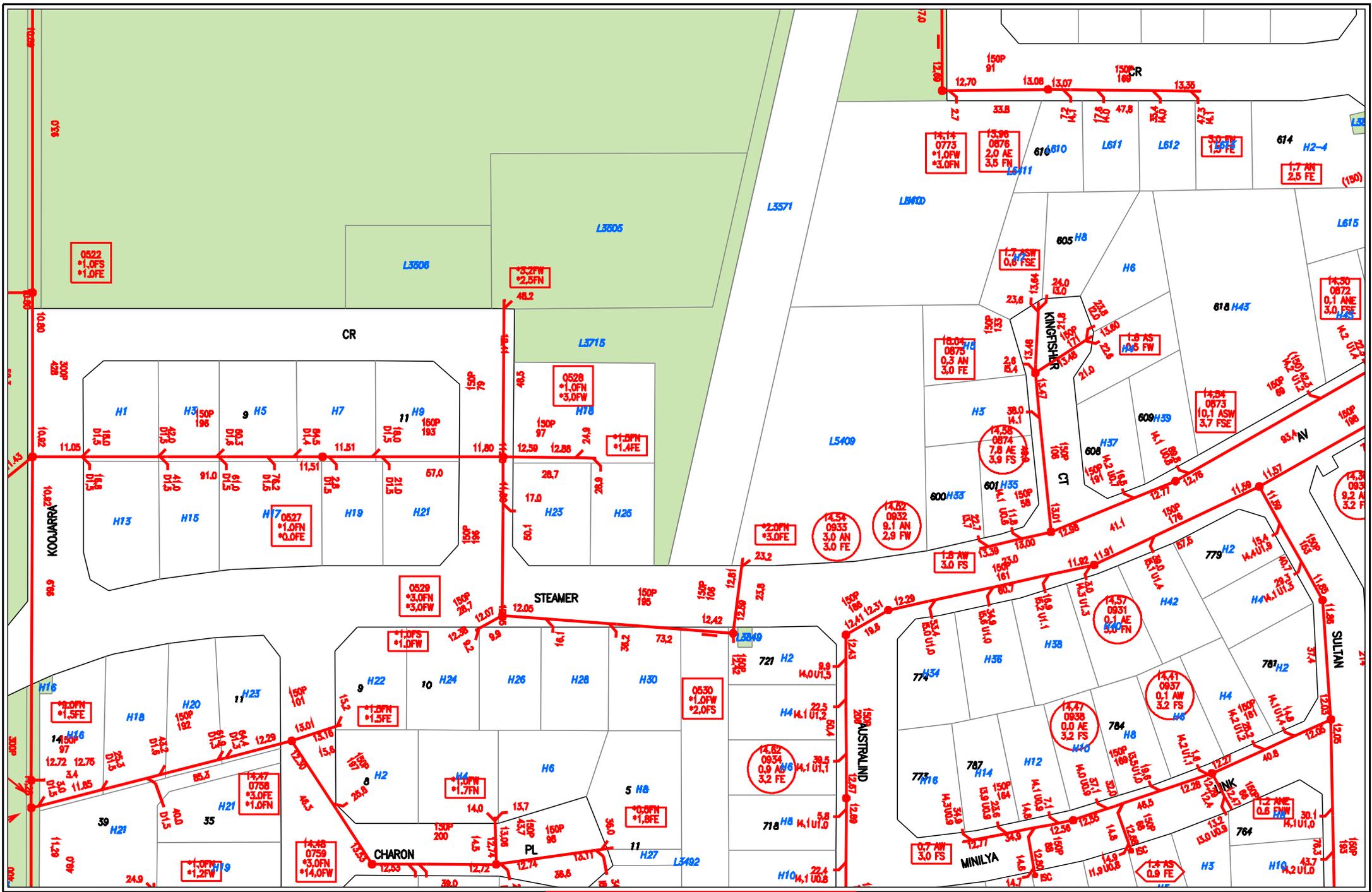
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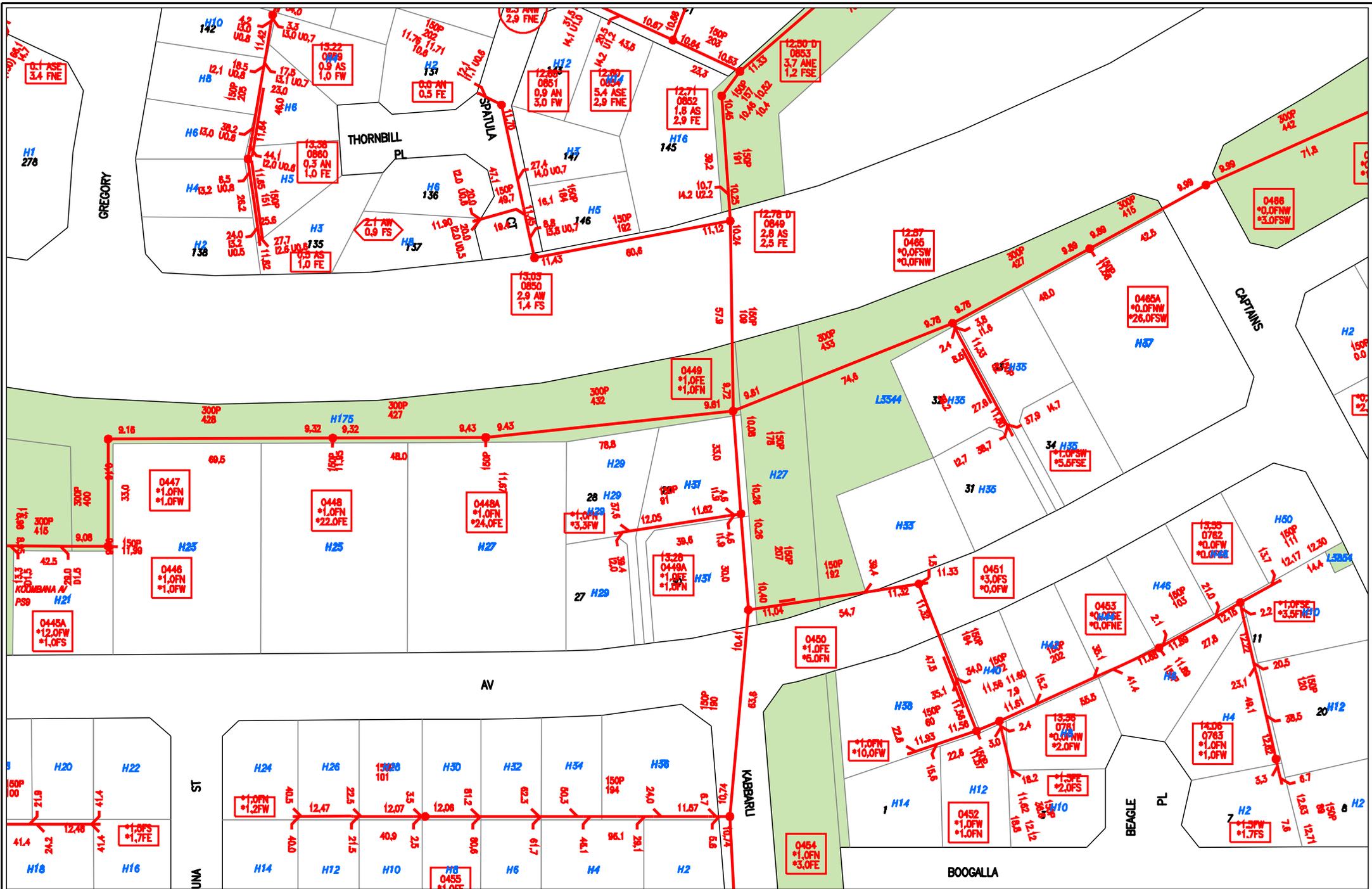


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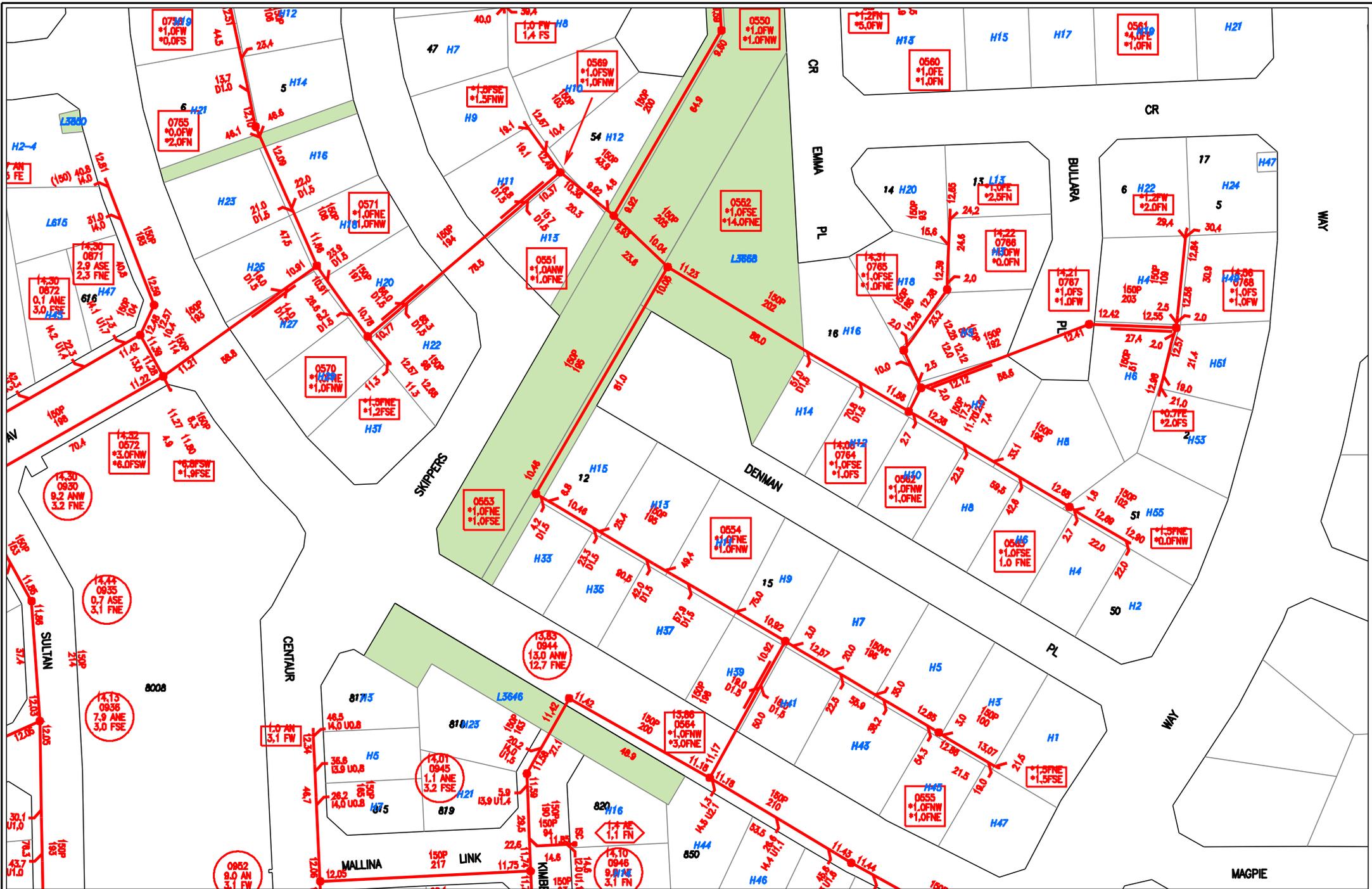


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 Print Date: 18/10/2010 Page: 7 of 10



WARNING - CRITICAL PIPELINE
 Refer to *Information Brochure Damage Prevention and Legend* for details

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Scale: 1:1500 Centre Point: 118.611°, -20.420°
 Sequence No: 19763445
 Print Date: 18/10/2010 Page: 8 of 10



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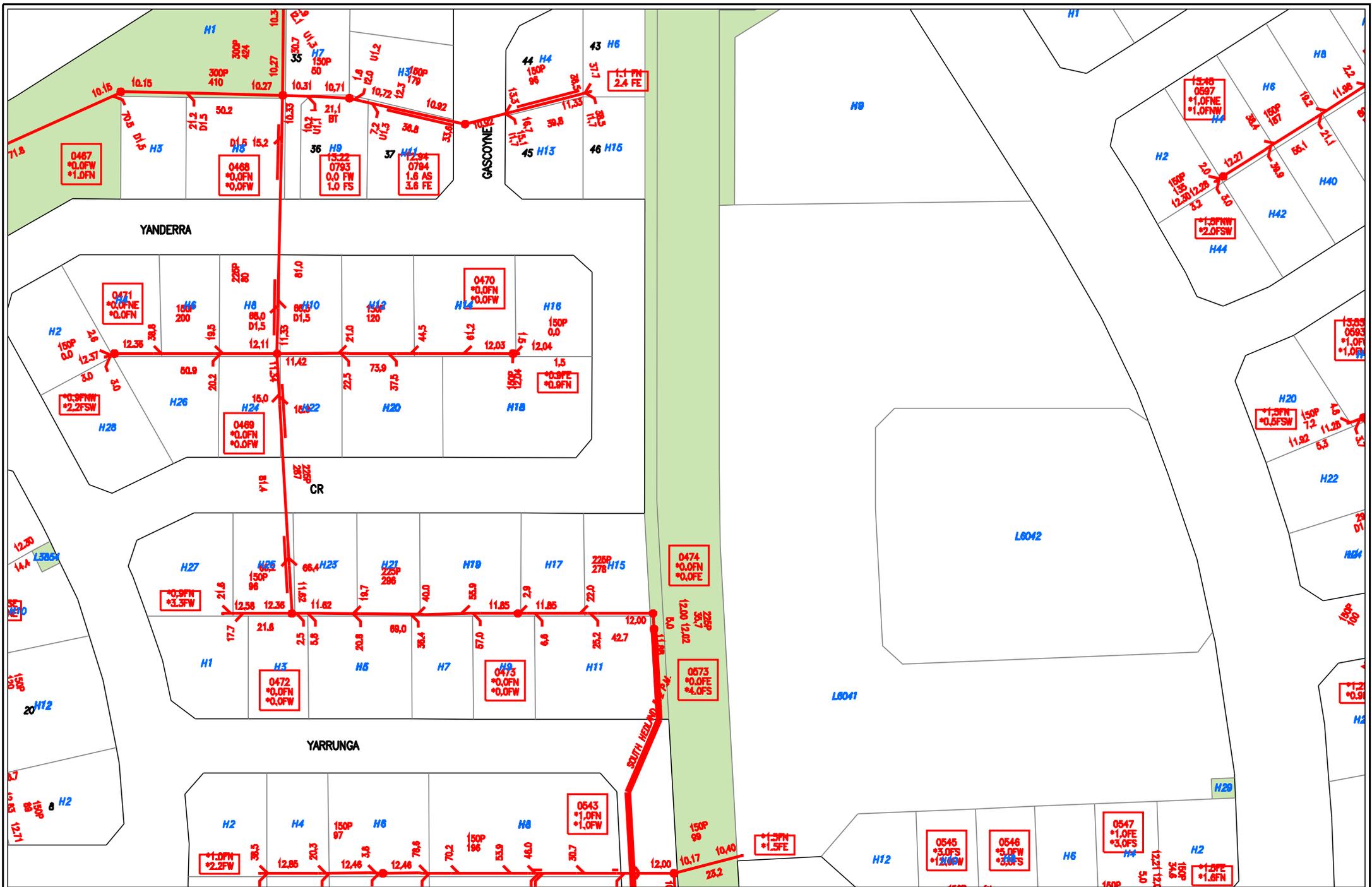
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 Sequence No: 19763445
 Print Date: 18/10/2010 Page: 9 of 10



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Scale: 1:1500 Centre Point: 118.611°, -20.415°
 Sequence No: 19763445
 Print Date: 18/10/2010 Page: 10 of 10



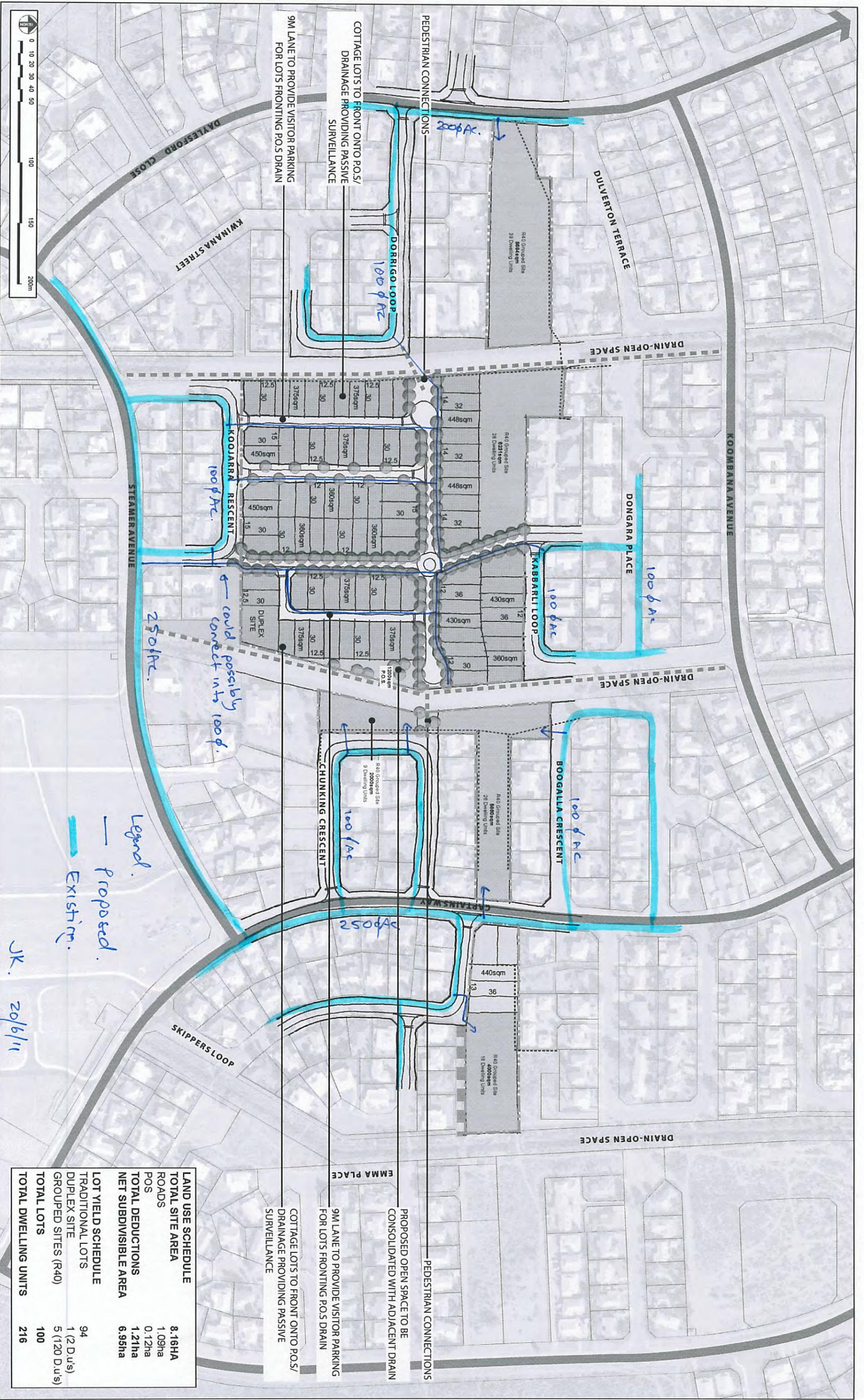
WARNING - CRITICAL PIPELINE
 Refer to **Information Brochure Damage Prevention and Legend** for details

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Appendix B

Preliminary Engineering Servicing Concept Plans



- LEGEND**
- SITE BOUNDARY
 - PEDESTRIAN LINKS
 - EXISTING SERVICES
 - IMPACTING ON DEVELOPMENT LOTS
 - PRINCIPAL CONNECTOR ROADS
 - R40 RESIDENTIAL
 - R30 RESIDENTIAL
 - R20 RESIDENTIAL
 - POS/DRAINAGE

NOTES

Areas and dimensions shown are subject to final survey calculations. All cartographics are shown for illustrative purposes only and are subject to detailed engineering design.

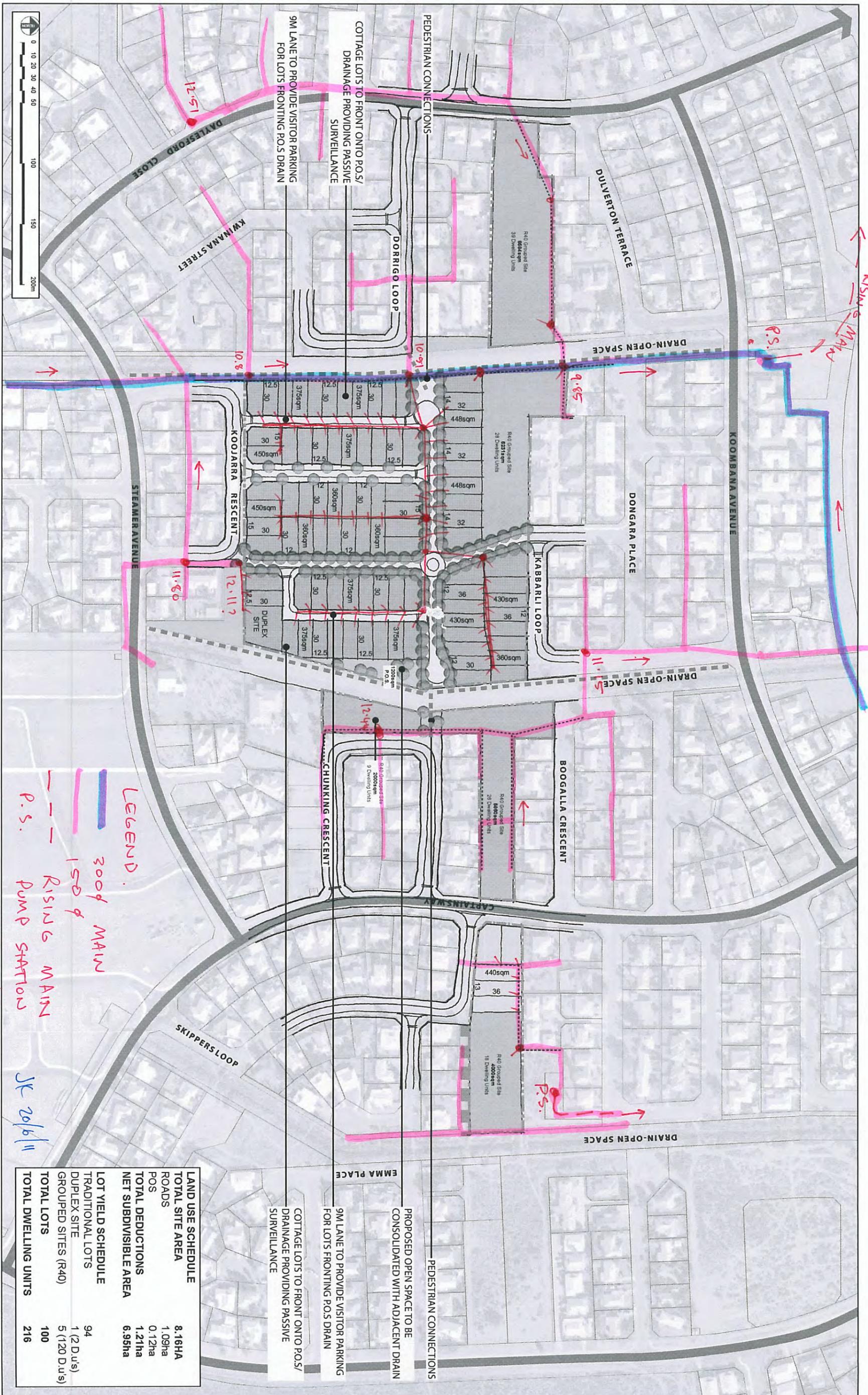
JAXON : CLIENT
 1:2000 @ A2 : SCALE
 15 June 2011 : DATE
 40019-9-9-010-01 : PLAN NO
 : REVISION
 N.T. : PLANNER
 M.P. : DRAWN
 N.T. : CHECKED

Property Description:
 Lots 3505-3506-3508 Koojarra Cres,
 Lots 3625-3570 Captains Way,
 Lot 3435 Dorrigo Loop &
 Lot 3509 Kabbarli Loop,
 SOUTH HEDLAND

LAND USE SCHEDULE	8.16HA
TOTAL SITE AREA	1.09ha
ROADS	0.12ha
POS	1.21ha
TOTAL DEDUCTIONS	6.95ha
NET SUBDIVISIBLE AREA	
LOT YIELD SCHEDULE	
TRADITIONAL LOTS	94
DUPLEX SITE	1 (2 D.u's)
GROUPED SITES (R40)	5 (120 D.u's)
TOTAL LOTS	100
TOTAL DWELLING UNITS	216

PRELIMINARY SUBDIVISION CONCEPT

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- LEGEND**
- SITE BOUNDARY
 - PEDESTRIAN LINKS
 - EXISTING SERVICES
 - IMPACTING ON DEVELOPMENT LOTS
 - PRINCIPLE CONNECTOR ROADS
 - R40 RESIDENTIAL
 - R30 RESIDENTIAL
 - R20 RESIDENTIAL
 - POS/DRAINAGE

NOTES

Areas and dimensions shown are subject to final survey calculations. All campaigns are shown for illustrative purposes only and are subject to detailed engineering design.

LEGEND:

- 3000 MAIN
- 1500 R
- Rising MAIN
- PUMP STATIONS
- JK 26/6/11

10.8 INVERT LEVEL

LAND USE SCHEDULE	
TOTAL SITE AREA	8.16HA
ROADS	1.09ha
POS	0.12ha
TOTAL DEDUCTIONS	1.21ha
NET SUBDIVISIBLE AREA	6.95ha
LOT YIELD SCHEDULE	
TRADITIONAL LOTS	94
DUPLEX SITE	1 (2 D.U's)
GROUPED SITES (R40)	5 (120 D.U's)
TOTAL LOTS	100
TOTAL DWELLING UNITS	216

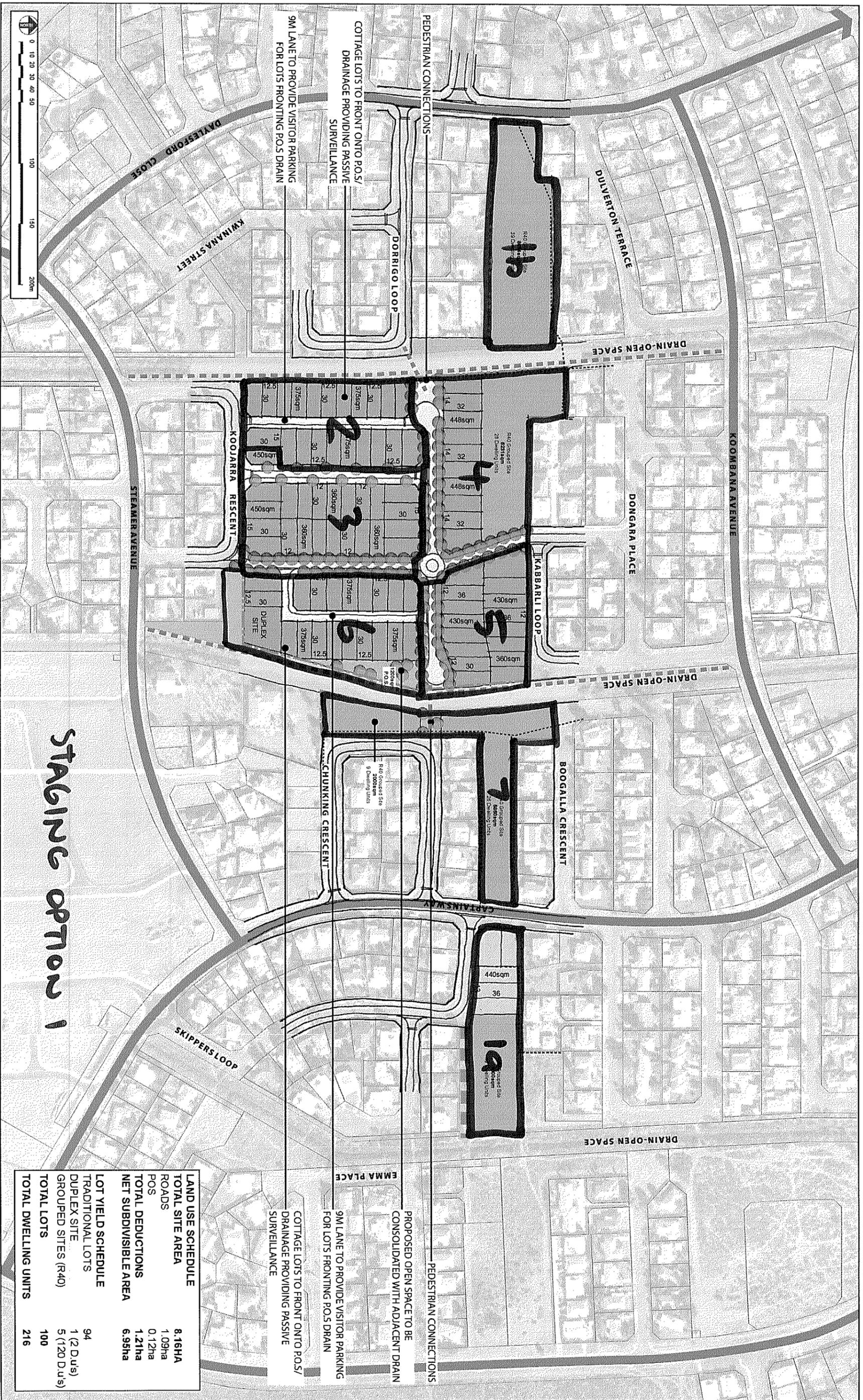
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 1:2000 @ A2 : SCALE
 15 June 2011 : DATE
 40019-S-010-A1 : PLAN No
 : : REVISION
 N.T. : PLANNER
 M.P. : DRAWN
 N.T. : CHECKED

Property Description:
 Lots 3505-3506-3508 Koojarrarra Cres,
 Lots 3625-3570 Captains Way,
 Lot 3435 Dorrigo Loop &
 Lot 3509 Kabbarli Loop,
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Appendix C

Potential Development Staging Options



LAND USE SCHEDULE	8.16HA
TOTAL SITE AREA	1.09ha
ROADS	0.12ha
POS	1.21ha
TOTAL DEDUCTIONS	6.95ha
NET SUBDIVISIBLE AREA	
LOT YIELD SCHEDULE	
TRADITIONAL LOTS	94
DUPLEX SITE	1 (2 D.u's)
GROUPED SITES (R40)	5 (120 D.u's)
TOTAL LOTS	100
TOTAL DWELLING UNITS	216

PRELIMINARY SUBDIVISION CONCEPT

STAGING OPTION 1

- LEGEND**
- ▬ SITE BOUNDARY
 - ▬ PEDESTRIAN LINKS
 - ▬ EXISTING SERVICES
 - ▬ IMPACTING ON DEVELOPMENT LOTS
 - ▬ PRINCIPLE CONNECTOR ROADS
 - ▬ R40 RESIDENTIAL
 - ▬ R30 RESIDENTIAL
 - ▬ R20 RESIDENTIAL
 - ▬ POS/DRAINAGE

NOTES

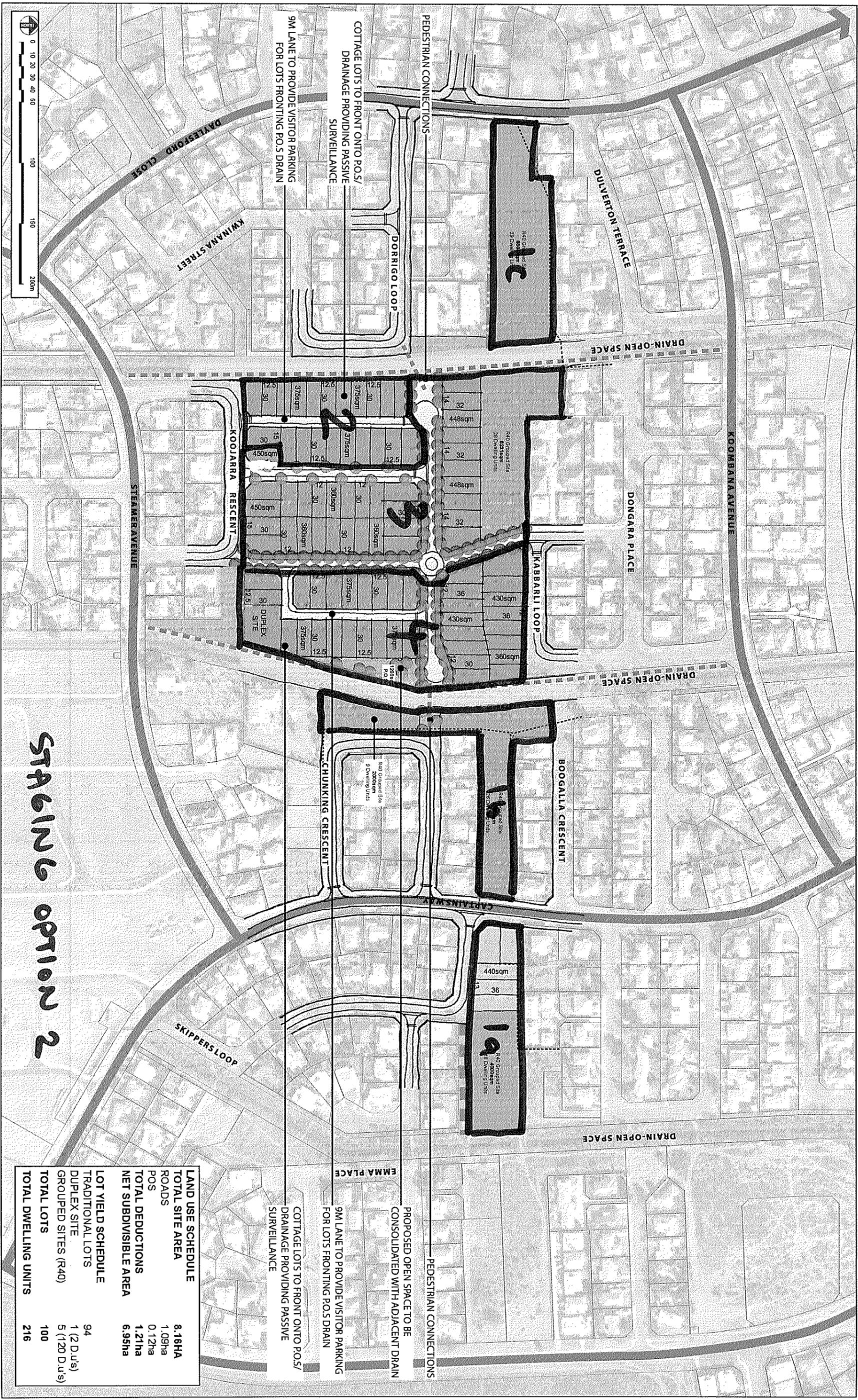
All dimensions shown are subject to final survey calculations. All easements are shown for illustrative purposes only and are subject to detailed engineering design.

JACKM : CLIENT
 1:2,000 @ A2 : SCALE
 15 June 2011 : DATE
 4001-9-94-910-01 : PLAN No
 : REVISION
 N.T : PLANNER
 M.P : DRAWN
 N.T : CHECKED

Property Description:
 Lots 3505-3506-3508 Koojarra Cres,
 Lots 3625-3570 Captains Way,
 Lot 3435 Dorrigo Loop &
 Lot 3509 Kabbarli Loop,
 SOUTH HEDLAND



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LAND USE SCHEDULE	8.18HA
TOTAL SITE AREA	1.09ha
ROADS	0.12ha
POS	1.21ha
TOTAL DEDUCTIONS	6.95ha
NET SUBDIVISIBLE AREA	
LOT YIELD SCHEDULE	94
TRADITIONAL LOTS	1 (2 D.U.s)
DUPLEX SITE	5 (120 D.U.s)
GROUPED SITES (R40)	100
TOTAL LOTS	
TOTAL DWELLING UNITS	216

PRELIMINARY SUBDIVISION CONCEPT

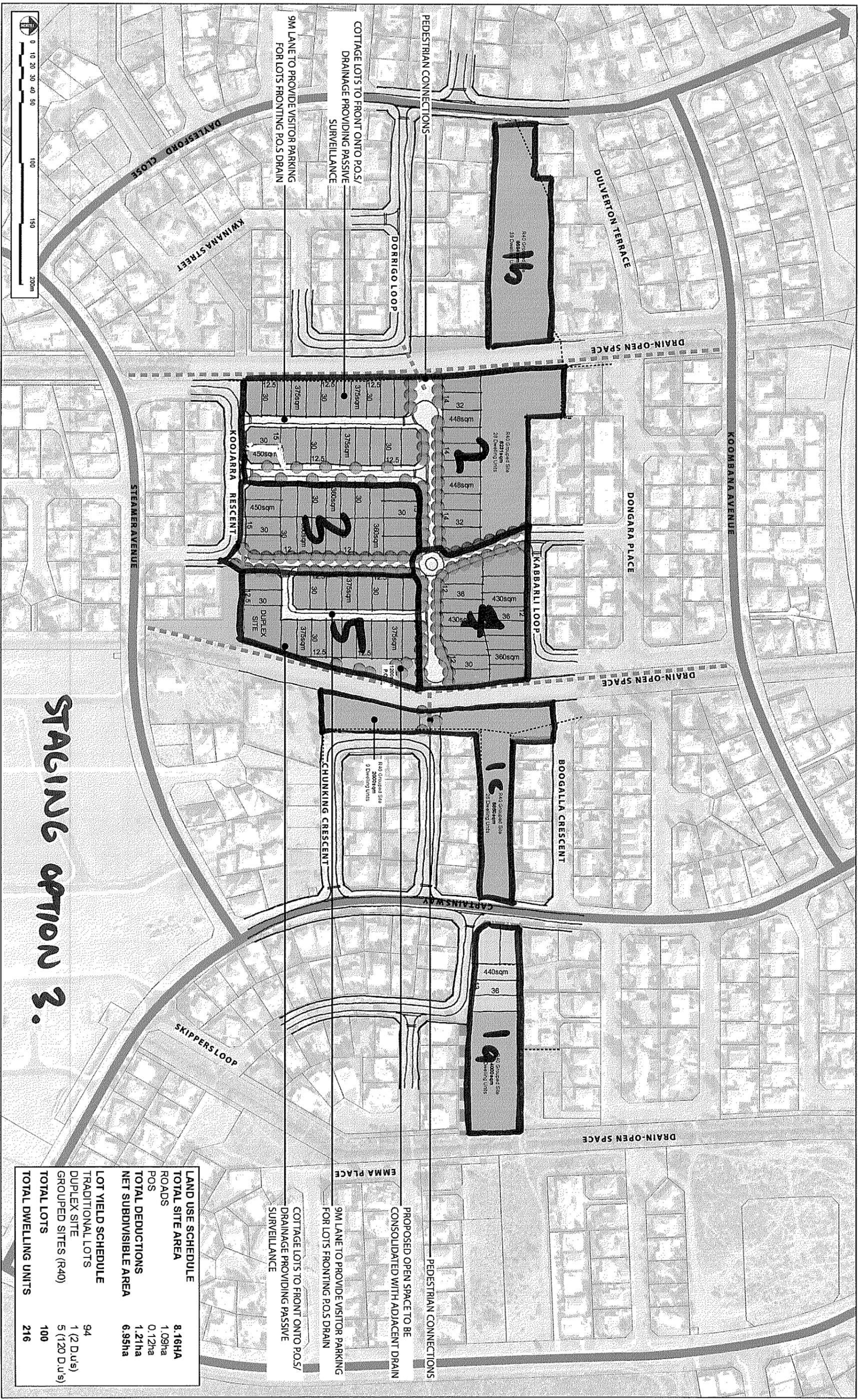
STAGING OPTION 2

- LEGEND**
- SITE BOUNDARY
 - PEDESTRIAN LINKS
 - EXISTING SERVICES
 - IMPACTING ON DEVELOPMENT LOTS
 - PRINCIPLE CONNECTOR ROADS
 - R40 RESIDENTIAL
 - R30 RESIDENTIAL
 - R20 RESIDENTIAL
 - POS/DRAINAGE

- NOTES**
- JACM : CLIENT
 1:2,000 @ A2 : SCALE
 15 June 2011 : DATE
 40019-94-010 a1 : PLAN No
- . : REVISION
 N.T. : PLANNER
 M.P. : DRAWN
 N.T. : CHECKED

Property Description:
 Lots 3505-3506-3508 Kwojarrarra Cres,
 Lots 3625-3570 Captains way,
 Lot 3435 Dorrigo Loop &
 Lot 3509 Kabbarli Loop,
 SOUTH HEDLAND

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LAND USE SCHEDULE	8.16HA
TOTAL SITE AREA	1.09ha
ROADS	0.12ha
POS	1.21ha
TOTAL DEDUCTIONS	6.95ha
NET SUBDIVISIBLE AREA	
LOT YIELD SCHEDULE	94
TRADITIONAL LOTS	1 (2 D.u/s)
DUPLEX SITE	5 (120 D.u/s)
GROUPED SITES (R40)	100
TOTAL LOTS	
TOTAL DWELLING UNITS	216

PRELIMINARY SUBDIVISION CONCEPT

STAGING OPTION 3.

- LEGEND**
- ▬ SITE BOUNDARY
 - ▬ PEDESTRIAN LINKS
 - ▬ EXISTING SERVICES
 - ▬ IMPACTING ON DEVELOPMENT LOTS
 - ▬ PRINCIPLE CONNECTOR ROADS
 - ▬ R40 RESIDENTIAL
 - ▬ R30 RESIDENTIAL
 - ▬ R20 RESIDENTIAL
 - ▬ POS/DRAINAGE

NOTES

Analysis and dimensions shown are subject to final survey calculations. All dimensions are shown for illustrative purposes only and are subject to detailed engineering design.

JACON : CLIENT
 1:2000 @ A2 : SCALE
 15 June 2011 : DATE
 49019-94-010-01 : PLAN No

REVISION
 N.T : PLANNER
 M.P : DRAWN
 N.T : CHECKED

Property Description:

Lots 3505-3506-3508 Koobjarra Cres,
 Lots 3625-3570 Captains way,
 Lot 3435 Dorrigo Loop &
 Lot 3509 Kabbarli Loop,
 SOUTH HEDLAND

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