LOCATION PLAN

City of Joondalup

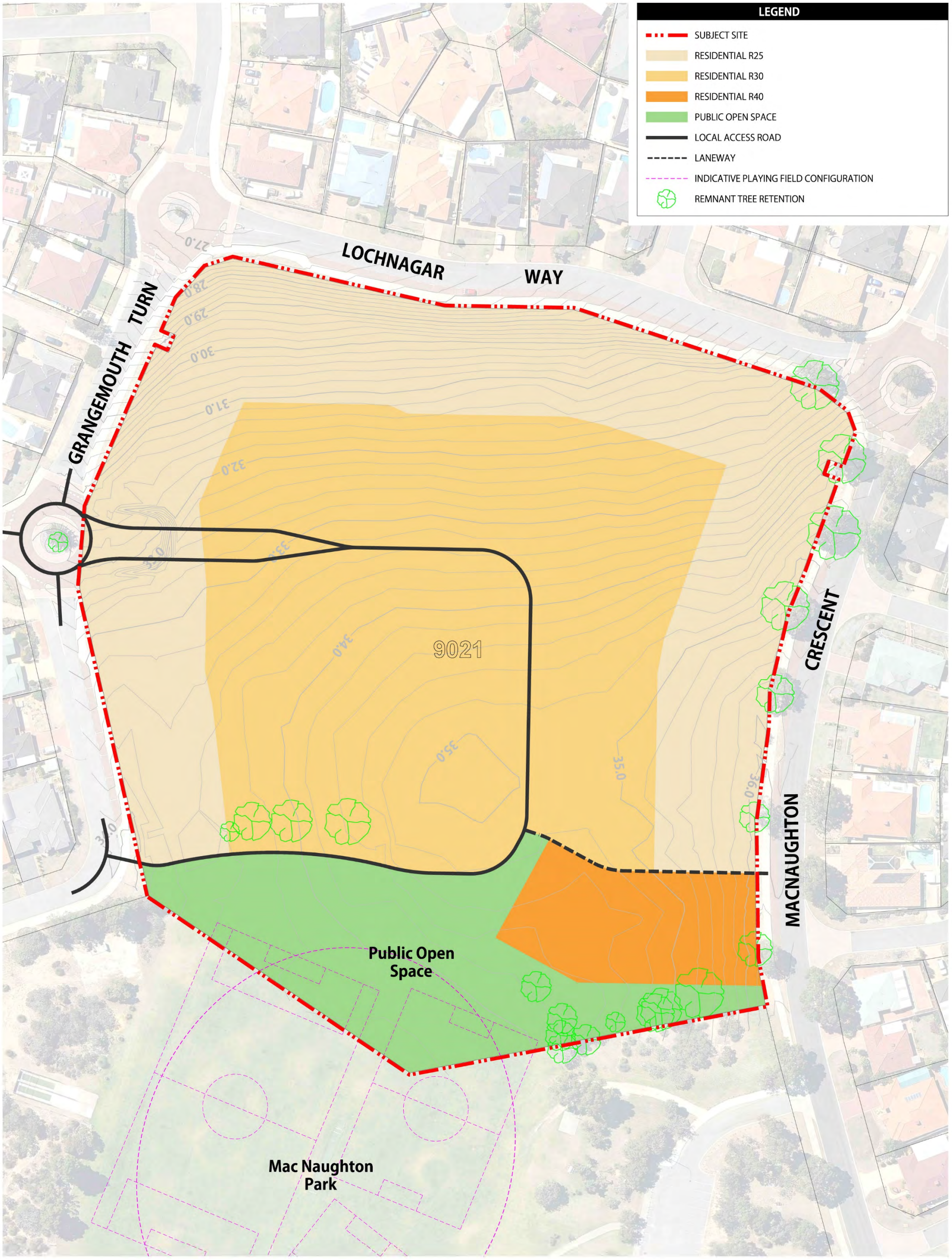
MacNaughton Local Structure Plan Boundary

20 0 20 40 Meters

macnaughton_lsp_boundary-01022023

MacNaughton Crescent Structure Plan Map

ATTACHMENT 2



PLAN 1 - STRUCTURE PLAN

Lot 9021 MacNaughton Crescent, KINROSS

NORTH

0 10 20 30m

Scale: 1:1000@A3
Date: 14/03/2017
Plan: PACBB-2-003E

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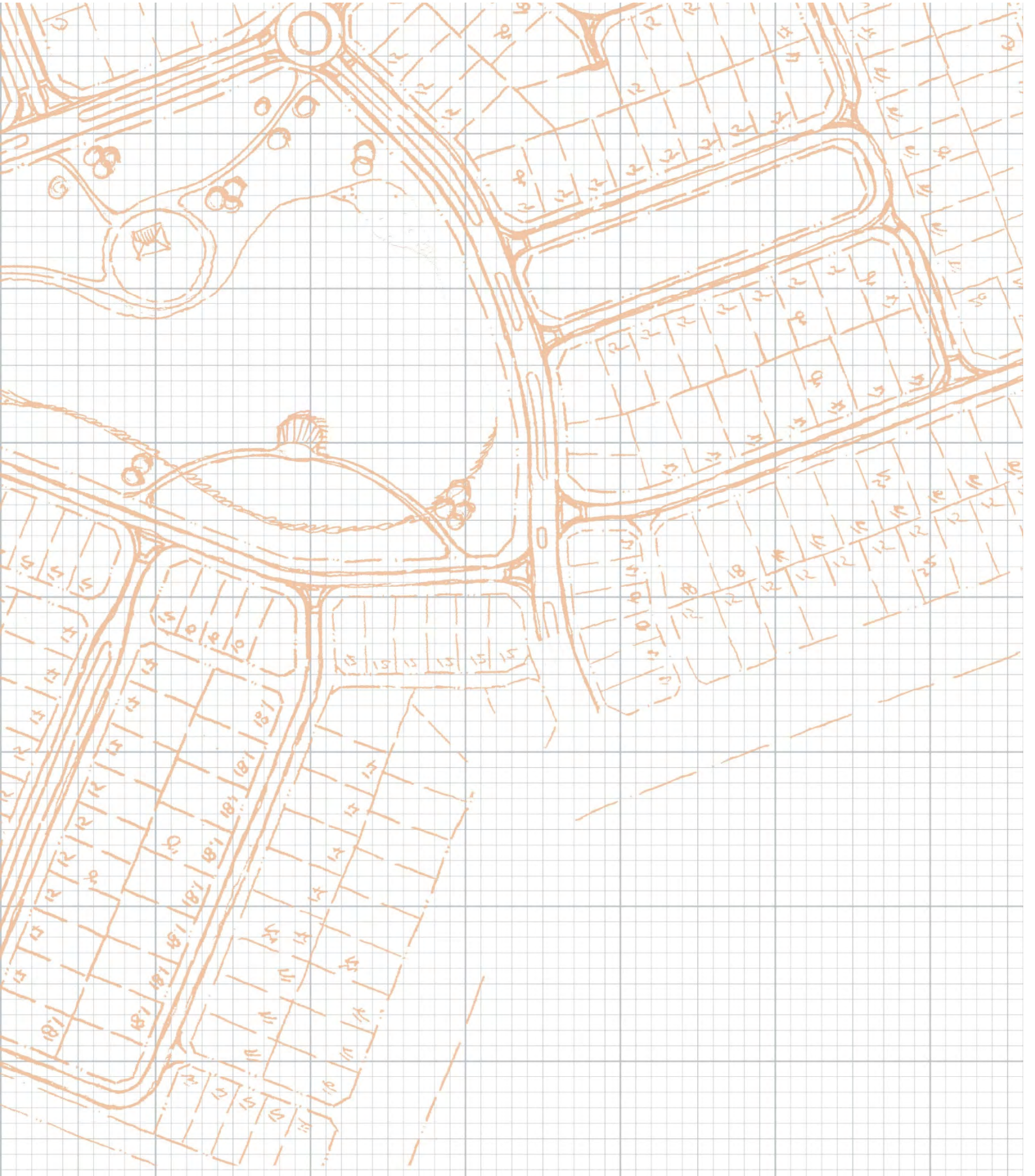
ATTACHMENT 3

MACNAUGHTON CRESCENT STRUCTURE PLAN

Lot 9021 MacNaughton Crescent, Kinross

March 2017

Peet Limited



Document Status

VERSION	COMMENT	PREPARED BY	REVIEWED BY	REVIEW DATE	APPROVED BY	ISSUE DATE
Final v1	Client Review	MS	SD	23.07.2015	JH	31.7.2015
Final v2	Submission	MS	SD	23.07.2015	JH	31.7.2015
Final v3	City Comments	MM	JH	26.10.2015	JH	26.10.2015
Final v4	City Submission_for Advertising	MM	JH	16.11.2015	JH	19.05.2016
Final v5	City Submission (Enviro Updates)_for Advertsing	MM	JH	15.08.2016	JH	19.08.2016
Final v6	WAPC Schedule of Modifications – 27 Feb 2017	JH	JH	27.02.2016	JH	14.03.2016

MACNAUGHTON CRESCENT STRUCTURE PLAN

LOT 9021 MACNAUGHTON CRESCENT, KINROSS

MARCH 2017

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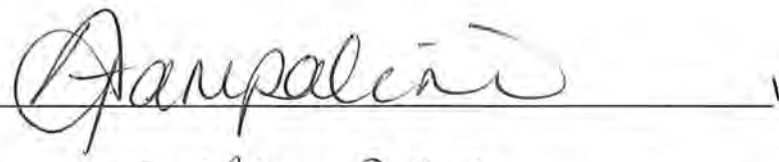
Our Ref: S:\Word\CD+P 2017\PacBb\Mis\MacNaughton\3. STP\3. Correspondence & Reports\170112 Lot 9021 SP (v6) WAPC Schedule of Mods\170227 MacNaughton SP (v6) WAPC SoM.docx

This structure plan is prepared under the provisions of the City of Joondalup District Planning Scheme No.2

IT IS CERTIFIED THAT THIS STRUCTURE PLAN WAS APPROVED BY RESOLUTION OF THE WESTERN AUSTRALIAN PLANNING COMMISSION ON: 1 May 2017

Signed for and on behalf of the Western Australian Planning Commission

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



Witness

1 May 2017

Date

Date of Expiry: 1 May 2027

Table of Amendments

AMENDMENT NO.	SUMMARY OF AMENDMENT	AMENDMENT TYPE	DATE APPROVED BY WAPC

EXECUTIVE SUMMARY

The *MacNaughton Crescent Structure Plan* (the 'Structure Plan') has been prepared to guide the subdivision and development of approximately 4.027 hectares of land on Lot 9021 MacNaughton Crescent, Kinross; within the City of Joondalup municipality.

Peet Limited is the sole landowner of the Structure Plan area.

The Structure Plan has been prepared for Peet Limited by the following specialist consultant team:

- Creative Design + Planning – urban design, town planning
- Emerge – environmental, landscape and hydrology
- Tabec – engineering
- Riley Consulting – traffic
- Creating Communities – community consultation

Purpose

The Structure Plan provides an overarching planning framework to guide and facilitate the development for *Urban* (Residential) purposes, and has been prepared in accordance with the *Planning and Development (Local Planning Schemes) Regulations 2015*.

This Structure Plan provides for an integrated and coordinated approach to land use planning, necessary to create a strong and vibrant residential community.

Project Overview

The Structure Plan will create a framework for the future subdivision and development of a target 72 dwellings within the existing Kinross community, and will accommodate in the vicinity of 201 people.

Executive Summary Table

ITEM	DATA (APPROX)	STRUCTURE PLAN REF (SECTION NO.)
Total area covered by Structure Plan	4.027 hectares	Part One – Plan 1
Area of each land use proposed: <u>Zones</u> - Residential <u>Reserves</u> - Road Reserves - Public Open Space Reserve	 2.889 hectares 0.675 hectares 0.463 hectares	Part Two – Section 3.1
Total estimated lot yield	~72 lots	Part Two – Section 3.3
Estimated number of dwellings	~72 dwellings	
Estimated residential site density	~25 dwellings per *site hectare* [1]	
Estimated population *(based on 2.8 persons per dwelling)*	~201 people	
Estimated area and percentage of Public Open Space given over to: • Local parks	1 Park @ 0.463 hectares (11%)	Part Two – Section 3.2
Estimated percentage of natural area	3% (0.106 hectares)	Part Two – Section 2.1.1

FOOTNOTES:

[1] *25 Dwellings per 'Site Hectare' refers to that prescribed by City of Joondalup District Planning Scheme No. 2. Definition - Clause 3.12.4.2 refers.*

This dwelling target is greater than the 22 dwellings per 'Site Hectare' recommended by WAPC's Liveable Neighbourhoods, and 15 dwellings per 'Gross Urban Zone' recommended by WAPC's Directions 2031 and supporting documents.

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ABBREVIATIONS

AHD	Australian Height Datum
ARI	Average Recurrence Interval
ASS	Acid Sulfate Soils
BPZ	Building Protection Zone
CBD	Central Business District
DPS2	District Planning Scheme No 2
DBH	Diameter at Breast Height
EAMS	Environmental Assessment and Management Strategy
EPA	Environmental Protection Authority
Ha	Hectare
Km	Kilometre
LDP	Local Development Plan
LWMS	Local Water Management Strategy
MGL	Maximum Groundwater Level
MRS	Metropolitan Region Scheme
PEC	Protected Ecological Community
POS	Public Open Space
RMD	Residential Medium Density
TEC	Threatened Ecological Community
UWMP	Urban Water Management Plan
vpd	Vehicles Per Day
WAPC	Western Australian Planning Commission

PART ONE

Implementation

MACNAUGHTON CRESCENT STRUCTURE PLAN

1. Structure Plan Area
2. Operation
3. Staging
4. Subdivision and Development Requirements
5. Local Development Plans
6. Other Requirements
7. Additional Information
8. Structure Plan (Plan 1)

PART ONE – IMPLEMENTATION

1 Structure Plan Area

This Structure Plan applies to Lot 9021 MacNaughton Crescent, Kinross the land contained within the inner edge of the line denoting the Structure Plan boundary on the Structure Plan (**Plan 1**).

This Structure Plan is identified as the *MacNaughton Crescent Structure Plan*.

2 Operation

This Structure Plan comes into effect on the date it is approved by the Western Australian Planning Commission.

3 Staging

The development of the Structure Plan area will be implemented in one stage.

4 Subdivision and Development Requirements

4.1 Land Use Permissibility

a) The Structure Plan Map outlines land use zones and reserves applicable within the Structure Plan Area, and development shall be in accordance with the corresponding zones and reserves listed in the City of Joondalup District Planning Scheme No. 2 ('the Scheme').

4.2 Public Open Space

a) The Structure Plan (Plan 1) nominates an area of 0.463 ha as creditable Public Open Space. The proposed Public Open Space meets the minimum 10% requirement as outlined in Part Two of this report.

b) An updated Public Open Space schedule is to be provided at the time of subdivision for determination by the WAPC upon advice of the City of Joondalup.

4.3 Residential Density Targets

a) Density Targets within the Structure Plan area include:

i. The density target for the 'gross urban zone' is 15 dwellings per hectare across the Structure Plan area; and

ii. The density target in terms of 'site hectare' is 25 dwellings per hectare across the Structure Plan area.

The WAPC, in consultation with the City of Joondalup, will consider a lower density target at the time of subdivision or development where the development demonstrates environmental or engineering benefits. This may include retaining trees, minimising retaining walls, providing for conventional lot designs, or for any other environmental or engineering benefits deemed worthy at the time of assessment.

b) Residential densities applicable to the Structure Plan Areas are to be in accordance with the density code shown on the Structure Plan Map (Plan 1).

4.4 Tree Retention

a) Trees are to be retained in Public Open Space, road reserves and on future private lots in accordance with Plan 1.

b) The developer is required to construct crossovers to those lots affected by trees to be retained via the imposition of the appropriate condition of any subdivision approval. Suitable arrangements are to be made with the local government for the provision of vehicular crossover(s) to service the lot(s) shown on an approved plan of subdivision.

5 Local Developments Plans

Local Development Plans will be prepared for the Structure Plan area pursuant to the WAPC's *Local Development Plan Framework* and the Schedule 2, 'Deemed Provisions for Local Planning Schemes' of the *Planning and Development (Local Planning Schemes) Regulations 2015*.

5.1 Prescribed Requirements

Local Development Plans will be prepared to inform applications for subdivision and development in regard to the following:

LDP REQUIREMENT	GUIDING PRINCIPLES
a) Lots with direct frontage to an area of Public Open Space.	To guide the built form and surveillance of dwellings and fencing interfacing with the public realm (Public Open Space).
b) Lots with rear-loaded (laneway) vehicle access.	To guide the built form and surveillance of dwellings and fencing interfacing with the public realm (laneways). To guide garage locations, access and setbacks to minimise conflict with service infrastructure and refuse collection services.
c) Lots whereby the driveway or dwelling design is impacted by the retention of specified trees.	To guide garage locations and setbacks of dwellings and driveways/crossovers to ensure the retention and survival of identified existing trees; this to be informed by an arboricultural report where deemed appropriate.

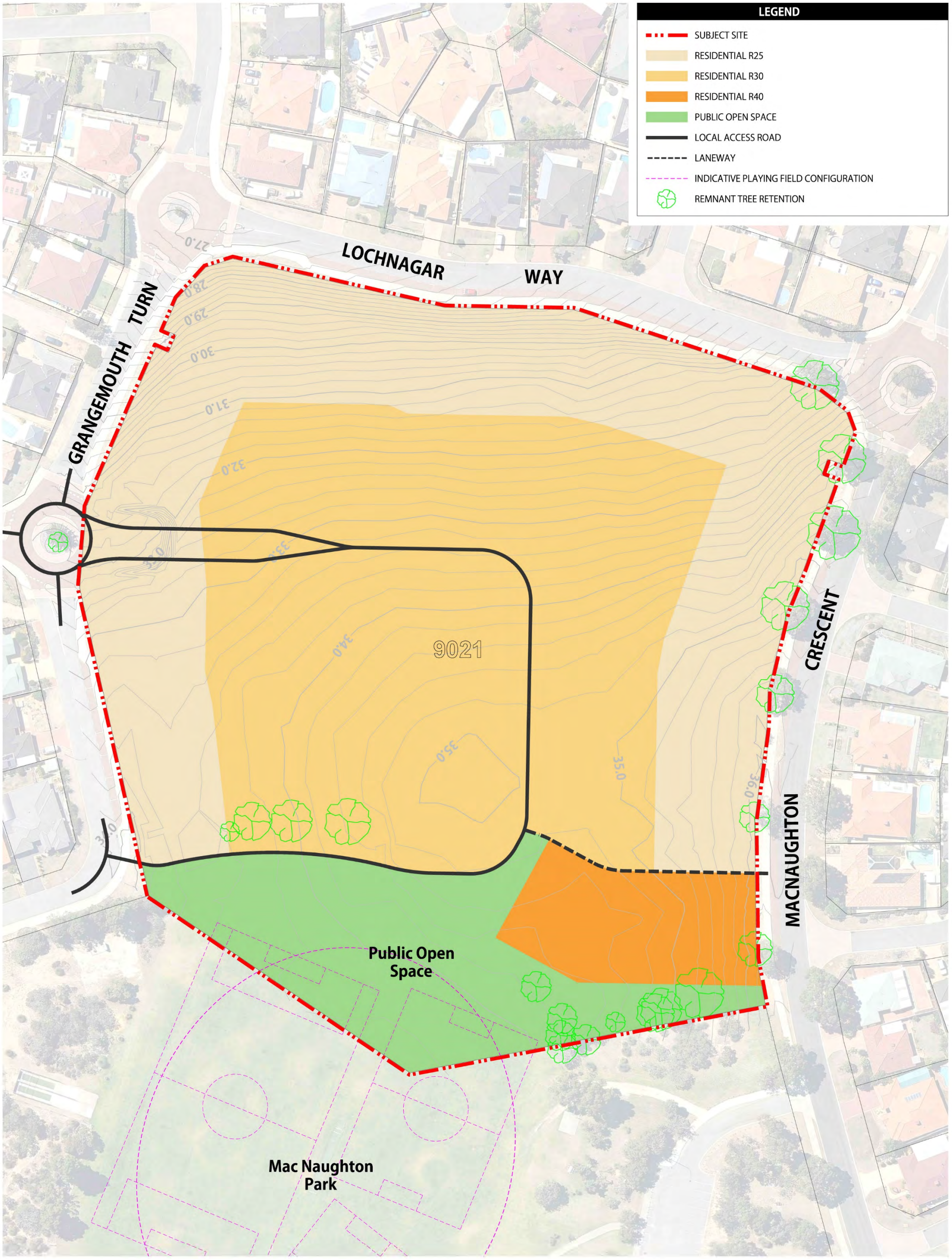
5.2 Medium-density Single House Development Standards (R-MD Codes)

The Medium-density Single House development standards as outlined in the WAPC Bulletin 112/2016 are proposed to be adopted for this Structure Plan area by way of a Local Planning Policy.

The R-MD standards will become applicable to development within the Structure Plan area on the adoption by Council of the relevant Local Planning Policy.

6 Additional Information

ADDITIONAL INFORMATION	APPROVAL STAGE	CONSULTATION REQUIRED
Urban Water Management Plan	Condition of Subdivision Approval	Department of Water
Site specific Fauna Survey	Condition of Subdivision Approval	Department of Environment Regulation
Local Development Plans	Condition of Subdivision Approval	WAPC



PLAN 1 - STRUCTURE PLAN

Lot 9021 MacNaughton Crescent, KINROSS

NORTH

0 10 20 30m

Scale: 1:1000@A3
Date: 14/03/2017
Plan: PACBB-2-003E

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PART TWO

Explanatory Section and Technical Appendices

MACNAUGHTON CRESCENT STRUCTURE PLAN

1. Planning Background
2. Site Conditions and Constraints
3. Land Use and Subdivision Requirements
4. Technical Studies (Appendices) Index

PART TWO – EXPLANATORY SECTION AND TECHNICAL APPENDICES

1 Planning Background

1.1 Introduction and Purpose

The purpose of this Structure Plan is to provide a framework to guide subdivision and development of Lot 9021 MacNaughton Crescent, Kinross for residential purposes. The Structure Plan identifies the pattern of development by depicting specific elements including the location of roads, residential densities, public reserves and pedestrian/cycle networks.

The information contained in this section provides justification and support for the comprehensive and co-ordinated design response for the Structure Plan.

The Structure Plan area was previously zoned *Public Use* with a pocket of *Residential (R20)* under the Scheme. The portion zoned *Public Use* had been earmarked for development as a school site. In 2012 the Department of Education determined that it no longer required the site for the development of a school.

Scheme Amendment No. 74 to the *City of Joondalup District Planning Scheme No. 2* was lodged in January 2014 to rezone the *Public Use* to *Urban Development* and amend the *Residential* portion to *Urban Development*, and remove the density code.

The proposed amendment was referred to the Environmental Protection Authority (EPA) for comment. The EPA determined that a formal environmental review was not required, however provided comments regarding flora and vegetation and specifically referred to the consideration of habitat for Carnaby's black cockatoo. A copy of the EPA advice has been provided in **Part Two - Appendix 1**.

In accordance with Section 87 of the *Planning and Development Act 2005* the Minister for Planning approved Scheme Amendment No.74 in January 2015.

1.2 Land Description

1.2.1 Location

The Structure Plan area is located ~30 kilometres north of the Perth Central Business District, ~4 kilometres north east of the Joondalup City Centre, and ~400m from Kinross Central Shopping Centre (refer **Figure 1**) within the Municipality of the City of Joondalup.

The Structure Plan area is bound by Lochnagar Way to the north, Grangemouth Turn to the east, MacNaughton Crescent to the west, and MacNaughton Park to the south. Extending beyond this, the Structure Plan area is surrounded by existing *Residential* zoned land coded R20 and R25.

1.2.2 Area and Land Use

The Structure Plan area comprises one landholding totalling 4.027 hectares.

The Structure Plan area is currently vacant, with the southern portion having been historically used as an extension of the MacNaughton Open Space.

1.2.3 Legal Description and Ownership

The Structure Plan area is in the ownership of Peet Limited.

The Certificate of Title is attached as **Part Two - Appendix 2**.

Table 1: Title Details and Land Ownership

Lot Number	Owner	Certificate of Title	Area (Ha)
9021	Peet Limited	2591/875	4.027
		Total Area	**4.027**

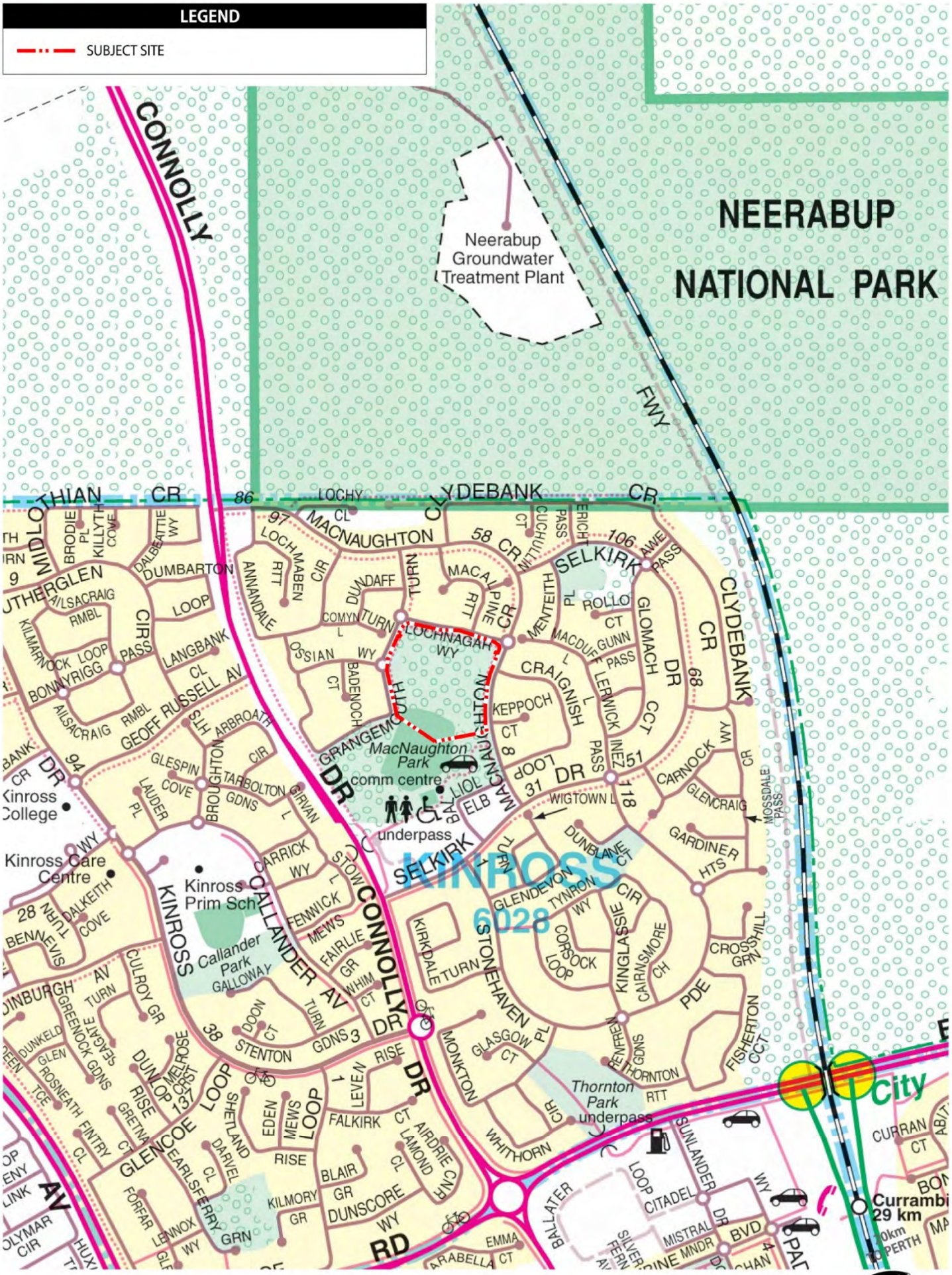
1.3 Planning Framework

1.3.1 Zoning and Reservations

Under the provisions of the *Metropolitan Region Scheme* (MRS) the Structure Plan area is zoned *Urban* (refer **Figure 2**).

The Structure Plan area is zoned *Urban Development* under the provisions of the *City of Joondalup District Planning Scheme No. 2* ('the Scheme'). Refer **Figure 3**.

Land zoned *Urban Development* under the Scheme is required to have a structure plan prepared and adopted prior to any subdivision or development proceeding. This Structure Plan has been prepared in accordance with *Schedule 2 Part 4 of the Planning and Development (Local Planning Schemes) Regulations 2015* and the WAPC's *Structure Plan Framework* to satisfy this requirement.



LOCATION PLAN

Figure 1

NORTH

0 100 200 300m

Scale: 1:10,000@A4 Date: 28/07/2015 Plan: PACBB-5-009a

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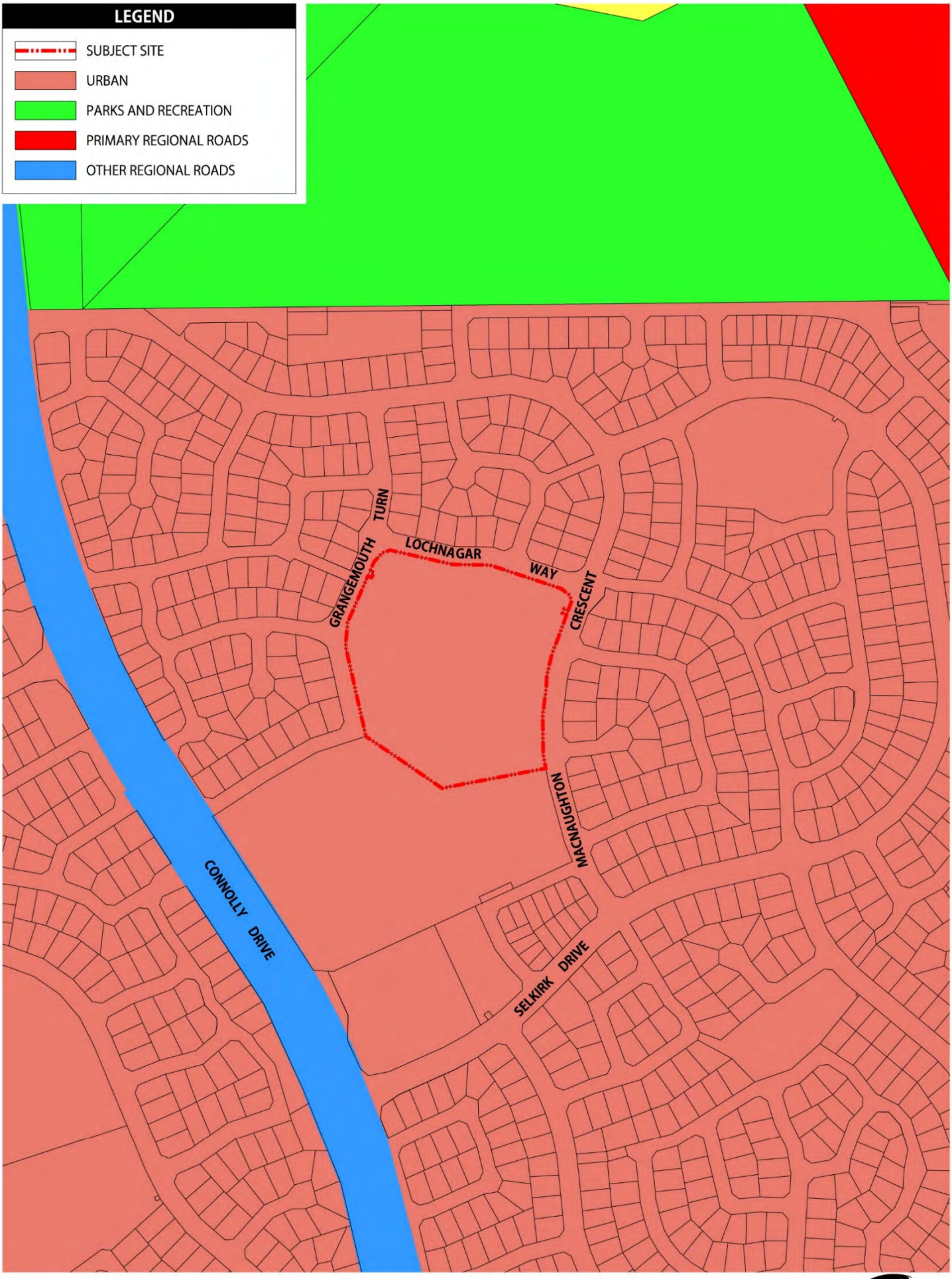

MRS ZONING

Figure 2

NORTH

0 50 100 150m

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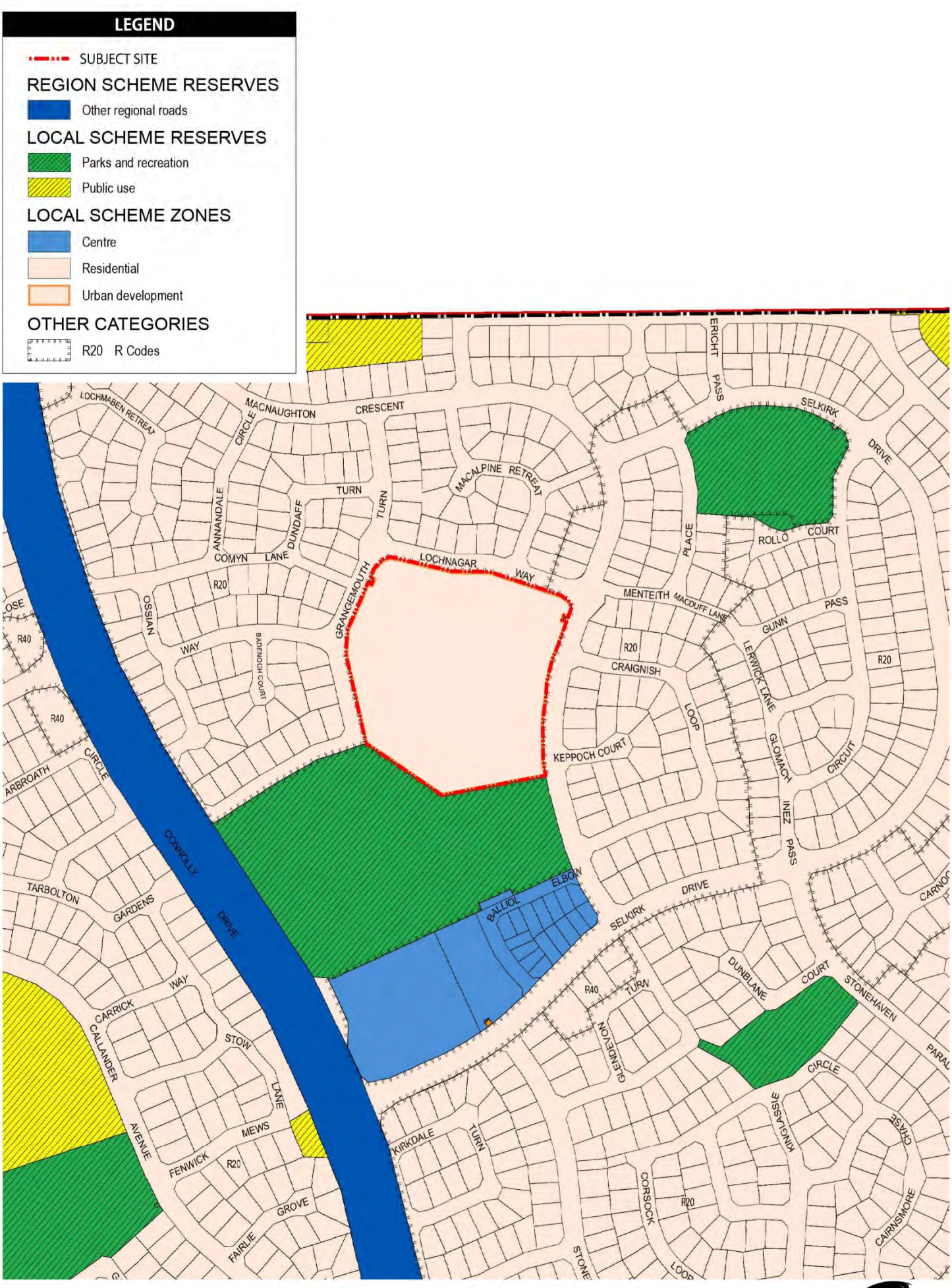

DISTRICT PLANNING SCHEME No. 2

Figure 3

1.3.2 Regional and Sub-Regional Structure Plan

1.3.2.1 DIRECTIONS 2031 – SPATIAL PLANNING FRAMEWORK FOR PERTH AND PEEL

Directions 2031, the WAPC's strategic planning framework document that establishes a vision for future growth, identifies strategic themes to guide future urban growth for Metropolitan Perth and Peel.

The Structure Plan area is located within an area identified as 'urban zone undeveloped', under the associated *'Outer Metropolitan Perth and Peel Sub-Regional Strategy'*. The *'Outer Metropolitan Perth and Peel Sub-Regional Strategy'* identifies ~100 ha of undeveloped urban zoned land within the City of Joondalup.

The Structure Plan will facilitate the future subdivision and development of an anticipated 72 dwellings, and 210 people to the Kinross community. This will contribute to the targets being sought by the *Directions 2031* documents.

1.3.2.2 DRAFT SUB-REGIONAL PLANNING FRAMEWORK

The draft *Perth and Peel@3.5 million* is a suite of strategic land use planning documents. The Structure Plan area is identified as 'Urban Expansion' in the *North-east Metropolitan Sub-Regional Planning Framework*. Under this framework the North-east Metropolitan Sub-Regional is expected to grow to 450,590 people by 2050.

The proposed Structure Plan and associated residential densities reflect the intent of these documents by facilitating infill residential development that is in character with the surrounding area.

1.3.2.3 DRAFT PERTH AND PEEL GREEN GROWTH PLAN FOR 3.5 MILLION

The draft *Perth and Peel Green Growth Plan for 3.5 Million* provides for the growth of the population to 3.5 million people while protecting the unique biodiversity and other environmental values of the regions. It sets out a framework which delivers improvements to the protection and management of state and national biodiversity and environment matters.

The Structure Plan area is identified as 'Urban Class of Action' under the Strategic Conservation Plan and mapped as part of the 'Broad Commitment and Values'. This Class of Action provides for existing, new and proposed urban development.

This includes residential land uses and associated functions such as employment, education, retail, civic facilities, light industry and open space. The mapping that has informed the location of these 'Broad Commitments and Values' was based on regional vegetation and not on site specific data. Site specific data has been obtained to support lodgement of the Structure Plan and is presented as part of the Environmental Assessment and Management Strategy (refer **Appendix 3**). It includes a:

- *Flora and Vegetation Survey (Emerge Associates 2015);* and
- *Preliminary Tree Assessment* (Arbor Logic 2015).

1.3.3 Planning Strategies

1.3.3.1 CITY OF JOONDALUP LOCAL PLANNING STRATEGY 2014

The City of Joondalup's *Local Planning Strategy* provides the strategic direction for land use planning and development for the City of Joondalup for the next 10 – 15 years. The *Local Planning Strategy* identifies the Structure Plan area as the East Kinross Primary School. The Department of Education has advised it no longer has any need for this site due to insufficient demand; and Scheme Amendment No.74 rezoned the Structure Plan area to *Urban Development* in January 2015, subsequent to the City's *Local Planning Strategy*.

Notwithstanding the *Local Planning Strategy* identifies the Structure Plan area as a Primary School site, the proposed Structure Plan is consistent with the following key objectives/strategies of the *Local Planning Strategy*:

- To provide additional and more diverse housing to cater for an ageing population and changing household structures;
- To ensure public open space is easily accessible and provides protection for vegetation and biodiversity, amenity and quality for recreation opportunities;
- Encourage diversity of housing in terms of lot sizes and housing types to reflect changing demographics;
- Promote good urban design outcomes in future housing developments which will contribute to improved quality of development and streetscapes over time;
- Encourage site-responsive design for significant new development proposals; and
- Encourage the retention, protection and enhancement of significant natural vegetation in new development, where appropriate, and possible.

1.3.3.2 CITY OF JOONDALUP LOCAL HOUSING STRATEGY

The City of Joondalup's *Local Housing Strategy* provides the rationale for determining future housing needs and to recommend appropriate policy measures for the provision of a range of housing types and densities. The proposed Structure Plan is consistent with the following objectives of the *Local Housing Strategy*:

- Ensure that a wide range of housing can be provided to meet the social and economic needs of the changing demographics of the City; and
- Identify mechanisms to ensure new infill development is based on good design principles thus improving the amenity of existing neighbourhoods.

Consistent with Section 7.2 of the *Local Housing Strategy,* the Structure Plan proposes residential densities which will facilitate a diverse mix of dwellings and are appropriate in the context of the established residential setting.

1.3.4 Planning Policies

1.3.4.1 RESIDENTIAL MEDIUM DENSITY CODES (R-MD CODES)

Planning Bulletin 112/2016 *Medium-density single house development standards – Development Zones* was released by the WAPC in 2016 and details acceptable residential development standards for medium-density single houses.

The Residential Medium Density Codes (R-MD Codes) are proposed to be applied to all residential areas in this Structure Plan via the adoption of a Local Planning Policy. It is noted, however, that the Local Planning Policy is subject to a separate process and Council decision.

1.3.4.2 CITY OF JOONDALUP SUBDVISION AND DEVELOPMENT ADJOINING AREAS OF PUBLIC OPEN SPACE POLICY

This Policy provides guidelines for the design of subdivisions and dwelling development adjoining areas of public open space to maximise outlook onto and casual surveillance of these areas from adjoining properties and streets and has been considered in the proposed Structure Plan.

The Structure Plan proposed residential development directly adjoining Public Open Space. The provisions of this Policy will be addressed at the detailed design stage to ensure an appropriate outcome is achieved.

Detailed design controls will be implemented via a Local Development Plan to ensure dwellings are appropriately designed to overlook the Public Open Space in accordance with the provisions of this Policy.

1.3.4.3 CITY OF JOONDALUP STORMWATER MANAGEMENT POLICY

The City of Joondalup's *Stormwater Management Policy* requires consideration of the management of stormwater at each phase of the planning process, including Local Planning (i.e. Structure Plan).

This proposed Structure Plan incorporates appropriate best management practices into the drainage system in accordance with this Policy and *Better Urban Water Management*.

2 Site Conditions & Constraints

An *Environmental Assessment and Management Strategy* (EAMS) has been prepared by Emerge Associates in support of this Structure Plan.

A summary of the key findings of the EAMS is provided below. The detailed findings of the EAMS are contained under **Part Two - Appendix 3**.

2.1 Biodiversity and Natural Area Assets

2.1.1 Vegetation and Flora

Vegetation within the Structure Plan area has been affected by past disturbances, with a high degree of weed invasion evident throughout the Structure Plan area. The majority of the Structure Plan area is characterised by small fragmented areas of low woodlands ranging from "Degraded" to "Good" condition. The remainder of the Structure Plan area is comprised of informal tracks, large open areas of bare ground (sand), and isolated trees in a "Completely Degraded" condition.

The flora and vegetation characteristics of the Structure Plan area can be summarised as follows:

- No Threatened or Priority Flora species were recorded within the Structure Plan area during the survey.
- No Threatened Flora species are considered likely to occur within the Structure Plan area, however there is a possibility that two Priority Flora species (Conostylis bracteata and Jacksonia sericea) may occur within, but were undetectable at the time of survey as a result.
- No TECs or PECs are likely to occur within the Structure Plan area.
- Vegetation condition of remnant vegetation within the Structure Plan area ranged from "Completely Degraded" to "Good" in small areas.

None of these findings preclude development of the Structure Plan area. Subject to detailed design, the Structure Plan proposes to retain a number of trees within residential lots and Public Open Space. The total 'natural area' retained by the Structure Plan equates to approximately 0.106 ha.

2.1.2 Fauna and Habitat

The Structure Plan area contains remnant vegetation inclusive of banksia species, however this vegetation does not present an area regarded as 'significant' for quality black cockatoo foraging habitat. Such areas of vegetation are small and fragmented and is in predominantly "Completely Degraded" and "Degraded" condition with only small areas in "Good" condition. No evidence of foraging by black cockatoo species has been observed.

An assessment of the vegetation, flora and fauna habitat was conducted by Emerge Environmental consultants in 2015; this to inform development of the proposed Structure Plan and to support Emerge's EAMS (2015) prepared for the site. This included an assessment of all vegetation (including all trees) within the site to determine the presence of any habitat values for potential use by any of the three black cockatoo species. The results are detailed within the EAMS and summarised below; this also includes definition of the tree assessment criteria utilised to inform this process.

For the purposes of assessing trees of significance, notably those for their potential use by black cockatoos, the following definition of 'breeding habitat' was utilised to inform the assessment:

'Trees of species known to support breeding within the range of the species which either have a suitable nest hollow OR are of a suitable diameter at breast height (DBH) to develop a nest hollow. For most tree species, suitable DBH is 500 mm.'

Site assessment results for suitable breeding habitat, as defined above, identified a total of six Eucalyptus sp. trees with a DBH of over 500mm and having potential for use by black cockatoos. Said tree species and locations were recorded and area illustrated in Figure 6 of the EAMS.

Five of the trees are planted Eucalyptus gomphocephala (tuarts) with trunks that have split into multiple branches, albeit no hollows were noted. Due to their form, these trees are considered unlikely to produce hollows of sufficient size (i.e. entry of >10 cm in diameter) that could be used for breeding by black cockatoos.

The sixth tree, a remnant Eucalyptus marginata (jarrah), is located in the south eastern corner of the site and has a DBH over 500mm. Whilst this tree contains a large hollow that has the potential to be used by black cockatoos, the hollow was inspected and no typical evidence (i.e. scratches around the entry) were observed.

Whilst no other trees meeting the above >500mm DBH criteria were identified within the site, there are other species of trees at >500mm that will be considered for retention within the Structure Plan area, as addressed below.

OEPA ADVICE

In June 2014, the OEPA provided the below advice and recommendations in regards to the site:

"*The EPA expects that habitat trees within the amendment area be retained as part of the detailed design of the Structure Plan. Scheme provisions and subdivision conditions requiring the retention of habitat trees to the satisfaction of the Department of Parks and Wildlife and other relevant agencies are recommended.*"

The proposed Structure Plan responds to the OEPA's advice by providing site specific survey data and recommending the retention of four planted tuarts within the southern (POS fronting) road reserve as detailed in Attachment B of Emerge's *Tree Retention Study* (**Appendix 3a** refers). Three of the said trees are over 500mm DBH.

Specialist advice and results by a qualified arboricultural consultant, and together with detailed engineering and planning design criteria, were used to inform a draft subdivision and crossover layout to enable retention of these four trees; these trees represented as T2, T3, T5 and T7 under Appendix 3a. In this original grouping, a further three trees (>500mm DBH) are proposed to be removed primarily due to signs of health deterioration, thus considered to be structurally inadequate. These trees are represented as T1, T4 and T6 under Appendix 3a.

An isolated Jarrah tree (>500mm DBH), represented as T8 under Appendix 3a is also recommended for removal due to signs of health decline; this exacerbated by its proximity to proposed residential lots and the ultimate risk to property.

The overall site contains a number of smaller trees (<500mm DBH) of mixed species however none of which fulfil the 'potential habitat trees' criteria defined above. Nonetheless, those located within the proposed POS area were surveyed and assessed by the arboricultural consultant to determine their suitability for retention. The aboricultural assessment also includes a number of tuarts planted as street trees, primarily within the MacNaughton Crescent verge. As these trees are proposed for retention, the final subdivision design, built form and associated crossovers will need to take into consideration the location of these trees and prescribed Tree Protection Zones.

Vegetation within the broader Structure Plan area has the potential to provide habitat for the 'Priority 5' Quenda species, however said habitat areas are small and fragmented. The Quenda is likely to preferentially inhabit the Bush Forever Sites surrounding the Structure Plan area; these sites offering larger areas of intact dense vegetation that have a lower risk of predation by foxes and domestic cats.

2.2 Landform & Soils

The topography of the Structure Plan area comprises a flat area within the southern portion of the site which slopes from the south east down towards the north west. The highest point within the south east portion of the Structure Plan area is at 35 metres Australian Height Datum (AHD) and declines to 27 metres AHD in the north west portion of the Structure Plan area.

Landform and soil mapping prepared by Churchward and MacArthur (1980) indicates that the Structure Plan area is representative of the "Cottesloe" unit, which is broadly described as "low hilly landscape with shallow brown sands over limestone; much exposed limestone".

Environmental geology (surface soils) across the Structure Plan area has been mapped by the Geological Survey of Western Australia (Gozzard 1986). The majority of the Structure Plan area consists of limestone with sand along the western portion of the site.

None of these findings preclude development of the Structure Plan area.

2.2.1 Acid Sulfate Soils

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

Mapping prepared by the WA Department of Environment and Regulation (formerly Department of Environment and Conservation) to support the *WAPC's Bulletin No. 64: Acid Sulfate Soils* (WAPC 2009) provides broad-scale mapping indicating areas of potential ASS risk. The mapping indicates that the Structure Plan area has been classified as having "no known risk of ASS".

FIGURE 4 - ORTHOPHOTO

Lot 9021 MacNaughton Crescent, KINROSS

NORTH

0 20 40 60m

Scale: 1:2000@A4 Date: 04/05/2016 Plan: PACBB-5-012A

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2.3 Groundwater and Surface Water

2.3.1 Ground water

The Superficial aquifer is considered to be the primary aquifer of interest in relation to this Local Water Management Strategy (LWMS) as this is the aquifer most likely impacted by water management practices within the Structure Plan area, and also most likely accessed for local use.

The Perth Groundwater Atlas (DoW 2015a) indicates regional historical maximum groundwater levels (MGL) of approximately 3.5 metres AHD. This equates to an approximate depth to groundwater of between 25.5 metres and 32.5 metres.

2.3.2 Surface water

The Structure Plan area is located within the Lochy Close sump catchment of the greater City of Joondalup drainage network. Surface runoff from the catchment that is not retained at source is discharged to the Lochy Close drainage sump, located approximately 250 metres north of the Structure Plan area. Runoff is conveyed to the sump either via the piped drainage network (flows up to the 5 year ARI event) or via overland flow within the road network.

The Lochy sump has been designed to retain 100 year ARI, 24 hour duration event runoff from the impermeable contributing area and has a total storage capacity of 14,600 m^3.

No surface water bodies or channels have been identified within the Structure Plan area. Surface water is likely to infiltrate freely across the site due to the high permeability of the underlying sands.

2.3.3 Monitoring

It is proposed that the overall condition of the development will be monitored on a bi-annual basis.

Monitoring will be implemented after the completion of the civil and landscaping works and will continue for a period of two years.

A visual assessment will be undertaken to monitor the overall condition of the development, with the aim to ascertain that the maintenance activities are achieving the overall management objectives for the development. The parameters that will be monitored include:

- Gross pollutants
- Terrestrial weeds
- Irrigation
- Vegetation density
- Paths, benches, walkways and other infrastructure.

The management and maintenance objectives will be detailed within the future Urban Water Management Plan (UWMP).

Site specific post-development groundwater monitoring is not proposed due to the significant (>25 metres) depth to groundwater.

2.4 Heritage

2.4.1 Indigenous heritage

A review of the Department of Aboriginal Affairs "Aboriginal Heritage Inquiry System" online database (DAA 2015), found that no Registered Aboriginal Heritage Sites within the Structure Plan area.

There are several Registered Aboriginal Sites within the vicinity of the Structure Plan area, with the nearest Aboriginal site (DAA ID 3504) located approximately 780 metres east of the Structure Plan area. It is recorded as Joondalup Waugal Egg, a mythological site. This site will not be impacted upon by the proposed development of the Structure Plan area.

2.4.2 Non-Indigenous heritage

A desktop search of the State Heritage Office database (Heritage Council 2015) and the Australian Heritage Database (DoEnv 2015) indicated there are no registered heritage sites within the Structure Plan area.

2.5 Context and other land use constraints and opportunities

An 'Opportunities and Constraints Plan' (refer **Figure 5**) and a 'Context Plan' (refer **Figure 6**) illustrates the following sections.

2.5.1 Surrounding Land Use

Surrounding land uses predominantly comprise residential to the north, east and west. An area of active Public Open Space (POS) is located to the south which comprises associated community facilities including a community hall and skate park.

Located further south beyond the POS is the Kinross Central Shopping Centre.

The Structure Plan area is located less than 500 metres from Connolly Drive, ~1.5 kilometres north of the Mitchell Freeway and ~1.5 kilometres from the Currambine Train Station.

2.5.2 Movement Network

A Traffic Assessment was undertaken by Riley Consulting (**Part Two - Appendix 4** refers). The following provides a description of the existing movement network in the vicinity of the Structure Plan area.

2.5.2.1 CONNOLLY DRIVE

Connolly Drive is classified as a *Distributor Type A* road and is reserved for 'Other Regional Road' in the MRS. It is constructed as a four lane divided road within a 50 metre road reservation. It provides an important secondary north-south link to Marmion Avenue servicing the railway stations at Currambine and Butler. Traffic data provided by the City of Joondalup shows 18,113 vehicles per day (vpd) north of MacNaughton Crescent (2010 data), 20,046vpd south of MacNaughton Crescent (2012 data) and 29,448vpd north of Burns Beach Road (2012 data).

2.5.2.2 MACNAUGHTON CRESCENT

MacNaughton Crescent is classified as a *Neighbourhood Connector B* under *Liveable Neighbourhoods*. It is constructed with a 7.5 metre wide pavement within a 20 metre road reservation and considered suitable for up to 3,000 vehicles per day (vpd). It forms an internal loop road to the suburb with access to Connolly Drive and Selkirk Drive.

There is no current traffic data available for MacNaughton Crescent. However, based on the residential catchment it is projected that the present day demands would equate to:

- At Connolly Drive, catchment about 280 dwellings, expected demand 2,100vpd
- At Lochnagar Way, catchment about 100 dwellings, expected demand 740vpd.
- At Selkirk Drive, catchment about 150 dwellings, expected demand 1,110vpd.

2.5.2.3 SELKIRK DRIVE

Selkirk Drive is classified as a *Neighbourhood Connector A* under *Liveable Neighbourhoods*. It is constructed with a 9.5 metre wide pavement within a 25 metre road reservation and considered suitable to accommodate 7,000vpd. It forms an internal loop road to the suburb with access to Connolly Drive and MacNaughton Crescent. Traffic data provided by the City of Joondalup shows

- East of Connolly Drive – 3,640vpd
- East of MacNaughton Crescent – 548vpd.
- East of Clydebank Crescent – 332vpd.

2.5.2.4 LOCHNAGER WAY

Lochnager Way is a local *Access Street* to the north of the Structure Plan area. It is constructed with a 7.5 metre pavement within an 18 metre road reservation. It provides direct access to about 30 dwellings and serves a link between Grangemouth Turn and MacNaughton Crescent (for access to local shops).

No traffic data is available, but based on the residential catchment it can be expected to serve 200vpd - 300vpd. The road reservation and pavement accord with *Access Street Type A* under Liveable Neighbourhoods and would be suited to carry up to 3,000vpd.

2.5.2.5 GRANGEMOUTH TURN

Grangemouth Turn is a local *Access Street* to the west of the Structure Plan area. It is constructed with a 7.5 metre pavement within an 18 metre road reservation. It provides direct access to about 28 dwellings and serves a link between Annandale Crescent and Lochnagar Way.

No traffic data is available, however based on the residential catchment it can be expected to serves 300vpd. The road reservation and pavement accord with *Access Street Type A* under *Liveable Neighbourhoods* and would be suited to carry up to 3,000vpd.

2.5.3 Activity Centres & Employment

The Structure Plan area is located ~400 metres north of the Kinross Central Shopping Centre located on the corner of Selkirk Drive and Connolly Drive. This centre provides numerous variety and specialty stores including fresh food & continental stores, major store Supa IGA Supermarket, and various take away outlets and restaurants.

The Joondalup City Centre and Wangara Industrial Park are important activity centres and employment generators, which exist ~3.4 kilometers and ~11 kilometres respectively south east of the Structure Plan area.

2.5.4 Informal Community Consultation

A 'Community Engagement Session' was held by the applicant on Saturday 13 June 2015 between 12.30pm and 2.30pm and provided interested residents and stakeholders with an opportunity to drop in, discuss development opportunities for the site and provide feedback.

The applicant advised that over 55 community members attended the session. Three key priorities were identified from the feedback and discussions on the day, which included:

- Future residential densities in line with surrounding suburb;
- Integration with Public Open Space; and
- Retention of natural bushland where possible.

Additional themes were also identified and can be reviewed along with the detailed Community Consultation Report which is contained within **Part Two - Appendix 5**.

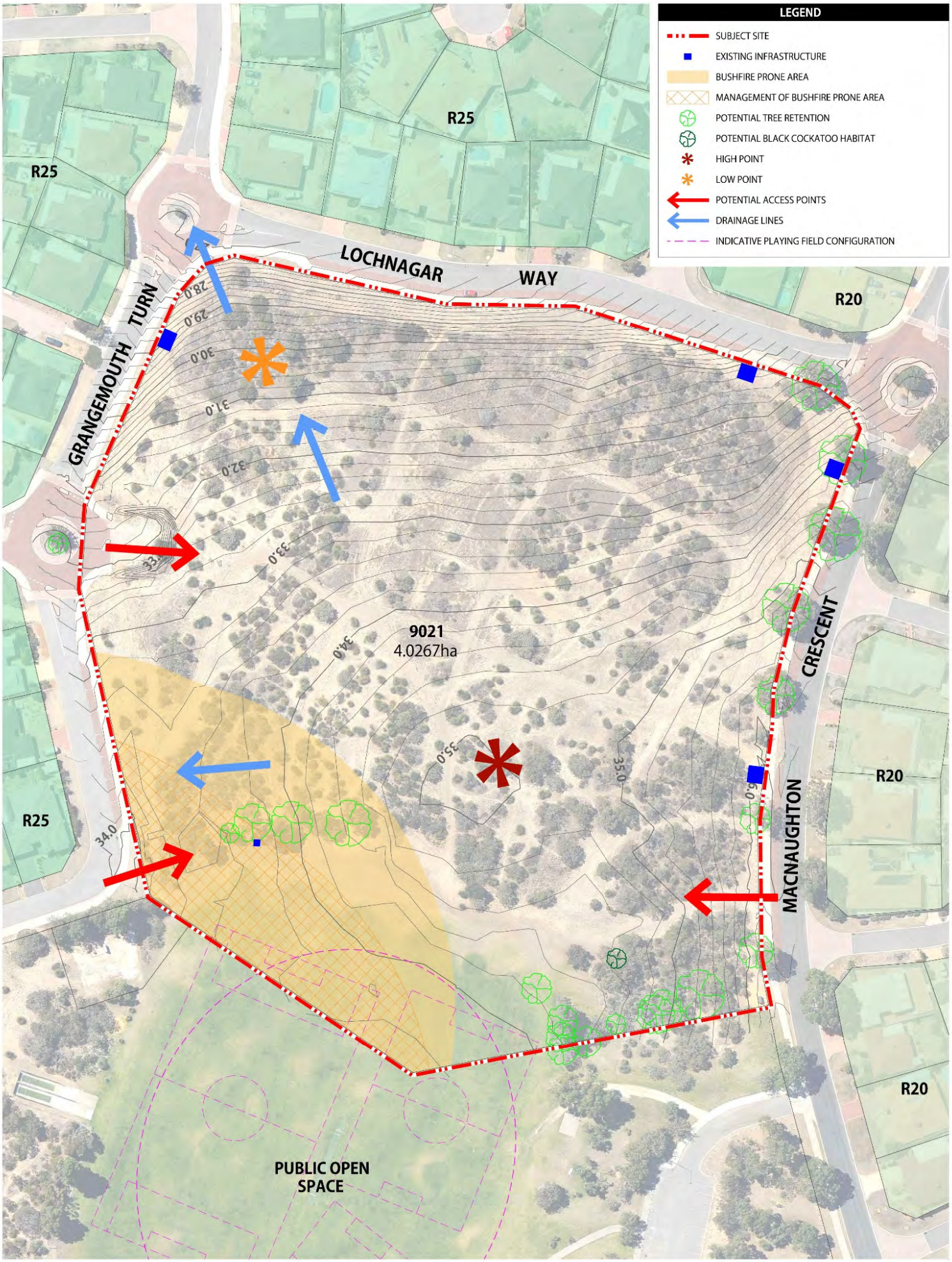

FIGURE 5 - OPPORTUNITIES AND CONSTRAINTS

Lot 9021 MacNaughton Crescent, KINROSS

A Peet Project

NORTH

0 10 20 30m

Scale: 1:1000@A3/1:500@A1
Date: 04/05/2016
Plan: PACBB-5-008

A 28 Brown St, East Perth WA 6004
P (08) 9325 0200
E info@creativedp.com.au
W creativedp.com.au

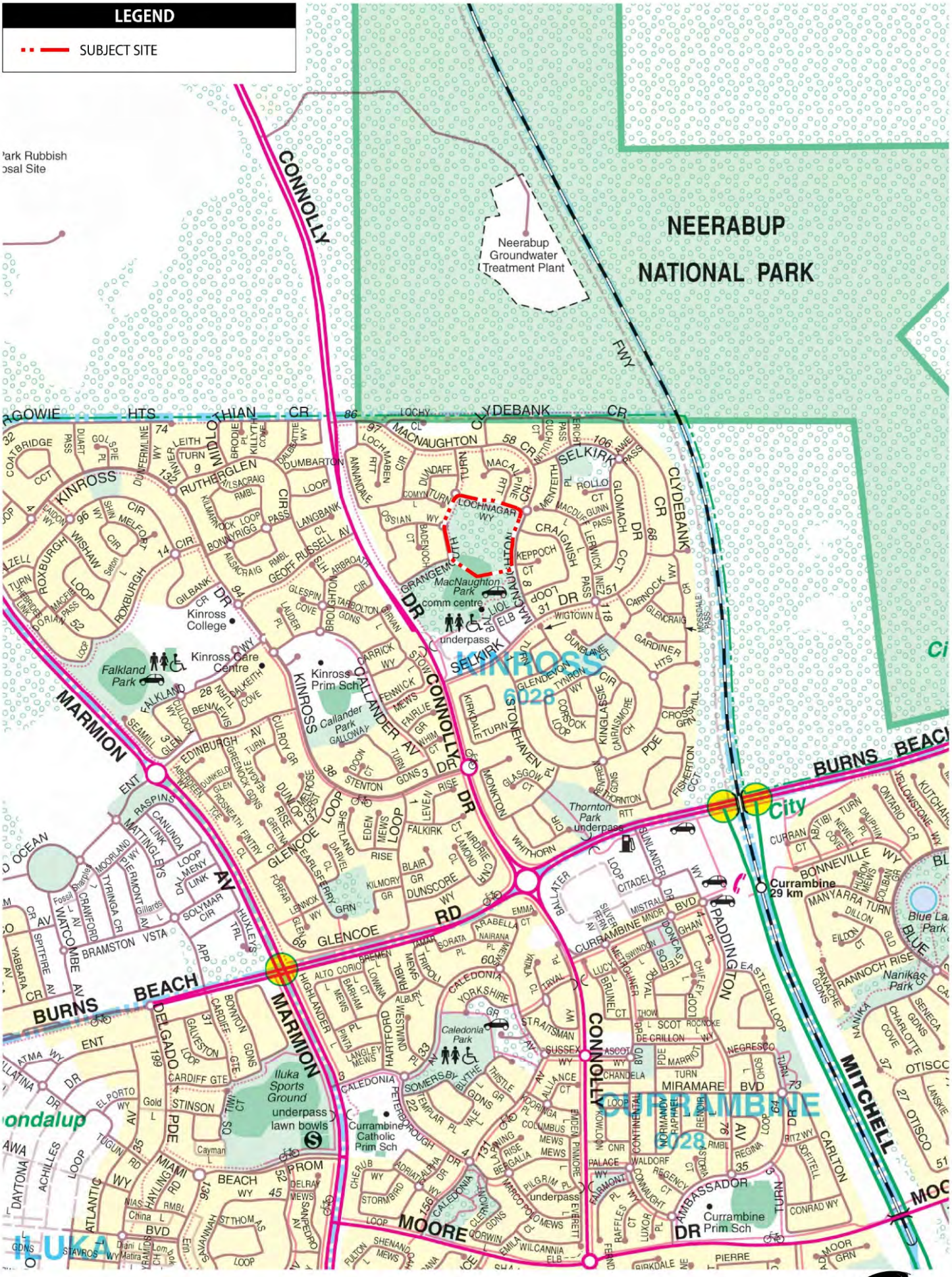

FIGURE 6 - DISTRICT CONTEXT PLAN

Lot 9021 MacNaughton Crescent, KINROSS

NORTH

0 150 300 450m

Scale: 1:15,000@A4 Date: 04/05/2016 Plan: PACBB-5-013

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3 Land Use and Subdivision Requirements

The Structure Plan proposes a design layout which fosters an efficient and permeable road network and corresponding residential development cells.

The Structure Plan design has taken into consideration the environmental attributes of the site, as well as acknowledging abutting land uses and how these can best be addressed with regard to interfacing with proposed residential land uses.

The design philosophy has been predicated upon the following objectives:

- Suitable interface with the local neighbourhood and public open space areas;
- Location and provision of public open spaces to ensure retention of existing park (MacNaughton Park), accessibility, usability, and tree retention where practical;
- Integration of stormwater management within open space and road reserve;
- Appropriate connection to local road networks;
- Diversity of dwelling product through mix of lot sizes (residential density);
- Delivery of safe and connected pedestrian and cyclist environments linking residential cells and associated local parks, as well as providing for external connectivity outside of the Structure Plan area; and
- Responsiveness to local landforms and environment.

In preparing the Structure Plan design, the following external constraint needed to be duly considered given the potential impact on the amenity of future Kinross residents. These external influences include:

- Retention of Trees and existing Public Open Space:

  The Structure Plan design supports the retention of the existing POS and portions of remnant vegetation as indicated on Plan 1.

  Remnant vegetation with potential foraging habitat is proposed to be retained within the existing POS, and a stand of trees located in the southern portion of the Structure Plan area and along the MacNaughton Crescent verge. The finished ground levels and drainage requirements will be carefully managed to ensure the retention and survival of these trees.

  The POS and road reserves will be landscaped utilising native species.

3.1 Land Use

The Structure Plan area will be developed generally for residential purposes, as outlined below:

Table 2: Land use Budget

Land Use Budget	*(ha)*	*(%)*
Site Area		
• Residential Land	2.889	72%
• Public Open Space	0.463	11%
• Roads	0.675	16%
Gross Site Area	**4.027**	

3.2 Public Open Space

Public Open Space (POS) is to be provided generally in accordance with **Plan 1** under Part One of the Structure Plan; with the provision of 10% POS across the Structure Plan area.

Table 3: Land Use Budget

Public Open Space	Area (Ha)
Structure Plan Area	**4.027**
Deductions	
1:1yr Drainage requirement:	0.004
Total Deductions:	0.004
Gross Subdivisable Area	**4.023**
POS Requirement @ 10%	**0.402**
Maximum Restricted Open Space Permitted *(20%):*	*0.080*
Minimum Unrestricted Open Space Required *(80%):*	*0.322*

The Structure Plan proposes one area of POS, which has been located and designed to ensure retention of existing POS and mature trees, while also creating amenity and walkable recreation opportunities for future residents.

Table 4 summarises drainage requirements and the creditable POS allocation.

Table 4: Creditable Open Space

Drainage Provisions and Creditable Open Space					
		Non Credit	Restricted POS (20% Max)	Unrestricted POS (80% Min)	Total Credited Open Space
POS Area	Land Area (ha)	Deduction	>1:1 – 1:5 Yr	Above 1:5 Yr	Combined
All Figures provided in m^2					
1	0.463	0.004	0.080	0.379	0.459
Total	0.463	0.004	0.080	0.379	0.459

The total creditable POS equates to ~0.459 ha. Drainage will be accommodated both within and external to the Structure Plan area at the discretion of the City.

The area of public open space will be developed and landscaped to a high standard by the proponent for the benefit of the existing and future community, as depicted in **Figure 12: MacNaughton Crescent Masterplan**.

Subsequent to further detailed design and planning the POS schedule is to be updated at the time of subdivision and provided within the subdivision application for determination by the WAPC.

3.3 Residential

3.3.1 Dwelling Forecasts

Directions 2031 and accompanying *Outer Metropolitan Perth and Peel Sub-Regional Strategy* sets the following dwelling target rates for the Structure Plan area:

Table 5: Dwelling Forecasts

Directions 2031 Scenarios	Projected Dwellings:
'Connected City' @ **15 dwellings** per *gross urban zone*	~60 dwellings (4.027 ha x 15)
'Business as usual' @ **10 dwellings** per *gross urban zone*	~40 dwellings (4.027 ha x 10)

Furthermore, WAPC's *Liveable Neighbourhoods* 'Site Hectare' definition equates to the Structure Plan having a 'developable area' of ~2.889 ha. In addressing *LN's* recommended ~22 dwellings per site hectare target, this equates to a target ~63 dwellings.

The *Directions 2031* and *Liveable Neighbourhoods* targets do however provide for lower dwelling targets than that prescribed by the City's Scheme. Clause 3.12.4.2 of the Scheme states,

Where it is intended that a site is to be developed for residential purposes, any structure plan for that site must require that a minimum residential density of 25 dwellings per site hectare be achieved.

The 25 dwelling per site hectare target equates to ~72 dwellings.

Provision 4.3 under Part One of the Structure Plan notes that the WAPC, in consultation with the City of Joondalup, will consider a lower density target at the time of subdivision or development where the development demonstrates environmental or engineering benefits. This may include retaining trees, minimising retaining walls, providing for conventional lot designs, or for any other environmental or engineering benefits deemed worthy at the time of assessment.

This provision will be given due regard considering the environmental and topographical challenges the development site possesses.

3.3.2 Density

Residential density codings of R25 to R40 are proposed throughout the Structure Plan area. The average lot sizes for these density codes are as follows:

- R25: 350m²
- R30: 300m²
- R40: 220m²

The applicant indicates that the size of a single residential lot would average between 220m² and 540m².

The R25 density coding will typically shape the perimeter of the site, and provide a transitional interface to the established lower density development surrounding the site. R30 and R40 densities will be provided internal to the site and offer diversity in lot product subject to environmental and engineering limitations, including tree retention, service infrastructure, drainage and retaining.

3.3.3 Housing Typologies

The housing typologies envisaged will include Single-Storey, Double-Storey, Traditional Loaded and Rear Loaded Cottages. The character of these typologies will differ depending on the nature of the lot and surrounding environment.

Where the orientation of the lot makes it possible, dwellings will be orientated north for good solar

passive design. However, where contours and landform have taken priority in determining lot orientation, and northern orientation cannot be achieved, dwellings will be individually designed incorporating sun control elements such as solar shading devices for harsh summer sun, or the appropriate location of living spaces to maximise access to winter sun.

3.3.4 Local Development Plans

Local Development Plans will be prepared to inform applications for subdivision and development in regard to the following:

a) Lots with direct frontage to an area of Public Open Space.

The LDP principles will guide the built form and surveillance of dwellings and fencing interfacing with the public realm (Public Open Space).

b) Lots with rear-loaded (laneway) vehicle access.

The LDP principles will guide the built form and surveillance of dwellings and fencing interfacing with the public realm (laneways).

Principles will also guide garage locations, access and setbacks from the laneway to minimise conflict with service infrastructure (power domes, water meters, telco pits etc) and to adequately accommodate service vehicles for general refuse collection.

c) Lots whereby the driveway or dwelling design is impacted by the retention of specified trees.

The LDP provisions will guide garage locations and setbacks of dwellings and driveways/crossovers to ensure the retention and survival of identified existing trees within the Structure Plan area; this most apparent in the southern portion of the site and existing road verges.

The LDP may be informed by an arboricultural report where deemed appropriate, to determine minimum prescribed setbacks to trees.

3.4 Movement Networks

Access to the Structure Plan area will be provided via two key points along the existing Grangemouth Turn, with additional access from MacNaughton Crescent via a laneway.

The detailed Traffic Assessment is contained within **Part Two - Appendix 4**, and summarised below.

3.4.1 Traffic Generation and Distribution

When considering the movement network within, and around, the Structure Plan area consideration needs to be given to the expected use of the site. Previous Structure Planning for the local area earmarked the subject land as a primary school. Typical primary schools provide for 430 students, but can cater for up to 600 in temporary classrooms.

The Department of Education's Primary School brief sets out a trip generation rate for Primary Schools of 2.6 trips per student per day and 1 trip per student during the peak periods. Therefore, the planned primary school would be expected to generate 1,118 vehicle movements per day, of which 430 would be expected between 8am and 9am.

The proposed development is expected to generate only 504 vehicle movements per day.

When compared to the expected use of primary school on the subject site, the proposed development will generate 45% of the forecast daily traffic movements to the local road network.

3.4.2 Road Configuration and Hierarchy

The general road hierarchy in **Figure 7** responds to the natural topography of the Structure Plan area and existing access points.

The road reserves proposed within the Structure Plan area are as follows:

- 15.0 metres for *Access Street D*, and
- 6.0 metres for *Laneways.*

Reduced verge widths may be permitted adjacent to POS subject to detailed review at the subdivision phase.

3.4.2.1 ENTRY ROAD

The main entry road into the Structure Plan area is proposed from the existing roundabout at Grangemouth Turn.

This access point will comprise a wider road reserve to accommodate drainage within the median as depicted in **Figure 8**.

The median will be landscaped to a high quality utilising native vegetation and will provide an entry statement to the Structure Plan area.

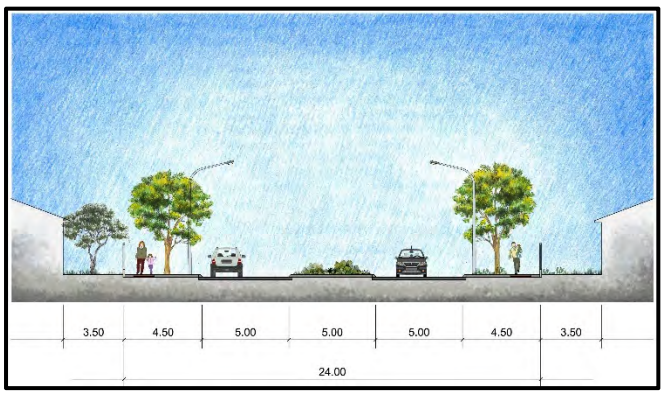

Figure 8: Entry Road Cross-section (24m)

3.4.2.3 ACCESS STREETS

The *Access Street D* roads will function as the internal road network.

The typical road reserve for *Access Street D* roads comprises a 6.0 metre wide trafficable carriageway pavement and 4.5 metre wide verges.

Where fronting POS, *Access Street* verges may be reduced to 2.5 metres depending on the location, services infrastructure and pedestrian network requirements.

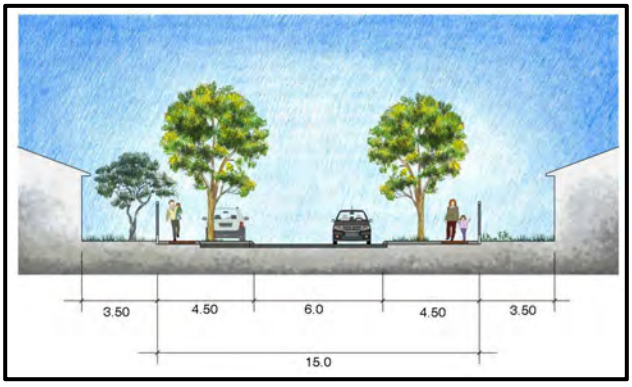

Figure 9: Access Street D Road Cross-section

3.4.2.4 LANEWAYS

The typical road reserve for laneways entails a 6.0 metre wide trafficable pavement sufficient to allow two-way movements, refuse collection, vehicle access into garages located on the rear of properties, flush kerbing and central drainage.

Visitor parking for rear-loaded lot product is proposed to be provided to the side of the lots in the adjacent verges and proximate to the POS; these generally provided at a rate of one bay per two laneway lots.

3.4.3 Existing On-Street Car Parking

The existing on-street car bays around the perimeter of the site were originally constructed to service the intended Primary School.

It is proposed for the majority of these car parking bays to be removed and verges and footpath alignments reinstated to serve the new residential lots. Original car bays closer to the POS, or adjacent to the proposed laneway lots may be retained where practical, and on the basis of not impacting garage access or driveways/crossovers to any new lots.

3.4.4 Pedestrian and Cycle Network

The proposed 'permeable grid' road network creates an excellent opportunity for the provision of accessible and permeable pedestrian and cyclist amenities, providing connection to the existing networks and maximising active transport both internal and external to the Structure Plan area.

Pedestrian footpaths will be distributed throughout the Structure Plan area as depicted in **Figure 10**. The path network provides for a legible and accessible network of pedestrian footpaths to the POS and the nearby *Neighbourhood Centre*.

All roads will have a footpath or shared path on at least one verge throughout the Structure Plan area.

3.4.5 Public Transport

Two bus routes currently operate along MacNaughton Crescent. Routes 473 and 474 provide connections to Butler and Joondalup railway stations. These bus routes also pass by Currambine station. However, the services do not provide a good level of accessibility to Currambine station due to the need to cross Burns Beach Road. Based on the current Public Transport Authority timetable there is one bus per hour during peak periods and thus bus services provided are not convenient for commuter use.

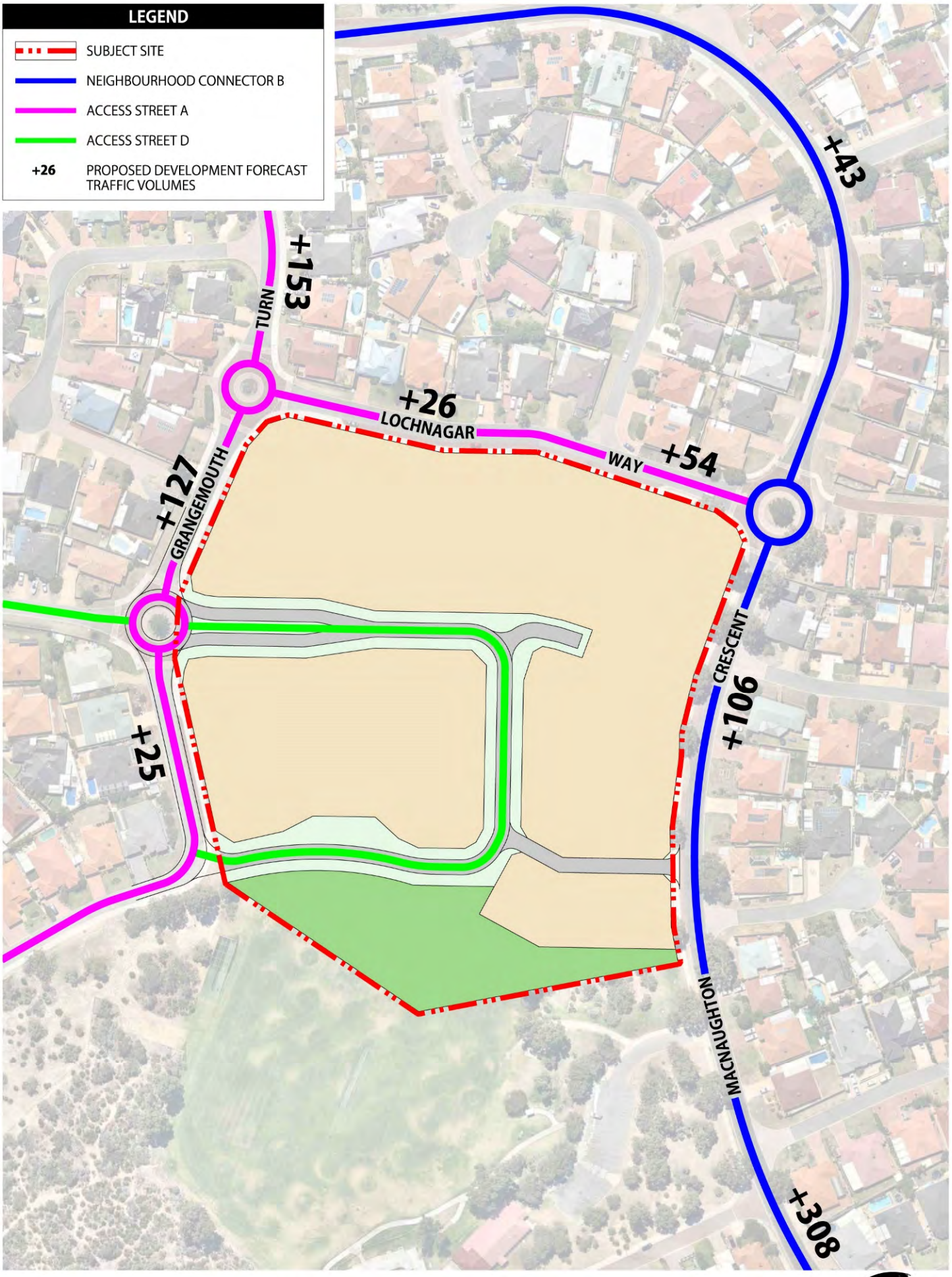

FIGURE 7 - ROAD HIERARCHY

Lot 9021 MacNaughton Crescent, KINROSS

NORTH

0 20 40 60m

Scale: 1:2000@A4 Date: 04/05/2016 Plan: PACBB-5-015A

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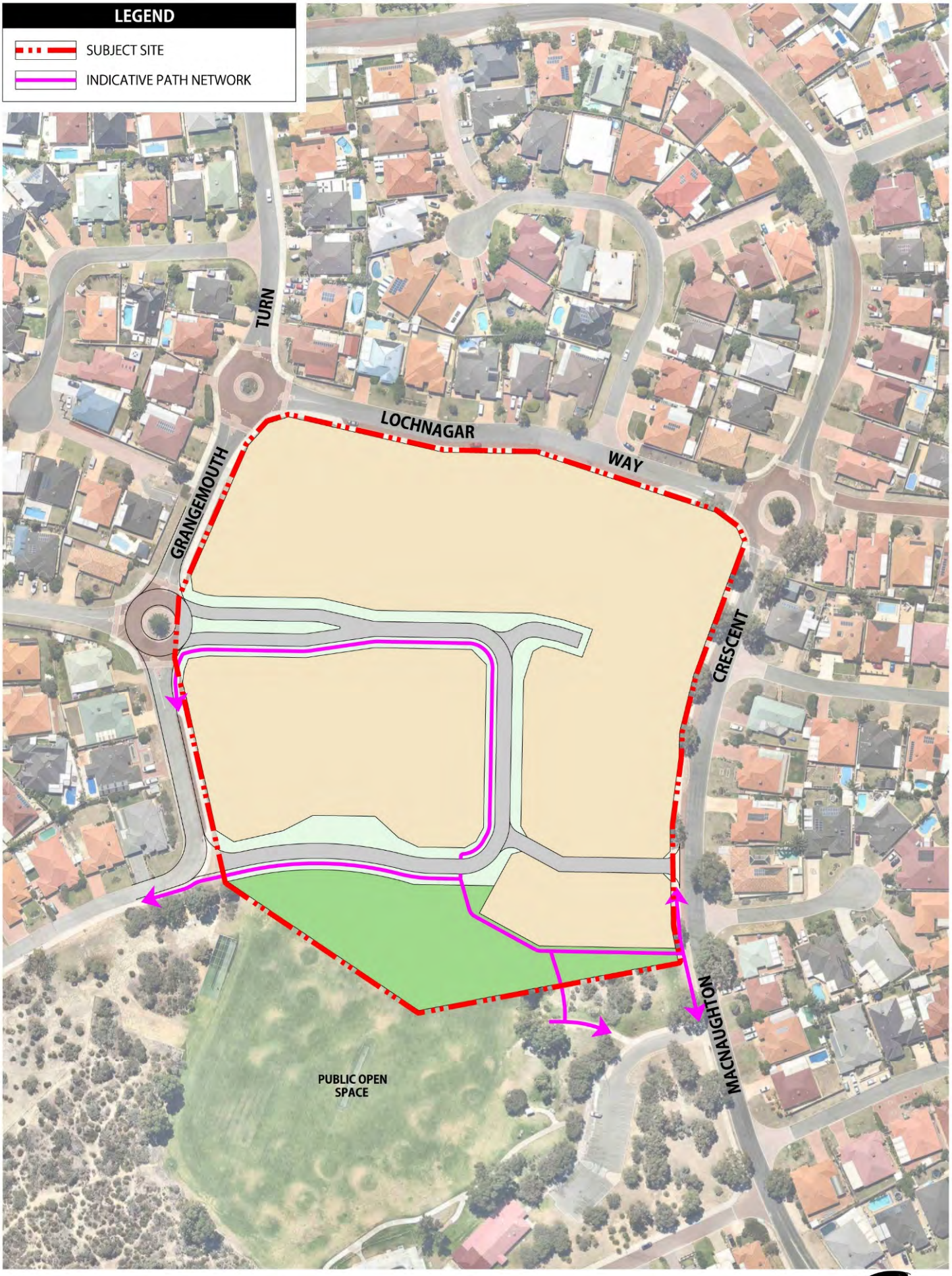

FIGURE 10 - INDICATIVE PATH NETWORK

Lot 9021 MacNaughton Crescent, KINROSS

NORTH

0 20 40 60m

Scale: 1:2000@A4 Date: 04/05/2016 Plan: PACBB-5-014A

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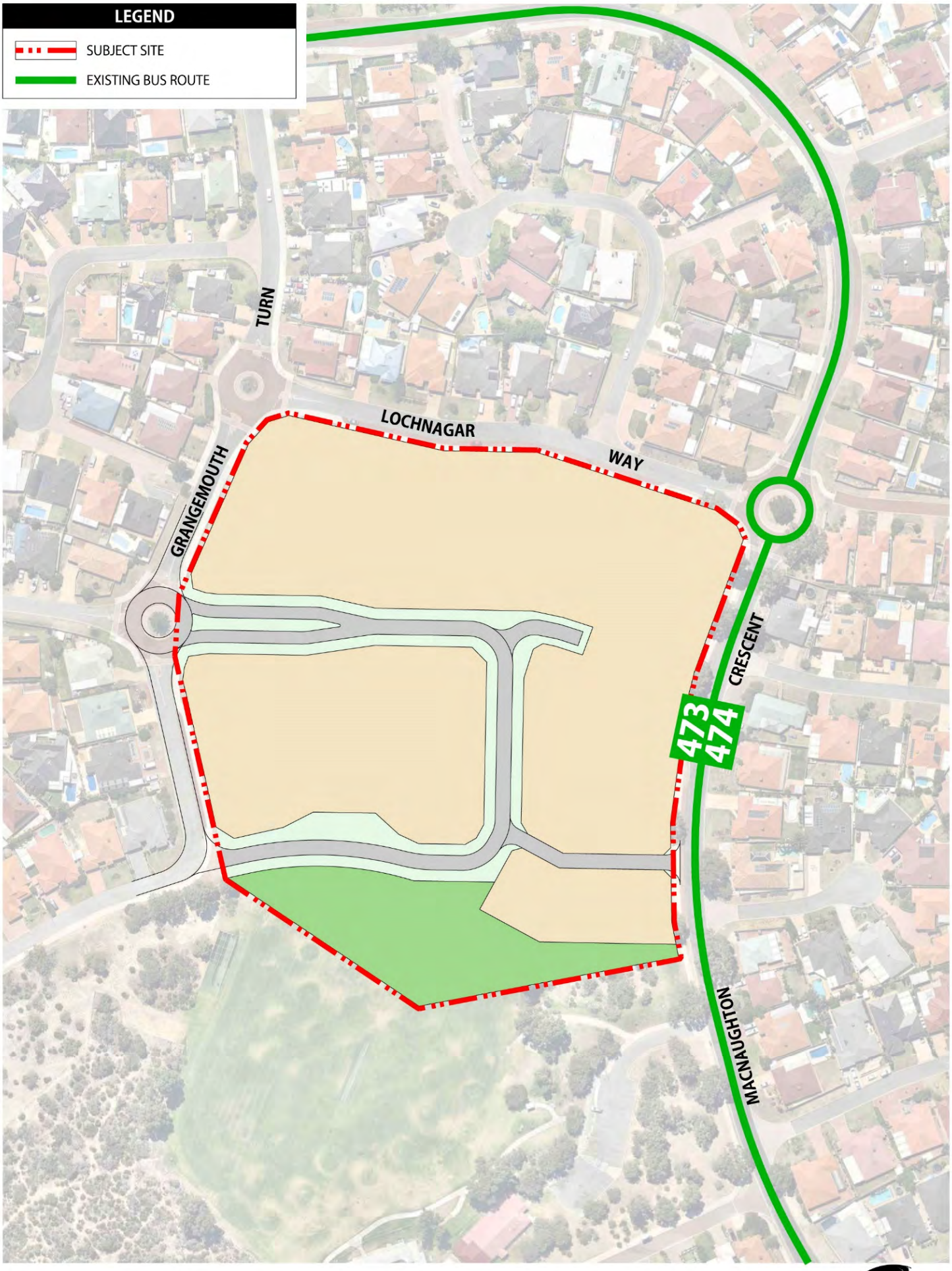

FIGURE 11 - EXISTING BUS ROUTE

Lot 9021 MacNaughton Crescent, KINROSS

NORTH

0 20 40 60m

Scale: 1:2000@A4 Date: 04/05/2016 Plan: PACBB-5-016A

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3.5 Water Management

A Local Water Management Strategy (LWMS) has been prepared in consideration of the objectives and principles detailed in *Better Urban Water Management* (WAPC 2008) (refer **Part Two - Appendix 6**). The LWMS is based on the following objectives:

- Provide a broad level stormwater management framework to support future urban development.
- Incorporate appropriate best management practices into the drainage system that address the environmental and stormwater management issues identified.
- Minimise development construction costs, which will result in reduced land costs for future home owners.
- Minimise ongoing operation and maintenance costs for the land owners and City of Joondalup.
- Develop a water supply and conservation strategy for the site that will aim to meet water use targets.
- Protect water quality to the underlying aquifer.
- Protect existing and proposed residences from flood risk.
- Gain support from Department of Water and City of Joondalup for the proposed method to manage stormwater within the site and potential impacts on downstream areas.

Detailed objectives for water management within the site are further discussed within Section 4 of **Part Two - Appendix 6**.

An Urban Water Management Plan (UWMP) will be required at subdivision stage, in order to address WAPC's standard model subdivision condition D2 (WAPC 2012) which states:

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

3.6 Infrastructure Co-ordination and Servicing

3.6.1 Roads

All internal roads will be constructed to City of Joondalup standards. Existing car parking embayment's, installed for the previously intended school in MacNaughton Crescent, Lochnagar Way and Grangemouth Turn will be removed as part of the future subdivision works, however the existing bus bay in MacNaughton Crescent would remain in place.

3.6.2 Sewerage

The Structure Plan area is located within, and will be connected to, the Water Corporation gravity sewer network. There is capacity within the existing system to accommodate residential development of the site.

3.6.3 Drainage and Stormwater Management

The Structure Plan area is located within the Lochy Close sump catchment of the greater City of Joondalup drainage network, as shown in the existing network construction designs and plans provided in Appendix C of the Local Water Management Strategy (LWMS) contained within **Part Two – Appendix 6**.

Surface runoff from the catchment that is not retained at source is discharged to the Lochy Close drainage sump, located approximately 250 metres north of the Structure Plan area. Runoff is conveyed to the sump either via the piped drainage network (flows up to the 5 year ARI event) or via overland flow within the road network.

The Lochy sump has been designed to retain 100 year ARI, 24 hour duration event runoff from the impermeable contributing area and has a total storage capacity of 14,600 m^3.

The Structure Plan area was allowed for in the design of Lochy Sump however it is unclear how much impermeable area from the site was included in the calculations. A 375 mm connection pipe exists at the proposed main entry road to the Structure Plan area from Grangemouth Turn, opposite Ossian Way. Advice from the City of Joondalup has confirmed that flows equivalent to 67% of the capacity of a 300 mm pipe can be assumed at this location. This equates to 0.08 m3/s. No other connections to the local pipe network have been provided for the Structure Plan area.

3.6.5 Power

The Structure Plan area is surrounded with existing Western Power infrastructure serving the adjoining area. The Structure Plan area has two existing transformers, a 315kVA transformer located on MacNaughton Crescent in the northwest portion of the site and a 500kVA transformer located on Grangemouth Turn in the northeast corner of the site.

Western Power has been requested to provide a design information pack and load logs for the transformers to review capacity within existing transformers to serve the proposed development. Based on their size and surrounding development it is expected that at least one (possibly both) of the existing transformers will need to be upgraded to service the Structure Plan area.

3.6.6 Telephone and NBN

Telstra infrastructure current exists around the Structure Plan area. There are two existing Telstra manholes and pillars, the first is located along Lochnager Way in the north-western corner of the Structure Plan area, and the second along MacNaughton Crescent in the south eastern portion of the Structure Plan area. Further discussion is required with Telstra to confirm if these locations are to be relocated/removed.

Due to the development size it doesn't meet NBN requirements for Brownfield developments and therefore an extension of the Telstra network would be proposed.

3.6.7 Water Supply

Water Corporation has provided preliminary advice that at R20/R25 zoning there is sufficient capacity in the surrounding water reticulation network to service the site.

3.6.8 Gas

Gas services are located in the adjacent development and have sufficient capacity to serve the area with minimal augmentation.

3.6.9 Earthworks and Retaining

Preliminary assessment of subdivision earthworks suggests that the steep topography rising from Lochnagar Way and Grangemouth Turn will warrant retaining walls potentially up to 4.0 metres in height; this to the rear (southern boundary) of the Lochnagar Way frontage lots.

The higher retaining walls in this section of the Structure Plan area will alleviate the extent of retaining wall heights and linear amount throughout the remainder of the site.

This is particularly beneficial for those lots on an east-west alignment and requiring retaining to the side boundaries; recognising the impact of side retaining is greater on house construction standards (footings) as well as overshadowing and associated amenity.

The extent of earthworks and retaining wall design will be reviewed at the detailed subdivision and engineering design phases. Indicative retaining and lot levels have been provided under Appendix E of the Local Water Management Strategy (**Appendix 6** refers). This earthwork plan is intended to be a guide only for Structure Plan purposes; the future subdivision design subject to an agreed lot yield and mix by the developer.

A Building Permit application is required to be submitted to the Local Authority for all retaining walls, consistent with an approved subdivision layout and final earthworks plan.

FIGURE 12 - MASTER PLAN

Lot 9021 MacNaughton Crescent, KINROSS

A Peet Project

NORTH

0 10 20 30m

Scale: 1:1200@A3
Date: 04/05/2016
Plan: PACBB-6-002A

A 28 Brown St, East Perth WA 6004
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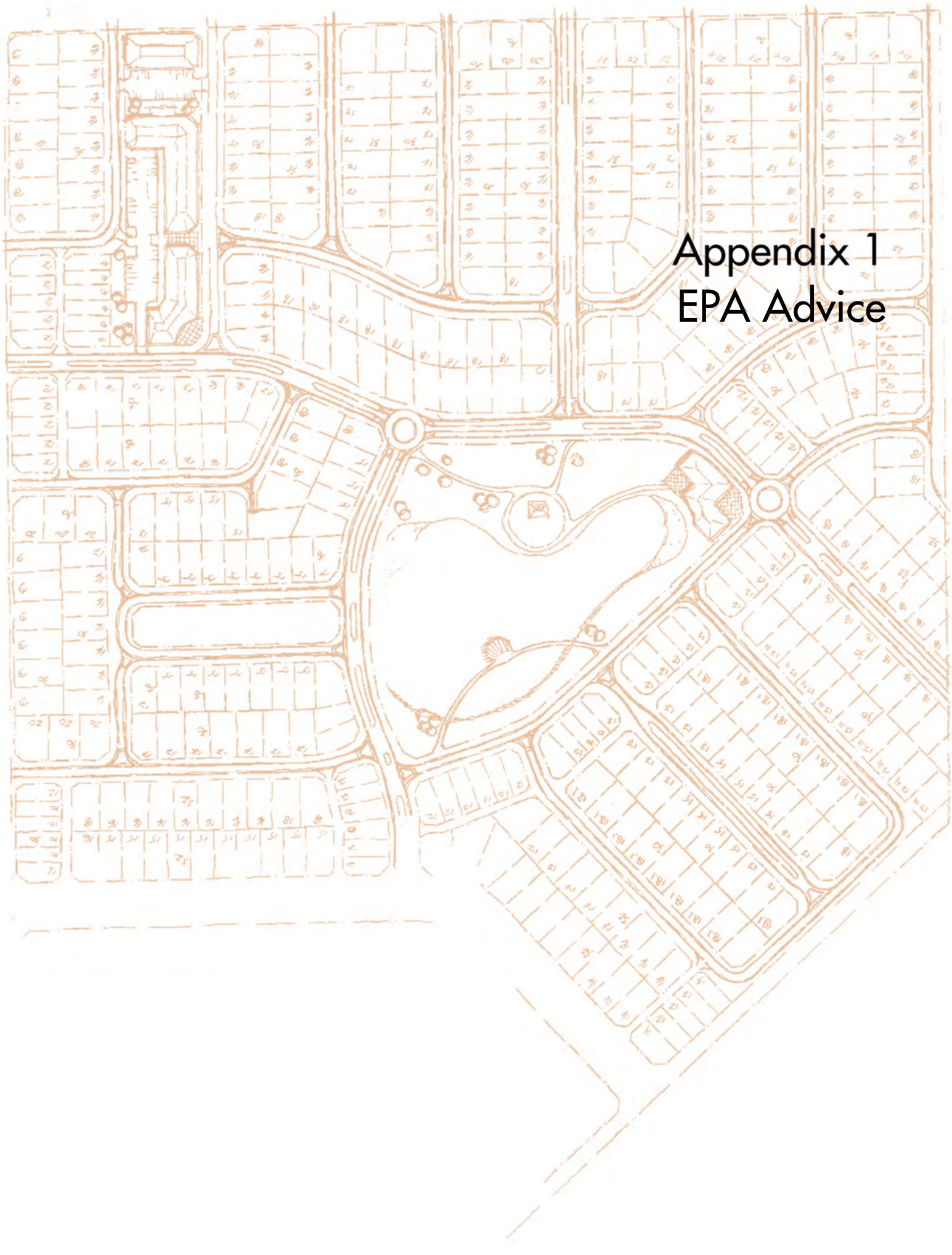
E info@creativedp.com.au
W creativedp.com.au

Creative DESIGN + PLANNING

4 Technical Studies (Appendices) Index

Ref	Appendix	Assessing Agency	Approval Status
1	EPA Advice	-	-
2	Certificate of Title	-	-
3	Environmental Assessment and Management Strategy *Emerge Associates*	Department of Environment Regulation	-
3a	Tree Retention Study *Emerge Associates + Abor Logic*	Department of Planning	
4	Traffic Assessment Report *Riley Consulting*	Department of Planning	-
5	Community Engagement Report *Creating Communities*	Department of Planning	-
6	Local Water Management Strategy *Emerge Associates*	Department of Water	-



Appendix 1
EPA Advice

Chief Executive Officer
City of Joondalup
PO Box 21
JOONDALUP WA 6919

Your Ref 103935
Our Ref 14-801096
Enquiries Angela Coletti
Phone 6145 0806

Attn: Brian Gray

Dear Sir/Madam

DECISION UNDER SECTION 48A(1)(a)
Environmental Protection Act 1986

SCHEME AMENDMENT TITLE:	**City of Joondalup District Planning Scheme 2 Amendment 74 - Zoning to Urban Development**
LOCATION:	**Lot 9021 (3) Lochnagar Way, Kinross**
RESPONSIBLE AUTHORITY:	**City of Joondalup**
DECISION:	**Scheme Amendment Not Assessed – Advice Given (no appeals)**

Thank you for referring the above scheme amendment to the Environmental Protection Authority (EPA).

After consideration of the information provided by you, the Environmental Protection Authority (EPA) considers that the proposed scheme amendment should not be assessed under Part IV Division 3 of the *Environmental Protection Act 1986* (EP Act) but nevertheless provides the following advice and recommendations.

ADVICE AND RECOMMENDATIONS

1. Environmental Issues

- Flora and Vegetation

2. Advice and recommendations regarding Environmental Issues

The EPA's records indicate that the vegetation within the amendment area may provide habitat for Carnaby's black cockatoo. Carnaby's black cockatoos are protected under both the *Wildlife Conservation Act 1950* and *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

The EPA expects that habitat trees within the amendment area be retained as part of the detailed design of the structure plan. Scheme provisions and subdivision conditions requiring the retention of habitat trees to the satisfaction of the Department of Parks and Wildlife and other relevant agencies are recommended.

The landowner should be made aware of the requirement under the EPBC Act to refer a proposal to the Commonwealth Department of Sustainability, Environment, Water, Population and Communities if a proposal is likely to impact on matters of national environmental significance.

3. General Advice

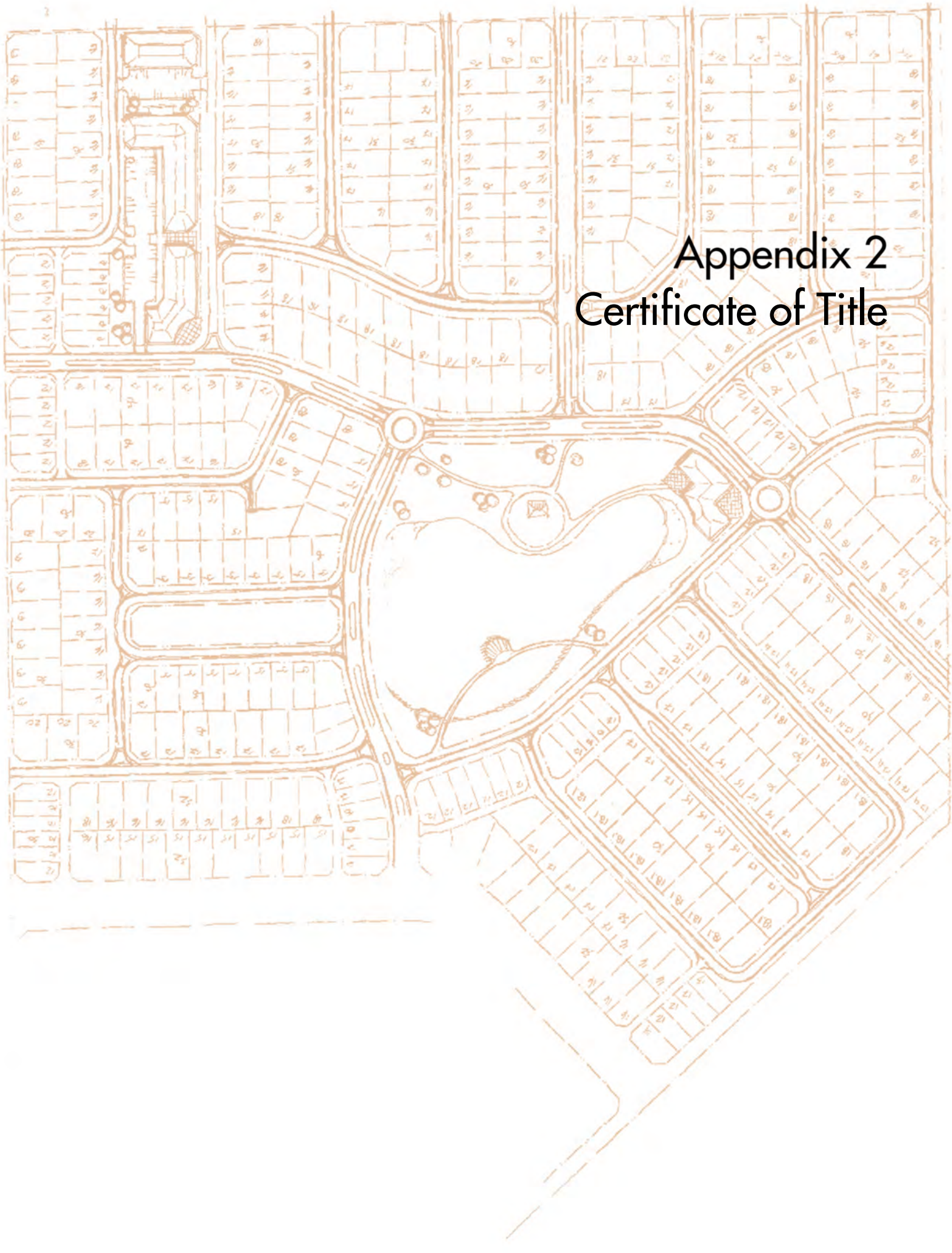
- For the purposes of Part IV of the EP Act, the scheme amendment is defined as an assessed scheme amendment. In relation to the implementation of the scheme amendment, please note the requirements of Part IV Division 4 of the EP Act.
- There is no appeal right in respect of the EPA's decision on the level of assessment of scheme amendments.
- A copy of this advice will be sent to relevant authorities and made available to the public on request.

Yours faithfully

Darren Foster
Director
Strategic Policy and Planning Division

3 June 2014

Appendix 2
Certificate of Title



WESTERN AUSTRALIA

REGISTER NUMBER	
9021/DP38409	
DUPLICATE EDITION	DATE DUPLICATE ISSUED
2	2/4/2009

RECORD OF CERTIFICATE OF TITLE

VOLUME 2591 FOLIO 875

UNDER THE TRANSFER OF LAND ACT 1893

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

REGISTRAR OF TITLES

REGISTRAR OF TITLES WESTERN AUSTRALIA

LAND DESCRIPTION:

LOT 9021 ON DEPOSITED PLAN 38409

REGISTERED PROPRIETOR:
(FIRST SCHEDULE)

PEET LTD OF LEVEL 7, 200 ST GEORGES TERRACE, PERTH
(AN K889357) REGISTERED 24 MARCH 2009

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

1. EXCEPT AND RESERVING METALS, MINERALS, GEMS AND MINERAL OIL SPECIFIED IN TRANSFER 7033/1940.
2. *H904959 CAVEAT BY WESTERN AUSTRALIAN PLANNING COMMISSION LODGED 22.10.2001.

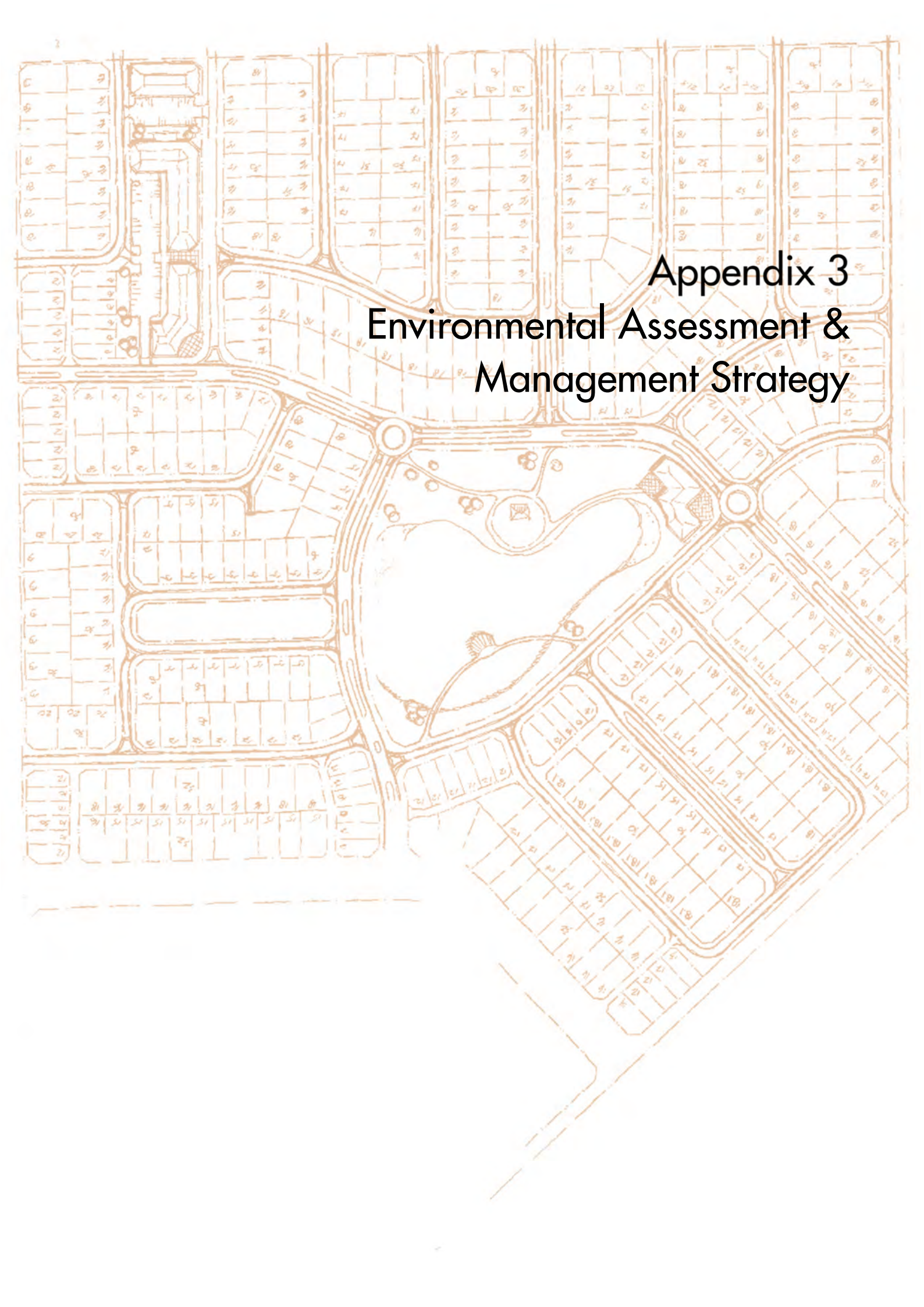
Warning: A current search of the sketch of the land should be obtained where detail of position, dimensions or area of the lot is required.
* Any entries preceded by an asterisk may not appear on the current edition of the duplicate certificate of title.
Lot as described in the land description may be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

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

STATEMENTS:

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

SKETCH OF LAND:	DP38409.
PREVIOUS TITLE:	2565-138.
PROPERTY STREET ADDRESS:	NO STREET ADDRESS INFORMATION AVAILABLE.
LOCAL GOVERNMENT AREA:	CITY OF JOONDALUP.



Appendix 3
Environmental Assessment & Management Strategy

ENVIRONMENTAL ASSESSMENT & MANAGEMENT STRATEGY

LOT 9021 MACNAUGHTON CRESCENT LOCAL STRUCTURE PLAN, KINROSS

Project Number EP15-017

Prepared for Peet Ltd.
March 2017

Document Control

DOC NAME	LOT 9021 MACNAUGHTON CRESCENT LOCAL STRUCTURE PLAN, KINROSS – ENVIRONMENTAL ASSESSMENT & MANAGEMENT STRATEGY				
DOC NO.	EP15-017(02)—002A				
REVISION	DATE	AUTHOR		REVIEWER	
1	July 2015	Anle Tieu	AT	Kirsten Knox	KK
	For Issue to Client				
A	October 2015	Anle Tieu	AT	Jen Longstaff	JL
	Updated after comments from CoJ				
B	March 2017	Carli Turner	CJT	Jen Longstaff	JL
	Updated to remove references to bushfire after comments from WAPC				

Executive Summary

Emerge Associates (Emerge) were engaged by Peet Limited (Peet) to provide a suite of environmental services to support the preparation of a Local Structure Plan (LSP) for Lot 9021 MacNaughton Crescent, Kinross herein referred to as "the site". This has included numerous investigations to identify and assess the environmental attributes and values that are present within the site and are considered relevant for the local structure planning process.

The site is approximately 4.02 hectares (ha) and is located within a well-established residential suburb of Kinross. The site is currently zoned "Urban" under the Metropolitan Region Scheme (MRS) and "Urban Development" under the City of Joondalup District Planning Scheme No. 2.

The environmental attributes and values identified within the site have been outlined in **Section 2** and include:

- The site has been historically cleared for agricultural purposes resulting in disturbed and fragmented remnant woodland vegetation remaining within the site.
- There are no Threatened or Priority Flora species or Threatened Ecological Communities within the site.
- The condition of remnant vegetation ranged from "Completely Degraded" to "Good".
- No Bush Forever sites, Environmental Sensitive Areas, biodiversity linkages or Local Natural Areas have been identified within the site.
- No evidence of foraging, roosting or breeding by threatened black cockatoo species was observed within the site. Two plant communities identified within the site contain plant species known to provide foraging habitat for Carnaby's black cockatoo (*Calyptorhynchus latirostris*). However given the small size and fragmented areas of the remnant vegetation and its condition, the majority of which is mainly in "Completely Degraded" and "Degraded" condition with some areas in "Good" condition is not considered to represent quality black cockatoo foraging habitat. Five tuart and one jarrah tree have been identified as meeting the criteria for potential roosting and breeding habitat, however only the jarrah tree contained a hollow considered suitable for nesting.
- The sands within the site are likely to be highly permeable and it is likely that surface water is largely retained and infiltrated within the site.
- The topography ranges between 29 m Australian Height Datum (AHD) to 36 m AHD. The historical maximum groundwater level (MGL) is approximately 3.5 m AHD with the depth to groundwater ranging between 25.5 m and 32.5 m.

The proposed LSP (as shown in **Figure 9**) has responded to the environmental values and attributes of the site and are discussed further in **Section 4** of this document. Specifically the LSP has responded to the environmental values and attributes of the site through spatial provisions for the:

- Retention of selected trees and vegetation which have the potential foraging, breeding and nesting habitat for Carnaby's black cockatoo where possible, within road reserves and public open space (POS). The retention of trees and vegetation will depend on finished ground levels and drainage requirements within the site.
- Surface water will be managed by the existing drainage network and catchments located within POS.
- Water quality will be addressed using a treatment train approach, which incorporates lot scale retention, a bio-retention area (BRA) within POS (for minor rainfall events) and flood storage

area (FSA) (for major rainfall events) from road catchments that are not connected to the existing drainage network.

An Urban Water Management Plan will be prepared to address water management for each stage of subdivision.

These mechanisms will ensure that the future development of site will not significantly impact on the environmental values and attributes of the site and demonstrates that an appropriate planning and development framework exists to respond to, and manage, the environment.

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Appendices

Appendix A
EPA Assessment of MRS Amendment

Appendix B
Flora and vegetation Survey

1 Introduction

1.1 Background

Peet Limited (Peet) own Lot 9021 MacNaughton Crescent, Kinross, located in the City of Joondalup and herein referred to as "the site". The site is also known and recognised as Lot 9021 Lochnager Way by the City of Joondalup. Creative Design and Planning have prepared a Local Structure Plan (LSP) for the site on behalf of Peet to facilitate the future subdivision and development of the site for residential purposes.

The site is approximately 4.02 hectares (ha) and is located approximately 32 km north of the Perth Central Business District (CBD) within a well-established residential area. The location of the site is shown in **Figure 1**.

The site is currently zoned "Urban Development" under the City of Joondalup District Planning Scheme No. 2 (DPS No. 2) and "Urban" under the Metropolitan Region Scheme (MRS). In accordance with the City of Joondalup DPS No. 2, the preparation of a LSP is required to facilitate urban development over the site.

1.2 Purpose of this report

This report provides a synthesis of information utilised by Emerge to understand the environmental attributes and values of the site. It is based on a range of information sources including local and regional reports, databases and publically available mapping, and where existing or required, site specific investigations. Together, this information has been used to inform the layout of the LSP and the preparation of the LSP supporting documentation for the site.

Specifically, this Environmental Assessment and Management Strategy (EAMS) provides a summary of the environmental attributes and values found within the site and addresses the proposed development of the site as defined by the LSP. It specifies the environmental management framework for the future subdivision and development process.

The EAMS is the key supporting environmental document for the LSP process, to ultimately facilitate the consideration of any environmental issues by the various state government agencies and authorities. It is consistent with the Environmental Protection Authority's (EPA) current *Guidance Statement No. 33 Environmental Guidance for Planning and Development and the Structure Plan Preparation Guidelines* (WAPC 2012a) and includes:

- Identification of significant environmental features (**Section 2**).
- Management strategies specific to each environmental feature within the LSP area (**Section 5**).
- Opportunities for enhancement of the environmental features and issues to address at later stages of development (**Section 5**).

1.3 Scope of work

Emerge have been engaged to provide a suite of environmental consultancy services to support the preparation of the LSP for the site. This has included a review of existing information and a number of investigations to identify and assess the environmental attributes and values present within the site.

To date, services provided include:

- A level 1 flora and vegetation survey.
- A Local Water Management Strategy (LWMS) (Emerge Associates 2015).
- An Environmental Assessment and Management Strategy (this document.

1.4 Historic planning and environmental assessment context

The site is currently located within a well-established residential area of Kinross. The site was set aside for a future primary school as part of structure planning for the Kinross locality in the early 1990's. It was reserved as "Public Use" under City of Joondalup DPS No. 2, but has remained undeveloped.

In 1999, an application to subdivide the northwest portion of the site was lodged with conditional Western Australian Planning Commission (WAPC) subdivision approval provided by the WAPC. This portion of the site was subsequently zoned "Residential" under City of Joondalup DPS No. 2 but the subdivision approval was never enacted upon. The Department of Education subsequently determined that the remainder of the site would not be required for a primary school.

On the 15th April 2014, a scheme amendment (Scheme Amendment No. 74) was brought to the City of Joondalup Council for consideration. The amendment proposed to remove the "Public use" reservation and "Residential" zoning from the site and rezone the entire site to "Urban Development" and change the density code of the site from R20 to un-coded.

The proposed amendment was referred to the Environmental Protection Authority (EPA) for comment. On the 3rd June, 2014, the EPA determined that a formal environmental review was not required but provided comments regarding flora and vegetation and specifically referred to the consideration of habitat for Carnaby's black cockatoo and the retention of habitat trees. A copy of the EPA advice has been provided in

Appendix A. Subsequently, the proposed amendment was advertised for public comment.

On the 16th September 2014, following the public consultation process, the City of Joondalup Council considered and recommended that the proposed amendment be adopted and be submitted to the WAPC for determination by the Minister of Planning.

On the 30th January, 2015, Scheme Amendment No 74 was formally adopted to the City of Joondalup DPS No.2.

2 Description of the Existing Environment

2.1 Local context

The site is approximately 4.02 ha in size and is found within the locality of Kinross, within the City of Joondalup, approximately 32km south of Perth CBD as shown in **Figure 1**. The site is located in a developed residential area and is bound by Grangemouth Turn to the west, Lochnagar Way to the north and MacNaughton Crescent to the east. The southern boundary of the site interfaces MacNaughton Park and further south is the Kinross Central Shopping Centre, as shown in **Figure 2**. The current MRS zoning of the site and its surroundings is shown in **Figure 3**.

2.2 Climate

The climate of the site (which applies to the broader south west region of Western Australia) is described as Mediterranean with hot, dry summers and moderately wet, mild winters. The majority of rainfall within the region occurs between May and October each year, and on average is between 600 to 1000 mm per year. However, in the last 40 years there has been a marked decrease in rainfall (between 10 to 15% decrease), with a noticeable shift to a drier climate across the south west of Western Australia (CSIRO 2009).

The closest inland weather station to the site is located approximately 32 km to the south. Average climate statistics recorded at the Perth Metro station between 1993 to 2014 (Bureau of Meteorology 2015) is summarised in **Table 1** below.

Table 1: Rainfall and temperature averages for the Perth Metro weather station (1993– 2014) (BoM 2015)

STATISTICS	J	F	M	A	M	J	J	A	S	O	N	D
Mean Maximum Temperature (°C)	31.2	31.7	29.6	25.9	22.4	19.3	18.4	18.1	20.3	23.3	26.5	29.1
Mean Minimum Temperature (°C)	18.1	18.4	16.6	13.8	10.6	8.5	7.6	8.3	9.6	11.4	14.2	16.4
Mean Rainfall (mm)	15.4	8.8	20.5	35.7	90.5	127.9	146.7	122.8	89.6	39.5	23.8	9.9

2.3 Landforms and soils

2.3.1 Topography

The topography of the site is varied and is comprised of a flat area within the southern portion of the site which then slopes from the southeast down towards the northwest. The highest point within the southeast portion of the site is at 35 m Australian Height Datum (AHD) and declines to 27 mADH in the northwest portion of the site. The site has a north westerly aspect.

Topographic contours across the site are shown in **Figure 4**.

2.3.2 Regional geomorphology

The site is located on the Swan Coastal Plain, which forms the central portion of the Perth basin. The Perth basin extends from the Darling Fault in the east to the continental slope west of Rottnest Island, and from the Murchison River in the north and the Southern Ocean in the south. The Perth basin is sedimentary in original and is marginal to the west of the Australian Shield (Seddon 2004).

The Swan Coastal Plain is generally flat and is approximately 20 to 30 km wide, consisting of a series of geomorphic entities running parallel to the coastline. The youngest and most western of these geomorphic entities is the Quindalup Dunes, followed by the Spearwood Dunes and at the most eastern extent the Bassendean Dunes. The site is situated within the Spearwood Dunes system.

2.3.3 Landform and soils

Landform and soil mapping prepared by Churchward and MacArthur (1980) indicates that the site is representative of the "Cottesloe" unit, which is broadly described as "low hilly landscape with shallow brown sands over limestone; much exposed limestone."

Environmental geology (surface soils) across the site has been mapped by the Geological Survey of Western Australia (Gozzard 1986). The majority of the site consists of limestone with sand along the western portion of the site as shown in **Figure 5**. The geological units are listed in **Table 2** below.

Table 2: Geological units located within the site.

GEOLOGICAL UNIT	DESCRIPTION
LS1- Limestone	Light yellowish brown, fine to coarse-grained, sub-angular to well rounded, quartz.
S7- Sand	White to pale yellowish brown and olive-yellow, medium- to coarse-grained, sub-angular quartz with some trace of feldspar, moderately sorted, of residual origin.

2.3.4 Acid Sulfate Soils

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

Mapping prepared by the WA Department of Environment and Regulation (DER) (formerly Department of Environment and Conservation) to support the WAPC's *Bulletin No. 64: Acid Sulfate Soils* (WAPC 2009) provides broad-scale mapping indicating areas of potential ASS risk. The mapping indicates that the site has been classified as having "no known risk of ASS".

2.4 Biodiversity and natural assets

2.4.1 Flora and vegetation

A Level 1 flora and vegetation survey was undertaken by a botanist and environmental consultant from Emerge on 27 March 2015. As part of the survey, trees that could be used as potential black cockatoo breeding habitat and plant species that could be used for foraging by black cockatoo species were also recorded. The flora and vegetation survey is provided in **Appendix B**.

2.4.1.1 Regional vegetation context

Regional vegetation mapping undertaken by Heddle *et al* (1980) indicates that the site was originally composed primarily of the "Cottesloe Complex - Central and South" vegetation complex which is described as mosaic of woodland of *Eucalyptus gomphocephala* and open forest of *E. gomphocephala - E. marginata - E. calophylla*; closed heath on the limestone outcrops.

2.4.1.2 Significant flora

Species of flora acquire Threatened ("Declared Rare") Flora (TF) or Priority Flora (PF) conservation status where populations are restricted geographically or threatened by local processes. The Department of Parks and Wildlife (DPaW) recognises these threats and subsequently applies regulations towards population protection and species conservation. DPaW enforces regulations under the WC Act to conserve TF species and protect significant populations. PF species are potentially rare or threatened, however are not under direct statutory protection. The definition and categories of TF and PF species are listed in **Table 3**.

Table 3: Definitions of Threatened ("Declared Rare") and Priority Flora species (Smith 2010).

CONSERVATION CODE	CATEGORY
T	**Threatened Flora – Extant Taxa** Taxa which have been adequately searched for and are deemed to be in the wild either rare, in danger of extinction, or otherwise in need of special protection, and have been gazetted as such.
X	**Threatened Flora – Presumed Extinct Taxa** Taxa which have not been collected, or otherwise verified, over the past 50 years despite thorough searching, or of which all known wild populations have been destroyed more recently, and have been gazetted as such.
P1	**Priority One – Poorly Known Taxa** Taxa which are known from one or a few (generally <5) populations which are under threat, either due to small population size, or being on lands under immediate threat e.g. road verges, urban areas, farmland, active mineral leases etc, or the plants are under threat, e.g. from disease, grazing by feral animals etc. May include taxa with threatened populations on protected lands. Such taxa are under consideration for declaration as 'rare flora', but are in urgent need of further survey.
P2	**Priority Two – Poorly Known Taxa** Taxa which are known from one or a few (generally <5) populations, at least some of which are not believed to be under immediate threat (i.e. not currently endangered). Such taxa are under consideration for declaration as 'rare flora', but urgently need further survey.
P3	**Priority Three – Poorly Known Taxa** Taxa which are known from several populations, and the taxa are not believed to be under immediate threat (i.e. not currently endangered), either due to the number of known populations (generally >5), or known populations being large, and either widespread or protected. Such taxa are under consideration

	for declaration as 'rare flora' but needs further survey.
P4	**Priority Four – Rare Taxa** Taxa which are considered to have been adequately surveyed and which, whilst being rare (in Australia), are not currently threatened by any identifiable factors. These taxa require monitoring every 5-10 years.

The Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) promotes the conservation of biodiversity by providing statutory protection for plants at a species level. Some DRF species listed under the WC Act are also listed at a Federal level. Section 178 and 179 of the EPBC Act provides for the lists and categories of threatened species under the Act.

A review of the NatureMap list of flora species occurring within 5 km of the site indicates that a number of Threatened and Priority Flora species may potentially be present within the wider region of the site including; *Marianthus paralius* (T), *Conostylis bracteata* (P3), *Grevillea* sp. Ocean Reef (D. Pike Joon 4) (P1), *Hibbertia spicata* subsp. *leptotheca* (P3), *Jacksonia sericea* (P4), *Leucopogon maritimus* (P1), *Pimelea calcicola* (P3) and *Sarcozona bicarinata* (P3). However it should be noted that *Conostylis bracteata* (P3) and *Jacksonia sericea* (P4), are the only species of those listed above, that could occur within the site given their habitat preferences and the site conditions.

Conostylis bracteata (P3) and *Jacksonia sericea* (P4) are perennial and thus would have been detectable at the time of the March survey, however none of these species were recorded within the site. During the survey, it was noted that the northeastern portion of the site was recently burnt with many native species showing vigorous regeneration however neither species was identified within this area and as neither species was identified elsewhere onsite, or has been previously recorded it is therefore unlikely that *Conostylis bracteata* and *Jacksonia sericea* occurs within the burnt portions of the site. No other Threatened or Priority Flora species are considered likely to occur within the site as they are generally found in coastal habitats where limestone outcropping is present (FloraBase 2015).

2.4.1.3 Vegetation communities

Based on the Level 1 flora and vegetation survey, the site was found to contain two native plant communities as shown on **Figure 6** and described below:

- BXpHh - Isolated *Nuytsia floribunda* trees over low open woodland to low woodland of *Banksia attenuata* and *Banksia menziesii* over open shrubland to tall open shrubland of *Xanthorrhoea preissii, Banksia sessilis* and *Hakea trifurcata* over low shrubland of *Hibbertia hypericoides* over open sedgeland of *Mesomelaena pseudostygia* and open grassland to grassland of grass weed species (shown in **Plate 1**).
- EBHh - Low woodland of *Eucalyptus marginata*, *Eucalyptus todtiana*, *Nuytsia floribunda* and *Banksia* spp over tall open shrubland of *Xanthorrhoea preissii* over low shrubland of *Hibbertia hypericoides* over open sedge/rushland of *Mesomelaena pseudostygia* and *Desmocladus flexuosus* and open grassland of grass weed species (shown in **Plate 2**).

The remainder of the site contained isolated native species over weeds or bare ground (shown in **Plate 1**), while a portion of the southern extent of the site contained turf. These areas are described as Parkland Cleared/Cleared.

Plate 1: Bare ground (foreground) and plant community BXpHh community (background)

Plate 2: Plant community EBHh

2.4.1.4 Vegetation condition

The vegetation condition was rated according to Keighery (1994), a vegetation condition scale commonly used in the Perth Metropolitan Region. The categories are listed and defined in **Table 4**.

Table 4: Vegetation condition scale (Keighery 1994).

VEGETATION CONDITION	DEFINITION
Pristine	Pristine or nearly so, no obvious signs of disturbance.
Excellent	Vegetation structure intact, disturbance affecting individual species and weeds are non-aggressive species.
Very Good	Vegetation structure altered obvious signs of disturbance. For example, disturbance to vegetation structure caused by repeated fires, the presence of some more aggressive weeds, dieback, logging and grazing.
Good	Vegetation structure significantly altered by very obvious signs of multiple disturbances. Retains basic vegetation structure or ability to regenerate it. For example, disturbance to vegetation structure caused by very frequent fires, the presence of some very aggressive weeds at high density, partial clearing, dieback and grazing.
Degraded	Basic vegetation structure severely impacted by disturbance. Scope for regeneration but not to a state approaching good condition without intensive management. For example, disturbance to vegetation structure caused by very frequent fires, the presence of very aggressive weeds, partial clearing, dieback and grazing.
Completely Degraded	The structure of the vegetation is no longer intact and the area is completely or almost completely without native species. These areas are often described as “parkland cleared” with the flora comprising weed or crop species with isolated native trees or shrubs.

The site contains mainly native vegetation, with obvious signs of vehicle and pedestrian tracks dividing the vegetation into many small patches as shown in **Figure 2**. The patches of native vegetation ranged from “Degraded” to “Good” condition. The areas in “Good” condition contained relatively intact vegetation structure but were subject to weed invasion largely by grass weed species such as **Ehrharta calycina, *Briza maxima* and **Avena barbata*. The southern portion of the site contained managed turf and a number of planted *Eucalyptus gomphocephala* trees. This portion of the site was in “Completely Degraded” condition, along with the tracks and cleared areas intersecting the site. The northeastern portion of the site was noted to have been recently burnt (27th December 2014), however most native species were observed to be resprouting vigorously at the time of the survey. Based on the presence of resprouting native species showing evidence of natural vegetation structure, some areas of burnt vegetation were still considered to be in “Good” condition.

Vegetation condition throughout the site is shown on **Figure 7**.

2.4.1.5 Threatened and/or Priority Ecological Communities

In Western Australia, Threatened Ecological Communities (TECs) are defined by the Western Australian Threatened Ecological Communities Scientific Advisory Committee. Generally these can be described as vegetation communities that are assemblages of species that occur together in a particular type of habitat. They are the sum of species within an ecosystem and, as a whole provide many of the processes which support a specific ecosystem. TECs are recognised as specific ecological communities that are rare or under threat.

TECs are not afforded direct statutory protection at a State level but their significance is acknowledged through other State environmental approval processes (i.e. environmental impact assessment pursuant to Part IV of the *Environmental Protection Act 1986* (EP Act)). Under the State process the DPaW has been identifying and listing TECs since 1994, using a range of definitions to indicate the level of threat to the TEC in question. Specific TECs are also protected under the EPBC Act.

Based on the flora species present within the site, as well as soil and landform characteristics, it is considered that the vegetation is most likely to represent Floristic Community Type (FCT) 28 – "Spearwood *Banksia attenuata* or *Banksia attenuata – Eucalyptus* woodlands" as described by Gibson *et al.* (1994). This FCT is listed as "well reserved" and "low risk" by Gibson *et al.* (1994) and is not listed as a TEC or Priority Ecological Community (PEC) under state or federal lists.

2.4.1.6 Summary

All vegetation within the site has been affected by past disturbances and a high degree of weed invasion is evident throughout the site. The majority of the site is characterised by small fragmented areas of low woodlands ranging in "Degraded" to "Good" condition. The remainder of the site is comprised of informal tracks, large open areas of bare ground and isolated trees in "Completely Degraded" condition.

The flora and vegetation characteristics of the site can be summarised as follows:

- No Threatened or Priority Flora species recorded within the site during the survey.
- No Threatened Flora species are considered likely to occur within the site, however there is a possibility that two Priority Flora species (*Conostylis bracteata* and *Jacksonia sericea*) may occur within the burnt areas, but were undetectable at the time of survey as a result.
- No TECs or PECs are likely to occur within the site. Floristic Community Type (FCT) 28 was identified within the site and is not a TEC or PEC.
- Vegetation condition of remnant vegetation ranged from "Completely Degraded" to "Good".

2.4.2 Bush Forever and conservation reserves

The Government of Western Australia's *Bush Forever Policy* is a strategic plan for conserving regionally significant bushland within the Swan Coastal Plain portion of the Perth Metropolitan Region. The objective of Bush Forever is to protect comprehensive representations of all original ecological communities by targeting a minimum of 10 % of each vegetation complex for protection (Government of Western Australia 2000). Bush Forever Sites are representative of regional ecosystems and habitat and have a key role in the conservation of Perth's biodiversity.

There are no Bush Forever sites within the site. However the site is in close proximity to Bush Forever sites to the north, east and west. The closest Bush Forever site (No. 383) is situated approximately 300 m to the north and 700 m east of the site. Bush Forever site No. 322 is approximately 1.7 km to the east and approximately 600 m northeast of the site as shown in **Figure 8.**

2.4.3 Ecological linkages

The Perth Biodiversity Project's *Local Government Biodiversity Planning Guidelines for the Perth Metropolitan Region* (2004) identifies Regional Ecological Linkages for the Perth Metropolitan Region. These indicative 500 m corridors intend to provide a planning framework to link protected natural areas with other areas of native vegetation within the Perth Metropolitan Region. These in conjunction with the *Local Government Biodiversity Planning Guidelines for the Perth Metropolitan Region*

(WALGA 2004) are intended to provide best practice guidance for local government biodiversity planning.

There are no ecological linkages within the site. The Perth Biodiversity Project (PBP) identifies ecological linkages in close proximity to the site. A Regional Ecological Linkage (Link ID: 10) is aligned 500m to the north of the site and Ecological Linkages 1 and 6 link the Bush Forever sites to the east, north and west of the site. The ecological linkages are shown in **Figure 8**,. Given the largely fragmented and isolated nature of the site, the extent which the site contributes to any ecological linkage is minimal.

2.4.4 Environmentally Sensitive Areas

Environmentally Sensitive Areas (ESAs) are prescribed under the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004* and have been identified to protect native vegetation values of areas surrounding significant, threatened or scheduled flora, vegetation communities or ecosystems. Within an ESA exemptions under the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004* do not apply and the presence of an ESA would indicate that the site is likely to support significant environmental values. However, exemptions under Schedule 6 of the *Environmental Protection Act* 1986 still apply, and this included any clearing in accordance with a subdivision approval under the *Planning and Development Act 2005 (*a recognised exemption under the Schedule 6 of the *Environmental Protection Act* 1986).

There are no ESAs recorded within the site. The extent of declared ESAs within the vicinity of the site are shown in **Figure 8**.

2.4.5 Local Natural Areas

To assist local governments to strategically plan for the retention, protection and management of Perth's biodiversity, local governments were encouraged to prepare a Local Biodiversity Strategy (LBS) which would identify areas of remnant vegetation of local significance (i.e. native species or ecological communities in a relatively natural or intact state). These Local Natural Areas (LNAs), while considered locally significant, are not afforded any formal state of federal protection.

The City of Joondalup has not identified any LNA's or prepared a LBS. However, the City of Joondalup has produced an *Environment Plan* (2014-2019) which identified "natural areas" which aims to maintain and enhance biodiversity values through retention and protection of these areas. Based on mapping from the *Environment Plan* and information provided by the City of Joondalup, a vegetated area of McNaughton Park (McNaughton Park natural area) to the southwest of the site (**Figure 2**) is to be retained and managed for conservation. This area is shown in **Figure 2**.

2.4.6 Terrestrial fauna

The conservation status of fauna species in Western Australia is assessed under the state administered WC Act. The WC Act utilises a set of schedules to protect species and DPaW also produces a list of priority fauna species which while not considered threatened under the WC Act, there is some concern over their long-term survival. As well as those species protected under the WC Act, the Federal government also maintains a list of protected species under the EPBC Act.

Fauna species of conservation significance (State and Federally listed) potentially accessing the site include Baudin's black cockatoo (*Calyptorhynchus baudinii*), Forest red-tailed black cockatoo

(*C. banksii naso*) and Carnaby's black cockatoo (*C. latirostris*)) herein referred to as "black cockatoos" and Quenda (*Isoodon obesulus* subsp. *fusciventer*).

A search of DPaW's Naturemap identified occurrence of Baudin's black cockatoo (*Calyptorhynchus baudinii*), *Calyptorhynchus banksii naso* (Forest Red-tailed cockatoo) and *Calyptorhynchus latirostris* (Carnaby's black cockatoo) near the vicinity of the site. The site contains some vegetation that could be used for foraging and breeding by black cockatoos. As part of the flora and vegetation survey, Emerge assessed the potential for vegetation within the site to provide foraging and breeding habitat for black cockatoos.

The site contains remnant vegetation containing some foraging species for black cockatoos which included *Banksia attenuata, B. menziesii, B. sessilis, Eucalyptus marginata, E. gomphocephala, E. todtiana, Hakea lissocarpha*, *H. trifurcata* and *Xanthorrhoea preissii.* The degree to which each plant species located within the site represents potential foraging habitat for each species varies greatly. Marri and jarrah make up 90% of the diet of the Forest Red-tailed cockatoo (Johnstone and Kirkby 1999). Due to the absence of marri and minimal jarrah trees within the site, it is considered unlikely the Forest Red-tailed cockatoo visit the site to forage. Marri is the primary food source for the Baudin's black cockatoo (Johnstone and Kirby 2008), hence it is also unlikely that the species would visit the site to forage. Carnaby's black cockatoo are known to rely on banksia seeds and pine tree cones as the primary food source. Whilst the site contains remnant vegetation that includes banksia species, the vegetation is unlikely to present an area that could be regarded as significant or quality black cockatoo foraging habitat. The areas of vegetation are small and fragmented and is in predominantly "Completely Degraded" and "Degraded" condition with only small areas in "Good" condition. Some foraging on *E. marginata* fruit was noted within the site, however the chew marks were not consistent with that of any of the three species of black cockatoo. No evidence of foraging by black cockatoo species was observed.

A total of six *Eucalyptus* sp. trees were identified to have a Diameter at Breast Height (DBH) over 500 mm that have the potential to be used for roosting and nesting by black cockatoos. Five of these were planted *Eucalyptus gomphocephala* (tuart) trees with trunks that had split into multiple branches and no hollows were noted. Due to their form, trees are unlikely to produce hollows of sufficient size (entry of >10 cm in diameter) that could be used for breeding by the black cockatoos. One remnant *Eucalyptus marginata* (jarrah) tree, located in the southeastern corner of the site, had a DBH over 500 mm and contained a large hollow that has the potential to be used by black cockatoos (**Plate 3**). No evidence (i.e. scratches around the entry) was observed that this hollow has been used by black cockatoos. The locations of the potential habitat trees within the site are shown in **Figure 6**.

While there is the potential for the site to be used by Carnaby's black cockatoo, large areas of intact remnant vegetation (approximately 1500 ha) are located close to the northern and western portions of the site and are likely to be preferentially used by black cockatoos and provide large areas of higher quality intact foraging habitat. These areas of vegetation are also identified as Bush Forever Sites, indicating this vegetation is likely to remain uncleared in perpetuity. These Bush Forever sites are identified as Bush Forever Site No. 322 – *Burns Beach Bushland Burns Beach to Mindarie*, Bush Forever Site No. 323 - *Link from Burns Beach to Neerabup National Park (Tamala Park Tip Site Tamala Park* and Bush Forever Site No. 383 – *Neerabup National Park, Lake Gnowerup Nature Reserve & Adjacent Bushland, Neerabup* as shown in **Figure 8**.

The vegetation within the site also has the potential to provide habitat for the Priority 5 species the Quenda which tends to inhabit scrubby, often swampy vegetation with dense cover up to 1 m high (DPaW 2012) . However the potential areas within the site that support the Quenda's preferred habitat

are small and fragmented. This species is likely to preferentially inhabit the Bush Forever Sites surrounding the site which offer larger areas of intact dense vegetation that have a lower risk of predation by foxes and domestic cats.

Observations made during the flora and vegetation survey in addition to discussions with local residents who use utilise the site for passive recreation (such as walking and dog exercise) indicate that the site is not utilised by significant fauna to the extent that this would preclude or significantly complicate its use for residential development.

Plate 3: Hollow in Eucalyptus marginata tree in the southeastern corner of site

2.5 Hydrology

2.5.1 Groundwater

Groundwater beneath the site is a multi-layered system comprised of the following:

- Perth - Superficial (unconfined) aquifer
- Perth - Leederville (confined) aquifer
- Perth - Yarragadee North (confined) aquifer.

A Local Water Management Strategy (LWMS) has been prepared (Emerge Associates 2015). The key findings relating to the groundwater characteristics of the site included:

- The historical maximum groundwater level (MGL) is approximately 3.5 m Australian Height Datum (AHD) with the depth to groundwater ranging between 25.5 m and 32.5 m.
- Groundwater underlying the site flows west towards the Indian Ocean.

- The site is located in the Lochy Close sump catchment and the sump is located 250 north of site with a capacity of 14,600m^3.
- Water for irrigation will be sourced from groundwater. Discussions to determine the available quantity of water for irrigation with the City of Joondalup and DoW are being progressed and final details will be provided in the LWMS.

2.5.2 Surface water

No surface water bodies or channels have been identified within the site. Surface water is likely to infiltrate freely across the site due to the high permeability of the underlying sands.

2.5.3 Wetlands and waterways

The *Environmental Protection (Swan Coastal Lakes) Policy 1992 (EPP Lakes)* protects the environmental values of selected lake wetlands on the Swan Coastal Plain and DPaW maintains the Geomorphic Wetlands of the Swan Coastal Plain database.

No geomorphic wetlands have been identified within the site (DoW 2015).

2.5.4 Public Drinking Water Source Areas

Public Drinking Water Source Areas (PDWSAs) are proclaimed by the DoW to protect the quality of identified drinking water sources and can be surface water or groundwater sources (DoW 2015). They are proclaimed under the *Metropolitan Water Supply, Sewerage and Drainage Act 1909 or the Country Areas Water Supply Act 1947* as Water Reserves, Catchment Areas or Underground Water Pollution Areas (DoW 2009). PDWSAs provide Western Australia with the majority of its drinking water supplies and can be vulnerable to contamination from a range of land uses and water based activities (DoW 2009).

The site has not been identified as a PDWSA.

2.6 Heritage

2.6.1 Indigenous heritage

Based on a review of the Department of Aboriginal Affairs “Aboriginal Heritage Inquiry System” online database (DAA 2015), there are no Registered Aboriginal Heritage Sites within the site.

There are several Registered Aboriginal Sites within the vicinity of the site, with the nearest Aboriginal site (DAA ID 3504) located approximately 780 m east of the site and is shown in **Figure 8**. It is recorded as Joondalup Waugal Egg, a mythological site. This site will not be impacted upon by the proposed development of the site.

2.6.2 Non-Indigenous heritage

A desktop search of the State Heritage Office database (Heritage Council 2015) and the Australian Heritage Database (Department of Environment 2015) indicated there are no registered heritage sites within the site.

2.7 Land use considerations

2.7.1 Historic land uses and potential contamination

The site is currently vacant and unused with the exception of use by nearby residents (such as dog walkers who traverse the site for passive recreational purposes).

There does not appear to be any historic evidence of any activities (e.g. market gardening) within the site that would raise considerations in relation to potential soil and/or groundwater contamination. A search of the DER's Contaminated Sites Database (DER 2015) found no registered contaminated sites were located within or in close proximity to the site.

Based on a review of the historic land uses within the site and available information, there is not expected to be any significant risk of soil and/or groundwater contamination within the site.

2.7.2 Basic Raw Materials

Basic Raw Materials (BRM) are described as sand (including silica sand), clay, hard rock, limestone (including metallurgical limestone), gravel and other construction and road building materials, that are generally important to the land development processes (WAPC 2000). *State Planning Policy No. 2.4 Basic Raw Materials* (SPP 2.4) provides for the protection of BRM, with the intention of this policy to ensure that these resources can be fully utilised through appropriate land uses and timeframes for development that may otherwise conflict with the use of these resources.

Based on mapping prepared to support SPP 2.4, the site does not occur within areas identified to contain BRM.

2.7.3 Surrounding land uses

The site is surrounded by "Residential" zoned development to the east, north and west and the "Parks and Recreation" reserve (McNaughton Park) to the south. Connolly Drive, reserved as "Other Regional Roads", is located approximately 300 m to the west of the site and the Mitchell Freeway, reserved as "Primary Regional Roads" is located over 600 m to the east of the site. The City of Joondalup DPS No. 2 (City of Joondalup 2013) does not indicate that any incompatible land uses are located or proposed within the vicinity of the site.

2.8 Relevant environmental factors and considerations

Table 5 lists the full suite of environmental factors that have been investigated for the site, and summarises those that require further specific attention in **Section 4**.

Table 5: Relevant environmental factors and considerations for LSP

ENVIRONMENTAL FACTOR	RELEVANT CONSIDERATIONS
Climate	No issues posed and therefore no further consideration of this factor is required.
Topography	No issues posed and therefore no further consideration of this factor is required.
Geology	No issues posed and therefore no further consideration of this factor is required.
Landforms and soils	No issues posed and therefore no further consideration of this factor is required.
Acid Sulfate Soils	There is no known risk ASS occurring within the site, and therefore no further consideration of this is required.
Flora and vegetation	Remnant vegetation within the site is fragmented and is in “Completely Degraded” to “Good” condition. Retention of vegetation is further considered in **Section 4**.
Bush Forever and conservation reserves	No Bush Forever sites are identified within or in close proximity to the site, and therefore no further consideration of this factor is required.
Ecological Linkages	No Ecological Linkage have been identified within the site. No further consideration of this factor is required.
Environmentally Sensitive Areas (ESAs)	No ESAs are located within or in close proximity to the site, and therefore no further consideration of this factor required.
Local Natural Areas (LNAs)	No LNAs are located within the site, and therefore no further consideration of this factor is required.
Terrestrial Fauna	No fauna species of significance were observed within the site. Vegetation within the site has the potential to be used by the threatened Carnaby’s black cockatoo and is considered further in **Section 4**.
Groundwater	Groundwater is not considered to be a significant issue, however management of groundwater is considered further in **Section 4**.
Surface water	Surface water is not considered to be a significant issue, however management of surface water is detailed further in **Section 4**.
Wetlands and waterways	There are no wetlands or waterways identified within or in close proximity to the site. No further consideration of this factor is required.
Public Drinking Water Source Areas (PDWSAs)	No PDWSA’s are located within the site. No further consideration of this factor is required.
Indigenous Heritage	No Aboriginal heritage sites were identified within the site. No further consideration of this factor is required.
Non-Indigenous Heritage	No non-indigenous heritage values were identified within the site. No further consideration of this factor is required.
Historic Land Uses	Historical land uses within the site are unlikely to result in contamination. No further consideration of this factor is required.
Basic Raw Materials	The site is not identified within an area identified for BRM source area. No further consideration of this factor is required.
Surrounding Land Uses	No land uses have been identified in the vicinity of the site that could impact on future residential development. No further consideration of this factor is required.

3 The Local Structure Plan

3.1 Local Structure Plan

The LSP for the site has been prepared by Creative Design and Planning, with inputs from a multi-disciplinary consultant team, and is shown conceptually in **Figure 9**. The following are accommodated within the LSP:

- Residential lots.
- Public open space.
- A drainage reserve.
- Road reserves.

In recommending the rezoning of the site, the City of Joondalup required that the extent of the MacNaughton Park oval that currently extends within the site to be incorporated into POS. This has been supported within the LSP and is shown in **Figure 9**.

3.2 Future planning approvals process

Following the approval of the LSP, subdivision and development of areas will generally be progressed in accordance with the LSP. It is usual for this process to involve the application of subdivision conditions, in accordance with the WAPC's *Model Subdivision Conditions Schedule 2012,* and these generally cover the following relevant areas:

- Amenity.
- Buildings and use.
- Drainage and site works.
- Electricity and gas pipelines.
- Environmental conditions.
- Fire and emergency.
- Heritage (indigenous, state, local, etc.).
- Lot design.
- Reserves.
- School sites.
- Transport roads and access.
- Water and sewers.

This condition framework provides a future environment management framework for the site and is discussed further in **Section 4**.

4 Environmental Assessment and Management

This section discusses in detail the spatial response of the LSP to the environmental attributes and values associated with the site, and outlines the future environmental management considerations that will be required as part of future subdivision and development within the site. This section discusses only those environmental attributes and values that require specific consideration based on their presence within the site, and/or applicable legislation and policy requirements, and were identified in **Table 5**.

4.1 Flora and vegetation

4.1.1 Policy framework and management objective

The EPA's *Guidance Statement No. 33 Environmental Guidance for Planning and Development* (EPA 2008) states that the broad objective for flora and vegetation biodiversity conservation is: *"to maintain the abundance, diversity, geographic distribution and productivity of flora at the species and ecosystem levels through the avoidance or management of adverse impacts and through improvement in knowledge."*

4.1.2 LSP considerations for flora and vegetation

The LSP supports the retention of an area of remnant vegetation in "Good" condition within a POS located in the southeastern corner of the site. The extent of vegetation retained will be dependent on the finished ground levels and drainage requirements within the site.

4.1.3 Future flora and vegetation management requirements

Considerations will be made to ensure that areas of remnant vegetation that are retained are not adversely impacted by groundwork prior to subdivision. Some grasstrees and other native species may be salvaged and reused within the development site or immediately adjacent areas. Species will also be made available to the City of Joondalup for salvage where appropriate. Peet will also be amenable to undertake a season's seed collection (dependent on the correct season for collection and development program) and provide the seed to the City of Joondalup for use in other areas under their management.

The future management of the POS areas will be in accordance with standard POS guidelines, outlined by the City of Joondalup.

4.1.4 Predicted environmental outcomes

Areas of remnant vegetation are proposed to be retained in the POS and have been accommodated within the LSP. The POS and road reserves will be landscaped and planting in the POS and road reserves will include native species.

Retained vegetation within the adjacent MacNaughton Park natural area and the retention of some remnant vegetation within proposed POS will ensure maintenance of diversity and abundance of flora species as per the EPA's Guidance Statement.

4.2 Terrestrial fauna

4.2.1 Policy framework and management objective

The EPA's *Environmental Assessment Guideline No. 33 Environmental Guidance for Planning and Development* (2008) states their objective for terrestrial fauna conservation in the development process is *"to maintain the abundance, diversity, geographic distribution and productivity of native fauna at the species and ecosystem levels through the avoidance or management of adverse impacts and through improvement in knowledge."*

Based on the findings of fauna assessment undertaken across the site the existing fauna habitat values within the site are not considered to be of local or regional significance, given the limited extent and poor condition of available habitat.

4.2.2 LSP considerations for terrestrial fauna

Within the LSP, potential habitat trees are proposed to be retained within the area of southeastern POS and within the road reserve located in the southwestern portion of the site. Remnant vegetation with potential foraging habitat is proposed to be retained in the southeastern POS area. The retention of trees and vegetation within the site will depend on the finished ground levels and drainage requirements within the site.

4.2.3 Future terrestrial fauna management requirements

The habitat trees proposed to be retained in the area of POS and road reserve in the southern portion of the site will be protected through subdivision and development works, through consideration of *AS4970 Protection of Trees on Developed Sites*. The future management of the POS areas and road reserves will be in accordance with standard POS guidelines, outlined by the City of Joondalup.

A site specific fauna survey will be undertaken as part of the subdivision process to determine the full extent to which a fauna trapping and relocation program may be required. Birds are mobile and will be able to disperse easily from the site and it is considered unlikely that Quenda occur with the site. Notwithstanding this, during development works, a fauna spotter will be engaged and reptiles and other ground dwelling vertebrate fauna will be relocated so that they do not flee into adjoining residential areas.

4.2.4 Predicted environmental outcomes

Through the retention of key fauna habitat values, potential impacts on fauna species will be minimised. The retention of selected mature trees in the southern portion of the site (within the road reserve and POS) and retention of remnant vegetation within POS will assist in maintaining foraging, roosting and breeding habitat for the black cockatoos within the site. It is proposed that landscaping of the POS and road reserves will include native plants, and are likely to provide foraging habitat values.

Terrestrial fauna habitat values and linkages will be maintained through the vegetation within the adjacent MacNaughton Park natural area and nearby Bush Forever sites. Intact vegetation within the McNaughton Park natural area adjacent to the site and the nearby Bush Forever Sites will provide a means to maintain representation, diversity, and viability for terrestrial fauna species and are likely to remain protected in the long term.

4.3 Hydrology

4.3.1 Policy framework and management objective

The *State Water Strategy* (Government of Western Australia 2003) and *Better Urban Water Management* (WAPC 2008) endorses the promotion of total water cycle management and application of Water Sensitive Urban Design (WSUD) principles to provide improvements in the management of stormwater, and to increase the efficient use of other existing water supplies.

The key principles of integrated water cycle management include:

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

The EPA's *Environmental Assessment Guideline No. 8 Environmental factors and objectives* (EPA 2013) outlines the following key objectives for surface water and groundwater:

- To maintain the hydrological regimes of groundwater and surface water so that existing and potential uses, including ecosystem maintenance, are protected.
- To maintain the quality of groundwater and surface water, sediment and biota so that the environmental values, both ecological and social, are protected.

State Planning Policy 2.9 Water Resources (WAPC 2006) outlines the following key policy objectives:

- Protect, conserve and enhance water resources that are identified as having significant economic, social, cultural and/or environmental values;
- Assist in ensuring the availability of suitable water resources to maintain essential requirements for human and all other biological life with attention to maintaining or improving the quality and quantity of water resources; and
- Promote and assist in the management and sustainable use of water resources.

4.3.2 LSP considerations for hydrology

An LWMS has been prepared by Emerge Associates (2015) to support the preparation of the LSP, and provides a framework for the future delivery of a best practice approach to integrated water cycle management utilising WSUD principles, including detailed management approaches for:

- Water conservation.
- Stormwater quality management.
- Flood mitigation.
- Groundwater management.

The LWMS provides an overview of the spatial requirements that will be necessary to manage storm water which has been accommodated within the LSP. Water conservation is considered through the utilisation of groundwater for irrigation of landscaped areas within POS areas, with the POS areas to utilise water wise gardening (WWG) principles.

Within the LSP, stormwater quality is addressed through the provision of areas to support a treatment train approach, which incorporates lot scale retention, sub-surface storage and a bio-retention area (BRA) within POS (for treatment of surface water associated with minor rainfall events). Further non-structural measures will also be adopted and will be detailed in the future Urban Water Management Plan (UWMP).

With regards to flood mitigation, surface water will largely be integrated with the existing drainage network utilising existing stormwater infrastructure where available. Drainage catchments that do not connect to the existing pipe network will retain the 5 year Average Recurrence Interval (ARI) rainfall event in a flood storage area (FSA) that is accommodated within the area of POS.

Groundwater management focusses on protecting groundwater quality and recharging the aquifer. Measures to address groundwater quality are consistent with those proposed for surface water quality. Recharging the aquifer will be achieved through the retention and infiltration of runoff from lots at source through lot retention, sub-surface storage, a BRA and FSA

The LWMS (Emerge Associates 2015) can be referred to for further details.

4.3.3 Future hydrology management requirements

An Urban Water Management Plan (UWMP) will be required for each stage of subdivision within the site, in order to address WAPC's standard model subdivision condition D2 (WAPC 2012) which states: *Prior to the commencement of subdivisional works, an urban water management plan is to be prepared and approved, in consultation with the Department of Water, consistent with any approved Local Water Management Strategy. (Local Government).*

The main areas that will require further clarification within future a UWMP includes:

- Detailed drainage design.
- Implementation of water conservation strategies.
- Non-structural water quality improvement measures.
- Management and maintenance requirements for BRAs and FSAs.
- A management strategy for storm water during the construction period.
- Groundwater license and the applicability to the site.
- Subsurface infrastructure design.
- Geotechnical report.

4.3.4 Predicted environmental outcomes

The LWMS provides the framework for the LSP to manage surface and groundwater levels and quality in a contemporary best-practice approach utilising WSUD objectives, and is in accordance with the WAPC and EPA guidelines and policy frameworks. The preparation of a UWMP as a condition of future subdivision approval will provide design details for WSUD within the site, and will contribute to the sustainable use of surface and groundwater resources.

5 Summary and conclusions

Emerge Associates were engaged by Peet to provide a suite of environmental services to support the preparation of a LSP for Lot 9021 MacNaughton Crescent, Kinross also referred to as "the site". This has included numerous investigations to identify and assess the environmental attributes and values that are present within the site and are considered relevant for the local structure planning process.

The site is approximately 4.02 ha and is located within a well-established residential suburb of Kinross. The site is currently zoned "Urban" under the MRS and "Urban Development" under the City of Joondalup DPS No. 2.

The environmental attributes and values identified within the site have been outlined in **Section 2** and include:

- The site has been historically cleared for agricultural purposes resulting in disturbed and fragmented remnant woodland vegetation remaining within the site.
- The vegetation is in "Completely Degraded" to "Good" condition.
- The vegetation within the site was identified as potential foraging, roosting and breeding habitat for the threatened black cockatoos. This include a tuart and one jarrah tree which have been identified as meeting the criteria for potential roosting and breeding habitat, however only the jarrah tree contained a hollow considered suitable for nesting for black cockatoos.
- The sands within the site are likely to be highly permeable and it is likely that surface water is largely retained and infiltrated within the site.

The proposed LSP (as shown in **Figure 9**) has responded to the environmental values and attributes of the site and are discussed further in **Section 4** of this document. Specifically the LSP has responded to the environmental values and attributes of the site through spatial provisions for the following:

- Retention of selected trees and other species which have potential foraging, breeding and nesting habitat for Carnaby's black cockatoo where possible, within road reserves and public open space (POS). The retention of trees and vegetation will depend on finished ground levels and drainage requirements within the site.
- Surface water which will be managed by the existing drainage network and catchments located within POS.
- Water quality is accommodated through the provision of areas to support a treatment train approach, which incorporates lot scale retention, a bio-retention area within POS (for minor rainfall events) and a flood storage area (for major rainfall events) for road catchments that are not connected to the existing drainage network.

6. Recommendations

Further recommendations to support the subdivisional phase of the project include provision of following investigations and management plans:

- An Urban Water Management Plan for each stage of subdivision.
- A site specific fauna survey to determine the full extent to which a fauna trapping and relocation program that may be required prior to the commencement of bulk earthworks.

These mechanisms will ensure that the future development of site will not significantly impact on the environmental values and attributes of the site and demonstrates that an appropriate planning and development framework exists to respond to and manage the environment.

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FIGURES

Figure 1: Location Plan

Figure 2: Site Plan

Figure 3: Metropolitan Region Scheme

Figure 4: Topography

Figure 5: Environmental Geology

Figure 6: Vegetation Communities and Potential Habitat Trees

Figure 7: Vegetation Condition

Figure 8: Surrounding Ecological and Heritage Features

Figure 9: Proposed LSP

Figure 1:	**Site Locality**	**Plan Number: EP15-017(02)--F01**	
Project:	Environmental Assessment and Management Strategy Lot 9021 MacNaughton Crescent Local Structure Plan, Kinross	Drawn: ADB	Date: 04/05/15
		Approved: KK	Date: 03/07/2015
Client:	Peet Limited	Checked: AT	Scale: 1:12,500@A4

0 125 250 500 Metres

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Figure 2:	**Site Plan**
Project:	Environmental Assessment and Management Strategy Lot 9021 MacNaughton Crescent Local Structure Plan, Kinross
Client:	Peet Limited

Plan Number: EP15-017(02)--F02			
Drawn:	ADB	Date:	04/05/15
Approved:	KK	Date:	03/07/2015
Checked:	AT	Scale:	1:2,000@A4

0 20 40 80 Metres

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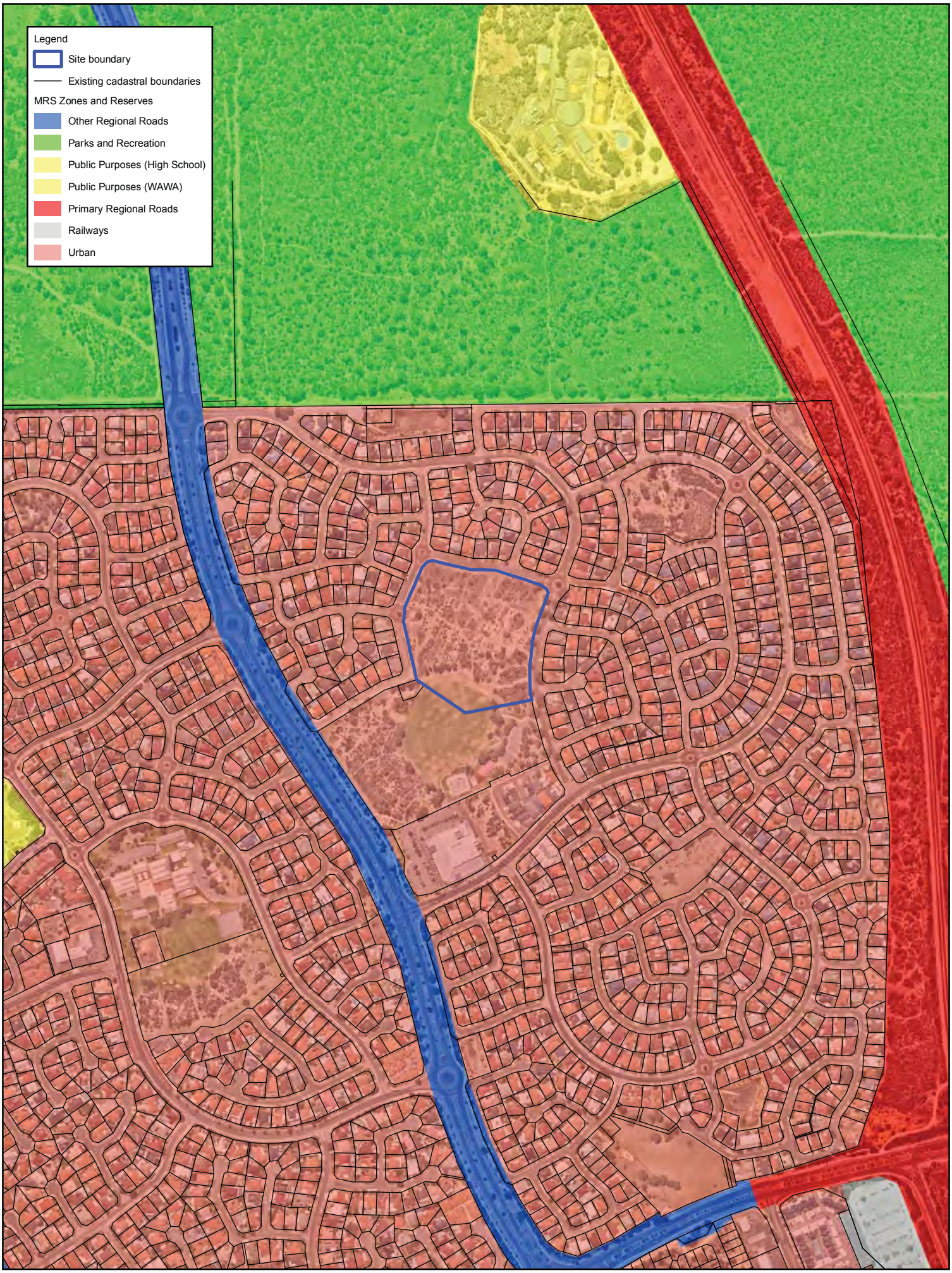

Figure 3: Metropolitan Region Scheme

Project: Environmental Assessment and Management Strategy
Lot 9021 MacNaughton Crescent Local Structure Plan, Kinross

Client: Peet Limited

Plan Number: EP15-017(02)--F03

Drawn:	ADB	Date:	04/05/15
Approved:	KK	Date:	03/07/2015
Checked:	AT	Scale:	1:7,500@A4

0 75 150 300 Metres

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Sources: The following datasets were used in the production of this map: MRS - DoP (2014)

Figure 4: Site Topography

Project: Environmental Assessment and Management Strategy
Lot 9021 MacNaughton Crescent Local Structure Plan, Kinross

Client: Peet Limited

Plan Number: EP15-017(02)--F04

Drawn:	ADB	Date:	04/05/15
Approved:	KK	Date:	03/07/2015
Checked:	AT	Scale:	1:2,000@A4

0 20 40 80 Metres

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Sources: The following datasets were used in the production of this map: Topographic contours, LiDAR - DoW (2008)

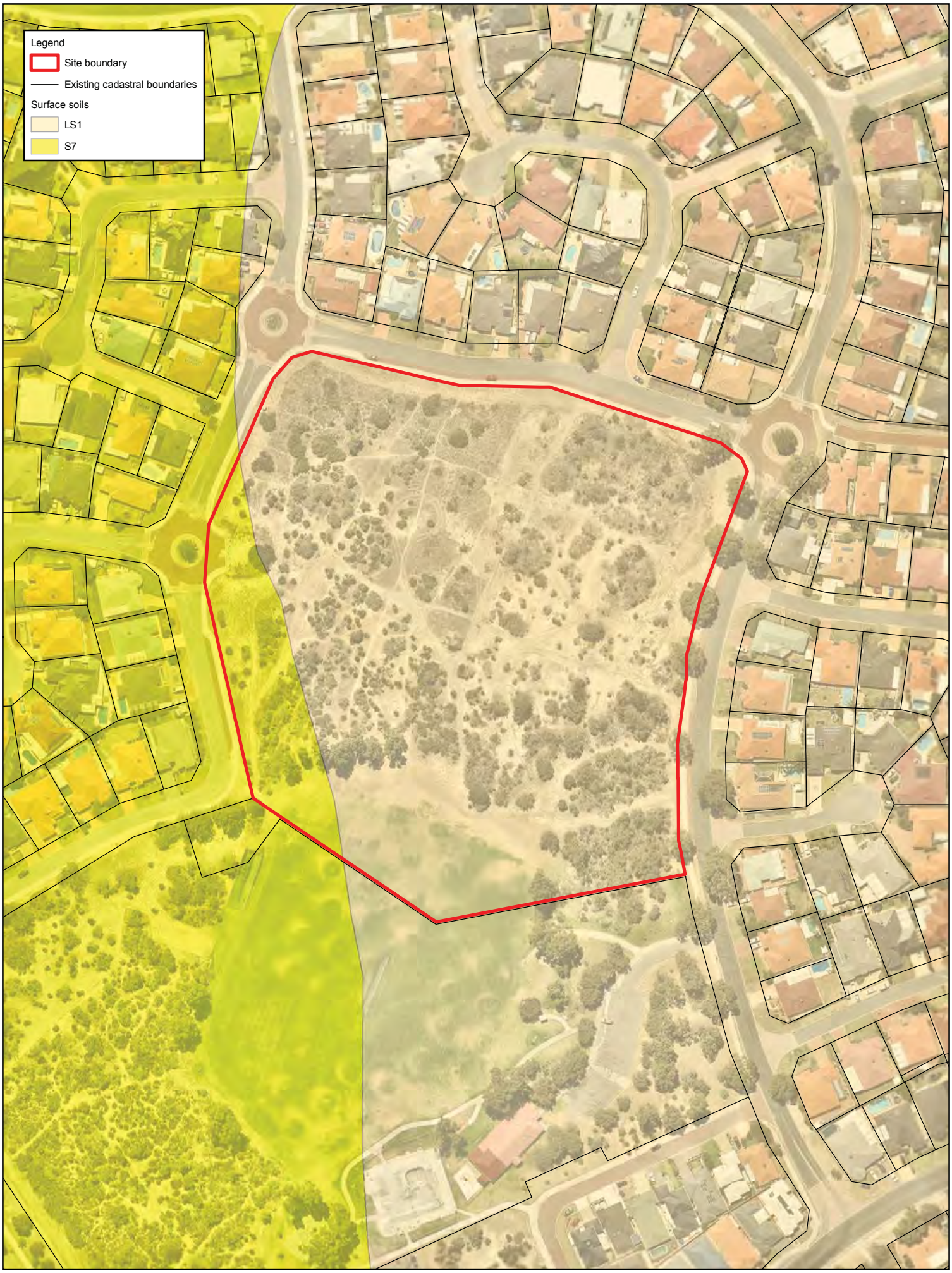

Figure 5: Environmental Geology

Project: Environmental Assessment and Management Strategy
Lot 9021 MacNaughton Crescent Local Structure Plan, Kinross

Client: Peet Limited

Plan Number: EP15-017(02)--F05

Drawn:	ADB	Date:	04/05/15
Approved:	KK	Date:	03/07/2015
Checked:	AT	Scale:	1:2,000@A4

0 20 40 80 Metres

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Sources: The following datasets were used in the production of this map: Surface soils - Gozzard (1986)

Figure 6: Plant Communities and Potential Habitat Trees

Project: Environmental Assessment and Management Strategy
Lot 9021 MacNaughton Crescent Local Structure Plan, Kinross

Client: Peet Limited

Plan Number: EP15-017(02)--F06

Drawn:	ADB	Date:	04/05/15
Approved:	KK	Date:	03/07/2015
Checked:	AT	Scale:	1:2,000@A4

0 20 40 80 Metres

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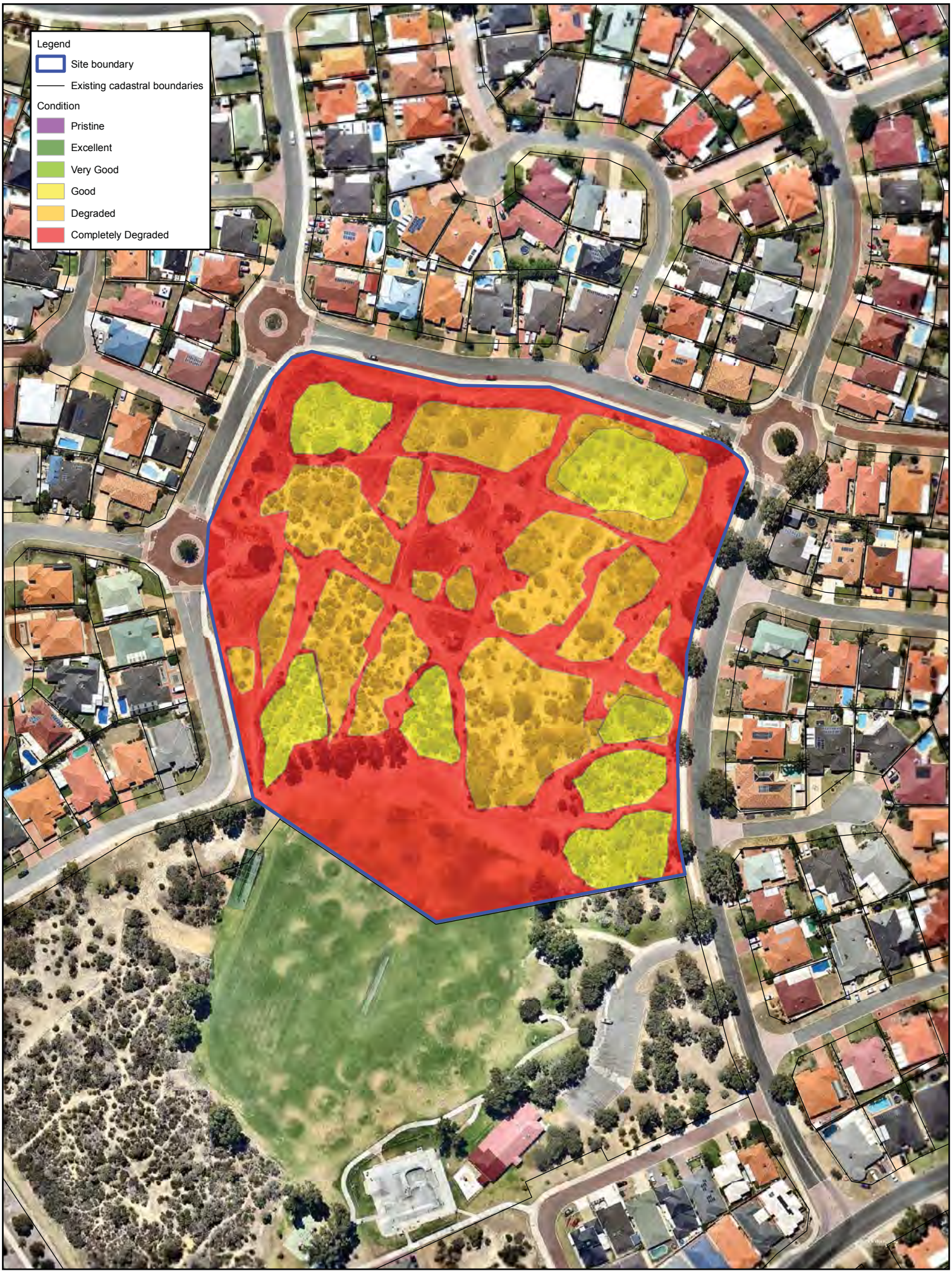

Figure 7: Vegetation Condition

Project: Environmental Assessment and Management Strategy
Lot 9021 MacNaughton Crescent Local Structure Plan, Kinross

Client: Peet Limited

Plan Number: EP15-017(02)--F07

Drawn:	ADB	Date:	04/05/15
Approved:	KK	Date:	03/07/2015
Checked:	AT	Scale:	1:2,000@A4

0 20 40 80 Metres

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Figure 8:	**Surrounding Ecological and Heritage Features**
Project:	Environmental Assessment and Management Strategy Lot 9021 MacNaughton Crescent Local Structure Plan, Kinross
Client:	Peet Limited

Plan Number: EP15-017(02)--F08			
Drawn:	ADB	Date:	04/05/15
Approved:	KK	Date:	03/07/2015
Checked:	AT	Scale:	1:12,500@A4

0 125 250 500 Metres

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Sources: The following datasets were used in the production of this map: Bush Forever - DoP (2007), Biodiversity linkages - PBP (2007), Environmentally Sensitive Areas - DER (2015), Aboriginal Heritage Sites and Places - DAA (2014)

Figure 9: Proposed Local Structure Plan

Project:	Environmental Assessment and Management Strategy Lot 9021 MacNaughton Crescent Local Structure Plan, Kinross
Client:	Peet Limited

Plan Number: EP15-017(02)--F09b

Drawn:	KNM	Date:	23/10/2015
Approved:	KK	Date:	23/10/2015
Checked:	AT	Scale:	1:2,000@A4

0 20 40 80 Metres

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APPENDIX A

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EPA ASSESSMENT OF MRS AMENDMENT

Chief Executive Officer
City of Joondalup
PO Box 21
JOONDALUP WA 6919

Your Ref 103935
Our Ref 14-801096
Enquiries Angela Coletti
Phone 6145 0806

Attn: Brian Gray

Dear Sir/Madam

DECISION UNDER SECTION 48A(1)(a)
Environmental Protection Act 1986

SCHEME AMENDMENT TITLE:	**City of Joondalup District Planning Scheme 2 Amendment 74 - Zoning to Urban Development**
LOCATION:	**Lot 9021 (3) Lochnagar Way, Kinross**
RESPONSIBLE AUTHORITY:	**City of Joondalup**
DECISION:	**Scheme Amendment Not Assessed – Advice Given (no appeals)**

Thank you for referring the above scheme amendment to the Environmental Protection Authority (EPA).

After consideration of the information provided by you, the Environmental Protection Authority (EPA) considers that the proposed scheme amendment should not be assessed under Part IV Division 3 of the *Environmental Protection Act 1986* (EP Act) but nevertheless provides the following advice and recommendations.

ADVICE AND RECOMMENDATIONS

1. Environmental Issues

- Flora and Vegetation

2. Advice and recommendations regarding Environmental Issues

The EPA's records indicate that the vegetation within the amendment area may provide habitat for Carnaby's black cockatoo. Carnaby's black cockatoos are protected under both the *Wildlife Conservation Act 1950* and *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

The EPA expects that habitat trees within the amendment area be retained as part of the detailed design of the structure plan. Scheme provisions and subdivision conditions requiring the retention of habitat trees to the satisfaction of the Department of Parks and Wildlife and other relevant agencies are recommended.

The landowner should be made aware of the requirement under the EPBC Act to refer a proposal to the Commonwealth Department of Sustainability, Environment, Water, Population and Communities if a proposal is likely to impact on matters of national environmental significance.

3. General Advice

- For the purposes of Part IV of the EP Act, the scheme amendment is defined as an assessed scheme amendment. In relation to the implementation of the scheme amendment, please note the requirements of Part IV Division 4 of the EP Act.
- There is no appeal right in respect of the EPA's decision on the level of assessment of scheme amendments.
- A copy of this advice will be sent to relevant authorities and made available to the public on request.

Yours faithfully

Darren Foster
Director
Strategic Policy and Planning Division

3 June 2014

APPENDIX B

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FLORA AND VEGETATION SURVEY

Flora and Vegetation Survey for Lot 9021 McNaughton Crescent, Kinross

Introduction

Emerge Associates (Emerge) conducted a flora and vegetation on 27 March 2015 to determine the current plant communities present and vegetation condition across Lot 9021 McNaughton Crescent, Kinross, herein referred to as 'the site'.

Methodology

The site was visited by an environmental consultant and a botanist from Emerge Associates on 27 March 2015. The vegetation was documented at three locations using non-permanent relevés, with all flora species recorded within 10m of a central point.

The condition of the vegetation was assessed to assist in determining the conservation values of the site and also noted at additional locations to mark changes in condition across the site. The vegetation condition was rated according to Keighery (1994), a vegetation condition scale commonly used in the Perth Metropolitan Region, but which is also appropriate for other urbanised and agricultural areas. The categories are listed and defined in **Table 1.**

Table 1: Vegetation condition scale (Keighery 1994).

VEGETATION CONDITION	DEFINITION
Pristine	Pristine or nearly so, no obvious signs of disturbance.
Excellent	Vegetation structure intact, disturbance affecting individual species and weeds are non-aggressive species.
Very Good	Vegetation structure altered obvious signs of disturbance. For example, disturbance to vegetation structure caused by repeated fires, the presence of some more aggressive weeds, dieback, logging and grazing.
Good	Vegetation structure significantly altered by very obvious signs of multiple disturbances. Retains basic vegetation structure or ability to regenerate it. For example, disturbance to vegetation structure caused by very frequent fires, the presence of some very aggressive weeds at high density, partial clearing, dieback and grazing.
Degraded	Basic vegetation structure severely impacted by disturbance. Scope for regeneration but not to a state approaching good condition without intensive management. For example, disturbance to vegetation structure caused by very frequent fires, the presence of very aggressive weeds, partial clearing, dieback and grazing.
Completely Degraded	The structure of the vegetation is no longer intact and the area is completely or almost completely without native species. These areas are often described as "parkland cleared" with the flora comprising weed or crop species with isolated native trees or shrubs.

Collection of plant species was undertaken to allow for positive taxonomic identification using taxonomic keys and comparison with known named material. The locations of any trees that could be used by Threatened species of black cockatoo were recorded.

Results

Flora

A total of 34 native and 10 introduced species were recorded within the site representing 20 families. The dominant families containing native taxa were Myrtaceae, Proteaceae and Fabaceae. The dominant families of introduced taxa were Asteraceae and Poaceae. For a complete species list and the individual survey site data refer to **Appendix A** and **B** respectively.

Plant Community

The site was noted to contain two native plant communities, which are shown on **Figure 1** and described below:

- **BXpHh** - Isolated *Nuytsia floribunda* trees over low open woodland to low woodland of *Banksia attenuata* and *Banksia menziesii* over open shrubland to tall open shrubland of *Xanthorrhoea preissii, Banksia sessilis* and *Hakea trifurcata* over low shrubland of *Hibbertia hypericoides* over open sedgeland of *Mesomelaena pseudostygia* and open grassland to grassland of grass weed species.
- **EBHh** - Low woodland of *Eucalyptus marginata, Eucalyptus todtiana, Nuytsia floribunda* and *Banksia* spp over tall open shrubland of *Xanthorrhoea preissii* over low shrubland of *Hibbertia hypericoides* over open sedge/rushland of *Mesomelaena pseudostygia* and *Desmocladus flexuosus* and open grassland of grass weed species.
- Additional parts of the site contained isolated native species over weeds or bare ground, and a section at the southern extent of the site contained planted turf species. These areas are described as **Parkland Cleared/Cleared**.

Based on the flora species present within the site, as well as soil and landform characteristics, it is considered that the vegetation is most likely to represent Floristic Community Type (FCT) 28 – 'Spearwood *Banksia attenuata* or *Banksia attenuata – Eucalyptus* woodlands' as described by Gibson *et al.* (1994). This FCT is listed as 'well reserved' and 'low risk' by Gibson *et al.* (1994) and is not listed as a Threatened Ecological Community (TEC) or Priority Ecological Community (PEC) under state or federal lists.

Vegetation Condition

The site contained mainly native vegetation with obvious signs of vehicle tracks dividing the vegetation into many small patches. The patches of native vegetation ranged from 'Good' to 'Degraded' condition. The areas in 'Good' condition contained relatively intact vegetation structure but were subject to weed invasion largely by grass weed species such as **Ehrharta calycina, *Briza maxima* and **Avena barbata*. The southern portion of the site contained managed turf and a number of planted *Eucalyptus gomphocephala* trees. This portion of the site was in 'Completely Degraded' condition, along with the tracks and cleared areas intersecting the site. Vegetation condition throughout the site is shown on **Figure 2**.

The north-eastern portion of the site was noted to have been recently burnt (27th December 2014), however most native species were noted to be resprouting vigorously at the time of the survey. Based on the presence of resprouting native species showing evidence of natural vegetation structure, some areas of burnt vegetation were still considered to be in 'Good' condition.

Threatened and Priority Species

A review of the NatureMap list of flora species occurring within 5 km of the site indicated the potential presence of a number of Threatened and Priority Flora species including; *Marianthus paralius* (T), *Conostylis bracteata* (P3), *Grevillea* sp. Ocean Reef (D. Pike Joon 4) (P1), *Hibbertia spicata* subsp. *leptotheca* (P3), *Jacksonia sericea* (P4), *Leucopogon maritimus* (P1), *Pimelea calcicola* (P3) and

Sarcozona bicarinata (P3). All listed Priority flora species are perennial and thus would have been detectable at the time of the site visit, however none of these species were recorded within the site. In addition, most of the listed species generally occur in coastal habitats often with limestone outcropping (FloraBase 2015), which was not found to occur within the site. Given the vegetation present within the site, there is some chance that the Priority species *Conostylis bracteata* and *Jacksonia sericea* could occur within the burnt areas of the site and thus have been undetectable at the time of the survey. No other Threatened or Priority Flora species are considered likely to occur within the site.

With regard to the potential use of the site by conservation significant fauna species, the site contains some vegetation that could be used by Threatened species of black cockatoo - *Calyptorhynchus latirostris* (Carnaby's cockatoo), *Calyptorhynchus baudinii (*Baudin's cockatoo) and *Calyptorhynchus banksii* (Red-tailed black cockatoo). A total of six *Eucalyptus* sp. trees had a Diameter at Breast Height (DBH) over 500 mm that have the potential to be used for roosting and nesting by black cockatoos. Five of these were planted *Eucalyptus gomphocephala* trees with trunks that split into multiple branches and in which no hollows were noted, these trees are considered unlikely to produce hollows sufficient in size (entry of >10 cm in diameter) to be used for breeding by species of black cockatoo. One *Eucalyptus marginata* tree, located in the south-eastern corner of the site, had a DBH over 500 mm and also contained a large hollow that has the potential to be used by black cockatoos. Locations of potential habitat trees within the site are shown on **Figure 3**. No evidence (i.e. scratches around the entry) that this hollow has been used by black cockatoos was noted.

In addition, plant communities **BXpHh** and **EBHh** contained some foraging species for black cockatoos. These species include: *Banksia attenuata, B. menziesii, B. sessilis, Eucalyptus marginata, E. gomphocephala, E. todtiana, Hakea lissocarpha*, *H. trifurcata* and *Xanthorrhoea preissii*. The remnant vegetation within the site partially to significantly disturbed and is in 'Degraded' to 'Good' condition, indicating that the area may not form 'quality' foraging habitat. Some foraging on *E. marginata* fruit was noted underneath the potential habitat tree, however the chew marks were not consistent with that of any of the species of black cockatoo. No evidence of foraging within the site by species of black cockatoo was noted. Thus the site contains potential foraging, roosting and nesting habitat for black cockatoo. Whilst the site may be used to some degree by black cockatoos, the large area of intact vegetation occurring close (300 m) to the north of the site and west of the site is likely to be preferentially used by black cockatoos and provide large areas of higher quality foraging habitat. This vegetation is also included within Bush Forever sites, indicating that vegetation within is likely to remain uncleared in perpetuity. These Bush Forever sites are No. 322 – *Burns Beach Bushland Burns Beach to Mindarie*, No. 323 - *Link from Burns Beach to Neerabup National Park (Tamala Park Tip Site Tamala Park* and No. 383 – *Neerabup National Park, Lake Gnowerup Nature Reserve & Adjacent Bushland, Neerabup*. These Bush Forever sites comprise over 1500 ha.

The vegetation within the site also has the potential to provide habitat for Priority 5 species *Isoodon obesulus* subsp. *fusciventer* (Quenda) which tends to inhabit scrubby, often swampy, vegetation with dense cover up to 1 m high (DPaW 2012) . However the potential areas within the site are small and fragmented, thus this species is likely to preferentially inhabit the Bush Forever sites surrounding the site which offer much larger areas of dense vegetation with lower risk of predation by foxes and domestic cats.

Summary

- The site contains two plant communities ranging in condition from 'Degraded' to Good' condition. Any retention of vegetation should target those areas in 'Good' condition.
- No Threatened or Priority Flora species were recorded within the site during the survey. No Threatened Flora species are considered likely to occur within the site, however there is possible that two Priority Flora
- species (Conostylis bracteata and Jacksonia sericea) occur within the burnt areas and were thus undetectable at the time of survey.
- No TECs or PECs are likely to occur within the site.
- The site contains some potential foraging, roosting and nesting habitat for black cockatoos, including one habitat tree with a hollow sufficient in size for use by black cockatoos. No evidence of use of the site by these species was observed during the survey. The site also has some potential to be used by Quenda. However, any fauna species utilising the site are not likely to do so exclusively and are more likely to frequent the large tracts of remnant vegetation present 300 m to the north of the site within Bush Forever sites that are likely to remain vegetated.

Figure 1:	**Plant Communities**
Project:	Local Structure Plan Peet Kinross Local Structure Plan
Client:	Peet Limited

Plan Number: ESX15-025(01)--WD06

Drawn:	GRO	Date:	31/03/15
Approved:	CKK	Date:	02/04/15
Checked:	AT	Scale:	1:1,400@A4

0 12.5 25 50 Metres

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Figure 2: **Vegetation Condition**

Project: Local Structure Plan
Peet Kinross Local Structure Plan

Client: Peet Limited

Plan Number: ESX15-025(01)--WD07

Drawn:	GRO	Date:	31/03/15
Approved:	CKK	Date:	02/04/15
Checked:	AT	Scale:	1:1,400@A4

0 12.5 25 50 Metres

emerge ASSOCIATES
Integrated Science & Design

Figure 3: **Potential Black Cockatoo Habitat Trees**

Project: Local Structure Plan
Peet Kinross Local Structure Plan

Client: Peet Limited

Plan Number: ESX15-025(01)--WD08

Drawn:	GRO	Date:	31/03/15
Approved:	CKK	Date:	02/04/15
Checked:	AT	Scale:	1:1,400@A4

0 12.5 25 50 Metres

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Appendix B

Species List - MacNaughton Crescent Kinross

Family		Species
Aizoaceae	*	*Carpobrotus edulis*
Amaranthaceae		*Ptilotus polystachyus*
Asparagaceae		*Lomandra sp.*
Asteraceae	*	*Conyza bonariensis*
	*	*Hypochaeris glabra*
	*	*Urisinia anthemoides*
Casuarinaceae		*Allocasuarina humilis*
Cyperaceae		*Mesomelaena pseudostygia*
		Schoenus ?clandestinus
Dilleniaceae		*Hibbertia hypericoides*
Ericaceae		*Conostephium sp.*
		Leucopogon parviflorus
Fabaceae		*Acacia cyclops*
		Acacia pulchella var. glaberrima
		Daviesia triflora
		Hardenbergia comptoniana
		Jacksonia calcicola
		Jacksonia sternbergiana
	*	*Lupinus sp.*
Goodeniaceae		*Lechenaultia linarioides*
Haemodoraceae		*Conostylis aculeata*
Hemerocallidaceae		*Corynotheca micrantha var. micrantha*
		Dianella revoluta
Iridaceae	*	*Gladiolus caryophyllaceus*
Loranthaceae		*Nuytsia floribunda*
Myrtaceae		*Agonis flexuosa*
		Eucalyptus gomphocephala
		Eucalyptus marginata
		Eucalyptus todtiana
		Calothamnus sp.
Poaceae	*	*Avena barbata*
	*	*Briza maxima*
	*	*Ehrharta calycina*

Species List - MacNaughton Crescent Kinross

Family	Species
	* *Lagurus ovatus*
Proteaceae	*Adenanthos cygnorum*
	Banksia attenuata
	Banksia menziesii
	Banksia sessilis
	Hakea lissocarpha
	Hakea trifurcata
	Petrophile macrostachya
Restionaceae	*Desmocladus flexuosus*
Xanthorrhoeaceae	*Xanthorrhoea preissii*
Zamiaceae	*Macrozamia riedlei*

Appendix A

Emerge Associates

Field Survey Vegetation Data Sheet

Site Details			
Locality	Kinross	Photo No.	
Date	27.03.2015	Photo direction	
Author	SP	Geographic datum and zone	GDA94 50
Sampling unit	Releve	Easting	380868
Sample number	1	Northing	6490501

Geographic and Habitat Data			
Aspect	NE	Hydrology	
Slope	very gentle	Adjacent Vegetation	
Topographic position	Slope	Vegetation Condition	D or G (recently burnt)
Altitude		Time since fire	<6 months
Bare ground %	90%	Disturbance	fire, weeds
Soil type/texture	sand	Rock type	-
Soil colour	yellowy brown	Rock %	0
Microclimate		Litter type and %	minimal

Vegetation Description

Open woodland Banksia spp. with occasional Nuytsia florabunda over open shrubland of Xanthorrhoea preissii and low open shrubland Hibbertia hyp (regenerating)

Strata			**Observations**
	Height	Total % Cover	Regeneration apparent
Emergent tree			resprouting of woody shrubs esp.
Canopy			Hibbertia
Sub-canopy			
Lower tree			
Upper shrub			
Lower shrub			
Upper herb			
Middle herb			
Lower herb			

Coll. No.	**Species**	**Layer**	**Life Form**	**Height**	**Habit**	**% Cover**
	Banksia menziesii					5
	Banksia sessilis					3
	Xanthorrhoea preissii					10
	Hibbertia hypericoides					3
	Lechenaultia linarioides					1
	Schoenus ?clandestinus					2
	Hakea trifurcata					4
	Calothamnus sp.					3
	Banksia attenuata					3
	Lomandra sp.					2
	Macrozamia riedlei					4
	Nuytsia florabunda					opp.
	Corynotheca micrantha subsp. micrantha					3
	Dianella revoluta					3
	Petrophile macrostachya					3
	Acacia pulchella subsp. glaberrima					3
	Conostephium sp.					2

Site Details			
Locality	Kinross	Photo No.	
Date	27.03.2015	Photo direction	
Author	SP	Geographic datum and zone	GDA94 50
Sampling unit	Releve	Easting	380748
Sample number	2	Northing	6490525

Geographic and Habitat Data			
Aspect	SE	Hydrology	
Slope	gentle	Adjacent Vegetation	Degraded/ CD
Topographic position	slope	Vegetation Condition	G (localised patch)
Altitude		Time since fire	>5 years
Bare ground %	10%	Disturbance	Weeds
Soil type/texture	sand	Rock type	-
Soil colour	yellow/brown	Rock %	0
Microclimate		Litter type and %	leaf 10%

Vegetation Description

Isolated Nuytsia floribunda over low open woodland of Banksia spp. over open shrubland to tall open shrubland of Xanthorrhoea preissii, Hakea trifurcata over low shrubland Hibbertia hypericoides over open sedgeland Mesomelaena pseudostygia and pasture weeds

Strata			Observations
	Height	Total % Cover	
Emergent tree			
Canopy			
Sub-canopy			
Lower tree			
Upper shrub			
Lower shrub			
Upper herb			
Middle herb			
Lower herb			

Coll. No.	Species	Layer	Life Form	Height	Habit	% Cover
	Nuytsia floribunda					3
	Banksia attenuata					7
	Banksia menziesii					5
	Hakea trifurcata					4
	Hibbertia hypericoides					15
	Hakea lissocarpha					5
	Mesomelaena pseudostygia					10
	Ehrharta calycina					5
	Lechenaultia linarioides					5
	Gladiolus caryophyllaceus					2
	Dianella revoluta					2
	Briza maxima					3
	Xanthorrhoea preissii					5
	Avena barbata					3
	Carpobrotus edulis					4
	Acacia pulchella subsp. glaberrima					3
	Ptilotus polystachyus					3
	Lupinus sp.					4

Coll. No.	Species	Layer	Life Form	Height	Habit	% Cover
	Desmocladus flexuosus					5
	Leucopogon parviflorus					2
	Jacksonia calcicola					2

Site Details			
Locality	Kinross	Photo No.	
Date	27.03.2015	Photo direction	
Author	SP	Geographic datum and zone	GDA94 50
Sampling unit	Releve	Easting	380716
Sample number	3	Northing	6490419

Geographic and Habitat Data			
Aspect	E	Hydrology	
Slope	very gentle	Adjacent Vegetation	cleared tracks, patchy veg
Topographic position	flat/slight slope	Vegetation Condition	D-G (G localised patches)
Altitude		Time since fire	>5 years
Bare ground %	10%	Disturbance	weeds, partial clearing
Soil type/texture	sand	Rock type	
Soil colour	white/pale yellow	Rock %	0
Microclimate		Litter type and %	

Vegetation Description

Open woodland of Banksia spp. over tall shrubland Xanthorrhoea preissii, Jacksonia sternbergiana and Adenanthos cygnorum over low shrubland Hibbertia hypericoides and open sedgeland of Mesomelaena pseudostygia

Strata			Observations
	Height	Total % Cover	
Emergent tree			Lawn with planted tuarts to S
Canopy			
Sub-canopy			
Lower tree			
Upper shrub			
Lower shrub			
Upper herb			
Middle herb			
Lower herb			

Coll. No.	Species	Layer	Life Form	Height	Habit	% Cover
	Xanthorrhoea preissii					10
	Banksia menziesii					4
	Banksia attenuata					4
	Hibbertia hypericoides					10
	Hakea trifurcata					3
	Jacksonia sternbergiana					7
	Mesomelaena pseudostygia					5
	Petrophile macrostachya					3
	Conostylis aculeata					2
	Banksia sessilis					3
	Ehrharta calycina					2
	Jacksonia calcicola					2
	Acacia pulchella subsp. glaberrima					2
	Briza maxima					3
	Lagurus ovatus					4
	Adenanthos cygnorum					2
	Eucalyptus gomphocephala					opp.

Site Details				
Locality	Kinross	Photo No.		
Date	27.03.2015	Photo direction		
Author	SP	Geographic datum and zone	GDA94	50
Sampling unit	Releve	Easting	380849	
Sample number	4	Northing	6490344	

Geographic and Habitat Data			
Aspect	S	Hydrology	
Slope	Very Gentle	Adjacent Vegetation	cultivated grass to S
Topographic position	Flat, slight slope	Vegetation Condition	G
Altitude		Time since fire	>5 years
Bare ground %		Disturbance	weeds
Soil type/texture	sand	Rock type	0
Soil colour	light brown	Rock %	
Microclimate		Litter type and %	leaf 10, dead grasses 15

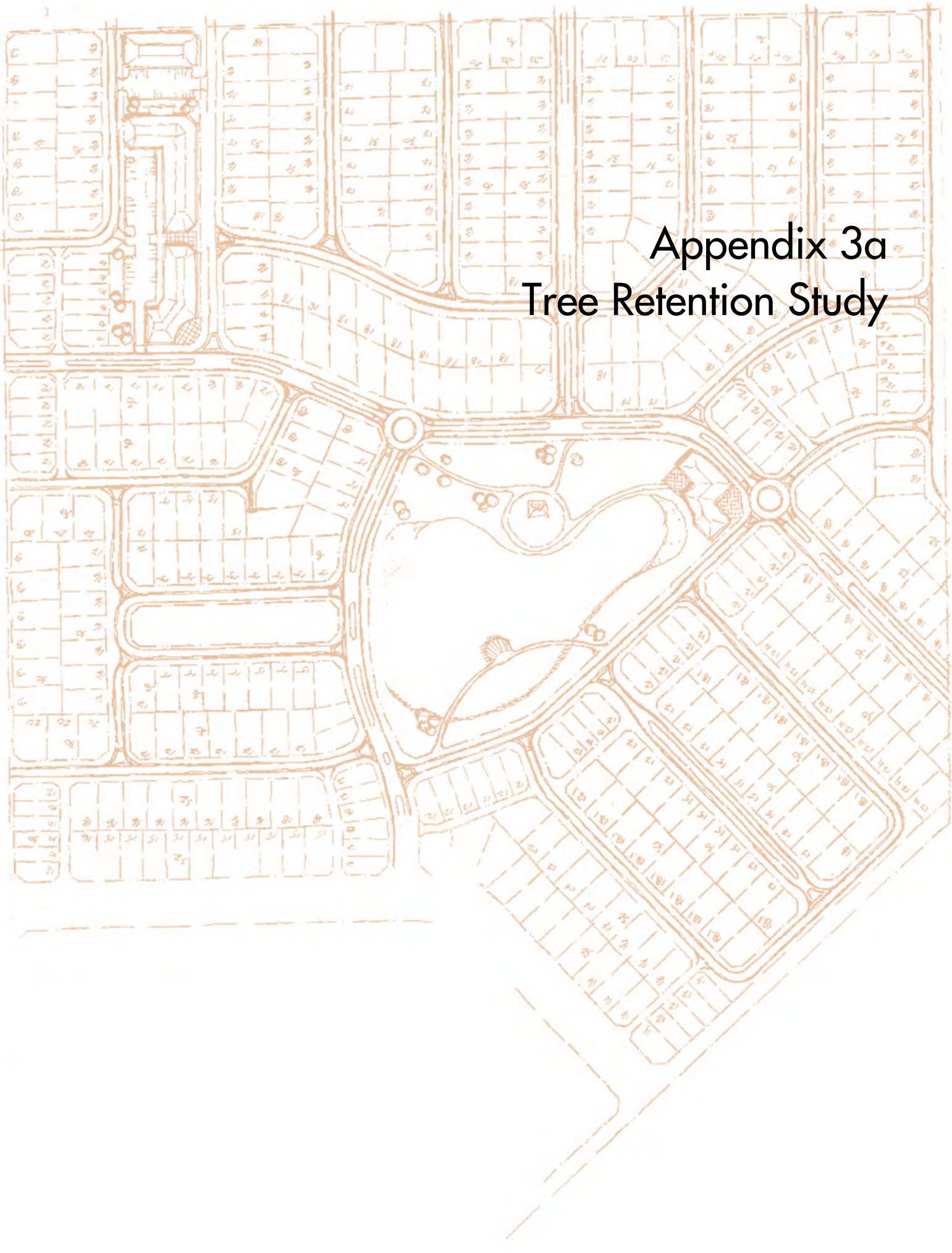
Vegetation Description

Low woodland of Eucalyptus todtiana, Eucalptus marginata and Banksia spp. over tall open shrubland Xanthorrhoea preissii over low shrubland of Hibbertia hypericoides and pasture weeds

Strata			Observations
	Height	Total % Cover	Cleared and maintained tracks surrounding
Emergent tree			lawn to south
Canopy			
Sub-canopy			
Lower tree			
Upper shrub			
Lower shrub			
Upper herb			
Middle herb			
Lower herb			

Coll. No.	Species	Layer	Life Form	Height	Habit	% Cover
	Eucalyptus marginata					10
	Agonis flexuosus					3
	Xanthorrhoea preissii					5
	Hardenbergia comptoniana					3
	Hibbertia hypericoides					10
	Mesomelaena pseudostygia					7
	Conyza bonariensis					2
	Macrozamia riedlei					3
	Gladiolus caryophyllaceus					2
	Carpobrotus edulis					3
	Hypochaeris glabra					2
	Desmocladus flexuosus					4
	Acacia cyclops					3
	Banksia menziesii					4
	Banksia attenuata					4
	Eucalyptus todtiana					5
	Daviesia triflora					2
	Conostylis aculeata					1

Coll. No.	Species	Layer	Life Form	Height	Habit	% Cover
	Allocasuarina humilis					2
	Jacksonia sternbergiana					3
	Ursinia anthemoides					opp.



Appendix 3a
Tree Retention Study

Justin Hansen

Subject: FW: (pacbbMIS) Lot 9021 MacNaughton Crescent SP

Importance: High

From: Jennifer Longstaff [mailto:Jen.Longstaff@emergeassociates.com.au]
Sent: Tuesday, 2 August 2016 1:11 PM
To: Graeme.Catchpole@joondalup.wa.gov.au; John.Corbellini@joondalup.wa.gov.au
Cc: Charlie Kennett <Charlie.Kennett@peet.com.au>; Justin Hansen <JustinH@creativedp.com.au>; Brian.Gray@joondalup.wa.gov.au
Subject: FW: (pacbbMIS) Lot 9021 MacNaughton Crescent SP
Importance: High

Hi Graham and John,

Further to my conversation with John late last week I can provide the following summary of information to confirm and consolidate some of the previously provided data regarding the assessment of the trees that occur within Lot 9021 MacNaughton Crescent, Kinross and the decision making process undertaken to inform tree retention and design of the proposed SP.

Previous investigation of Black Cockatoo Habitat:

An assessment of the vegetation, flora and fauna habitat was conducted by Emerge Environmental consultants in 2015 to inform development of the proposed structure plan and to contribute to the supporting Environmental Assessment and Management Strategy (Emerge Associates, 2015) prepared for the site. This included an assessment of all vegetation (including all trees) within the site to determine the presence of any habitat values for potential use by any of the three black cockatoo species. The results are detailed within the EAMS, but are summarised below as is the definition of the tree assessment criteria utilised to inform this process.

For the purposes of assessing trees for their potential use by black cockatoos for this project the following definitions of 'breeding habitat' and 'suitable nest hollows' were utilised. Both are taken from the *"EPBC Act referral guidelines for the three threatened black cockatoo species*" (DSEWPaC, 2012), and defined below.

Potentially suitable breeding and roosting tree species are defined as:

'Trees of species known to support breeding within the range of the species which either have a suitable nest hollow OR are of a suitable diameter at breast height (DBH) to develop a nest hollow. For most tree species, suitable DBH is 500 mm.'

For the purposes of this study a tree containing a potentially suitable cockatoo nest hollow was defined as:

"*Generally any tree which is alive or dead that contains one or more visible hollows (cavities within the trunk or branches) suitable for occupation by black cockatoo for the purpose of nesting/breeding. Hollows that had an entrance greater than about 12cm in diameter and would allow the entry of a black cockatoo into a suitably orientated and sized branch/trunk.*

Site assessment results for suitable breeding habitat as below:

- A total of six *Eucalyptus sp*. Trees were identified to have a DBH of over 500mm for the potential use by black cockatoos.
- Five of these were **planted** *Eucalyptus gomphocephala* (tuart) trees with trunks that had split into multiple branches and no hollows were noted.
- Due to their form, these trees are considered unlikely to produce hollows of sufficient size (entry of >10 cm in diameter) that could be used for breeding by the black cockatoos.
- One remnant *Eucalyptus marginata* (jarrah) tree, located in the south eastern corner of the site, had a DBH over 500 mm and contained a large hollow that has the potential to be used by black cockatoos, however the hollow was inspected and no evidence (i.e. scratches around the entry) were observed.

- The locations of the potential habitat trees were recorded and illustrated in **Figure 6** of the EAMS and is attached above for reference.
- **No other trees above the DBH criteria of 500mm were identified within the site and therefore those determined to be above this value and of suitable species, were nominated for retention possibility within the SP.**

EPA Advice, 3 June 2014.

In June 2014 the OEPA provided the below advice and recommendations in regards to the site:

"The EPA expects that habitat trees within the amendment area be retained as part of the detailed design of the structure plan. Scheme provisions and subdivision conditions requiring the retention of habitat trees to the satisfaction of the Department of Parks and Wildlife and other relevant agencies are recommended."

The proposed LSP responds to the OEPA's advice by proposing the retention of four (three of which are over 500mm DBH) of the planted tuarts within road reserve as detailed in the attached Figure titled 'Driveway Concept'. Considerable design effort and further inspection of the trees proposed for retention by a qualified arboricultural consultant has been also been undertaken, with the results and advice, together with engineering and lot design criteria, utilised to inform the proposed subdivision layout in this portion of the site. This included advice against retaining tree number four (>500mm DBH) and tree six (<500mm DBH), which were suspected as beginning to deteriorate in health and could not be considered structurally adequate. The only Jarrah tree of over 500mm DBH, was also not proposed for retention due to the arboriculture report identifying this tree as showing signs of decline in health.

There are also a number of smaller trees (<500mm DBH), of mixed species located within the site, none of which meet the criteria of a potential habitat trees as described above, but nonetheless, those located within the POS areas were also surveyed by the arboricultural consultant, in order to demonstrate their suitability for retention. This assessment also include a number of tuarts planted as street trees within MacNaughton Crescent, which are outside of the site, but were detailed in recent correspondence provided by Emerge Associates in May 2016, and again attached above for further reference. A full copy of the arboriculture report and the detailed driveway layout ('Driveway Concept') to accommodate the proposed trees for retention are also included within this attachment. This arboriculture report also proposes and identifies the recommended Tree Protection Zones for each tree proposed for retention.

I am hopeful that the above information provides further clarity as to the determination of trees assessed so far and those proposed for retention within the proposed LSP and that we can now move to formally advertise the proposal.

As you know we are very keen to progress this application so please do not hesitate to contact me to discuss this matter further if required on 0422 127 034,

Regards

Jen

Jennifer Longstaff
Senior Environmental Consultant, Team Leader - Environmental Planning & Management
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Document Reference: EP15-017(02)-012

Emerge contact: Jen Longstaff 0422 127 034

5 May 2016

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Blue Tang (WA) Pty Ltd as trustee for The Reef Unit Trust ABN 44656153170 and Emerge Environmental Services Pty Ltd ABN 57144772510 trading as Emerge Associates

Attention: Brian Gray
City of Joondalup
PO Box 21
JOONDALUP, WA 6027

Dear Brian,

LOT 9021, MACNAUGHTON CRESCENT, KINROSS- LOCAL STRUCTURE PLAN

This letter is to provide additional information in support of the proposed Local Structure Plan (LSP) application for Lot 9021 MacNaughton Crescent, Kinross, and is in response to the request for additional information following a meeting with yourselves on 11 March 2016.

The below information is provided as a summary of the main environmental attributes of the site, with specific reference to the quality of the vegetation and significant trees identified for retention. This information has been summarised from existing survey data also provided within the Environmental Assessment and Management Strategy (Emerge 2015), the appendiced Flora and Vegetation Survey (Emerge 2015a) and a recent arboriculturalist report undertaken by Arbor Logic Consultancy Services (Arbor Logic, 2015; **Attachment A**).

Existing vegetation values

A Level 1 flora and vegetation survey was undertaken by a botanist from Emerge Associates on 27 March 2015. The survey identified the following two native plant communities within the LSP area:

- BXpHh - Isolated *Nuytsia floribunda* trees over low open woodland to low woodland of *Banksia attenuata* and *Banksia menziesii* over open shrubland to tall open shrubland of *Xanthorrhoea preissii, Banksia sessilis* and *Hakea trifurcata* over low shrubland of *Hibbertia hypericoides* over open sedgeland of *Mesomelaena pseudostygia* and open grassland to grassland of grass weed species.

- EBHh - Low woodland of Eucalyptus marginata, Eucalyptus todtiana, Nuytsia floribunda and Banksia spp over tall open shrubland of Xanthorrhoea preissii over low shrubland of Hibbertia hypericoides over open sedge/rushland of Mesomelaena pseudostygia and Desmocladus flexuosus and open grassland of grass weed species.

Whilst the site contains remnant vegetation that includes Banksia species, the vegetation is considered unlikely to present an area that could be regarded as significant or quality black cockatoo foraging habitat. The areas of vegetation are small and fragmented and are in predominantly "Completely Degraded" and "Degraded" condition with only small areas in "Good" condition. No evidence of foraging by black cockatoo species has been observed within the site.

Identified Trees Onsite

In addition to the Flora and Vegetation Survey (Emerge 2015), a Arbor Logic has been appointed to determine the health and retention values of the tress more generally within the site, including their conservation value, the health of each tree, and the measures necessary to protect the tree- including the identification of appropriate Tree Protection Zones (TPZ's) The preliminary report provided by Arbor Logic is attached as **Attachment A**. Although the Level 1 Flora and Vegetation survey only identified six 'significant trees' for Black Cockatoo's, the tree study examined a wider total of 26 trees within the LSP area, with the distribution of the trees nominated for retention illustrated in **Figure 1**. As demonstrated by this figure, there are no other large trees located throughout the central portion of the site and most of the trees nominated for retention occur within the POS provided.

The trees within the LSP area which are proposed to be retained are listed in **Table 1** and illustrated in **Figure 1.**

Table 1 Trees proposed for retention

ID Number	Species	Height (m)	DBH (cm)	Canopy Spread (N-S)	Canopy Spread (E-W)	Health	Structure	Required TPZ	DEC (2011) Priority for planting for Carnaby's
T2	Tuart (*Eucalyptus gomphocephala*)	13	30	2-4	2-4	Excellent	Good	3	High
T3	Tuart (*Eucalyptus gomphocephala*)	16	55	6-8	6-8	Excellent	Acceptable - Good	5.5	High
T5	Tuart (*Eucalyptus gomphocephala*)	17	59	8-10	8-10	Excellent	Acceptable - Good	6	High
T7	Tuart (*Eucalyptus gomphocephala*)	16	66	10-12	8-10	Good	Acceptable	6.5	High
T8	Red Flowering Gum (*Corymbia ficifolia*)	7	45	6-8	6-8	Excellent	Good	4.5	Medium
T10	Tuart (*Eucalyptus gomphocephala*)	20	45	8-10	8-10	Good	Acceptable	4.5	High
T11	Tuart (*Eucalyptus gomphocephala*)	18	45	8-10	8-10	Excellent	Acceptable - Good	4.5	High
T12	Coastal Banksia (*Banksia attenuata*)	7	46	6-8	4-6	Poor	Good	4.5	High
T13	Coastal Banksia (*Banksia attenuata*)	7	50	6-8	4-6	Poor	Acceptable - Good	4.5	High
T14	Coastal Banksia (*Banksia attenuata*)	5	25-18	4-6	2-4	Poor	Acceptable	2.5	High
T16	Coastal Banksia (*Banksia attenuata*)	7	25	4-6	2-4	Poor	Acceptable - Good	6	High
T17	Prickly Bark (*Eucalyptus todtiana*)	8	30 (19x3)	10-12	10-12	Excellent	Good	6	Medium
T18	Prickly Bark (*Eucalyptus todtiana*)	8	40 (32x2)	8-10	12-14	Excellent	Good	7.5	Medium
T19	Tuart (*Eucalyptus gomphocephala*)	12	51	8-10	6-8	Excellent	Good	5	High
T20	Tuart (*Eucalyptus gomphocephala*)	12	43	8-10	6-8	Fair	Acceptable - Good	4.5	High
T21	Tuart (*Eucalyptus*	11	55	14-16	10-12	Excellent	Acceptable	5.5	High

	gomphocephala)						- Good		
T22	Tuart (*Eucalyptus gomphocephala*)	11	73	14-16	12-14	Excellent	Good	7.5	High
T23	Tuart (*Eucalyptus gomphocephala*)	13	82	12-14	12-14	Excellent	Good	8	High
T24	Tuart (*Eucalyptus gomphocephala*)	15	76	10-12	8-10	Excellent	Acceptable - Good	7.5	High
T25	Tuart (*Eucalyptus gomphocephala*)	14	73	12-14	12-14	Good	Good	7.5	High
T26	Norfolk Island Pine (*Araucaria heterophylla*)	11	35	6-8	6-8	Excellent	Good	3	Low

Retention Suitability

Further consideration of long term retention ability has been given to all trees nominated for retention within the site, with particular reference to trees numbered 1 to 7, as these trees have been nominated for retention within the road reserve in front of private lots. Additional factors that have been considered in regards to their long term retention have included individual tree values and health, habitat potential for Carnaby's Black cockatoo and also engineering and development requirements such as servicing provisions etc.

Of the 26 trees surveyed, 21 are proposed to be retained. Of the trees numbered 1 to 7, 4 trees are proposed to be retained, with the retention of trees 3 and 5 attributable to a shared 4 metre crossover driveway between Lots 57 and 58 (as shown in the concept drawing in **Attachment B**). Although within the expected TPZ for trees 3 and 7, the driveway between Lots 57 and 58 will be setback a minimum of 2 metres from the trunk of these two trees. Management of encroachment upon these TPZs will be determined following discussions with an arborist at detailed design stages, as recommended in the Arbor Logic report (**Attachment A**).

Tree number 1 has not been included for retention as it has been identified that a roadside drainage pit will be required in this location at the low point in the road reserve which would encroach upon the TPZ of this tree. If the drainage pit is able to be located outside of the 5 metre TPZ, tree 1 will be included for retention at subdivision stage. Tree number 4 has not been proposed for retention as the Arbor Logic report identified it is likely to cause issues long term. Its removal will also allow for retention of the adjacent trees on either side, by creating a wider access area to accommodate future driveways to service adjacent lots. Given access requirements to lots in the south-western portion of the site, tree 6 is also proposed to be removed. This tree has been selected as it is the smallest of the adjacent trees and has been identified by Arbor Logic as likely to cause issues long term (structurally). As with tree 1 however, tree 6 will be retained if access and servicing requirements permit, at more detailed design stages.

Tree 9 (Jarrah), abutting the Lot 26 boundary has also not been included for retention. The report prepared by Arbor Logic noted the canopy of the tree is slightly sparse and suggests that it may be starting to decline in health to some degree. An area of decay and cavity was also noted. Although a hollow was noted in this tree, there was no evidence of use and the location of the hollow is considered too low to be favoured by Black Cockatoos. Tree 15, a Coastal Banksia located within the POS has been reported as dead and will be removed as part of landscape works within this area. Trees 19 to 25 are located within the road reserve of MacNaughton Crescent and are all planted tuarts. It is expected that they may require some pruning to tidy up the lower limbs but are otherwise in good or better condition and are able to be retained in their current positions. TPZ's for these trees are also illustrated within **Figure 1**.

Select fencing and retaining walls will be necessary to facilitate the development and ideally be located outside of any identified TPZ. In the event that it is considered essential for fencing, retaining walls and associated works to encroach upon TPZs, advice will be sought from an Aboriculturalist and management measures put in place, prior to undertaking any works within a TPZ.

The proponent has endeavoured to identify the environmental values worthy of retention on site in accordance with the objective to 'encourage the integration of environmentally sustainable design principles into the siting, design and construction' as stated in the *City's Environmentally Sustainable Design Policy*. In addition, the proponent has identified those trees with aesthetic value to include in the streetscape in accordance with the objective to 'encourage an improved streetscape outcome, which is attractive and enhances and complements the visual character…' outlined in the City's *Residential Development Local Planning Policy*.

Should you have any questions regarding the content of this letter please do not hesitate to contact the undersigned.

Yours sincerely

Emerge Associates

Jen Longstaff
SENIOR ENVIRONMENTAL CONSULTANT, TEAM LEADER - ENVIRONMENTAL PLANNING & MANAGEMENT

Encl: Figure 1: Proposed tree retention in LSP area
Attachment A: Arbor Logic- Preliminary Tree Assessment 2015
Attachment B: Creative Planning and Design- Shared Crossover Concept Drawing

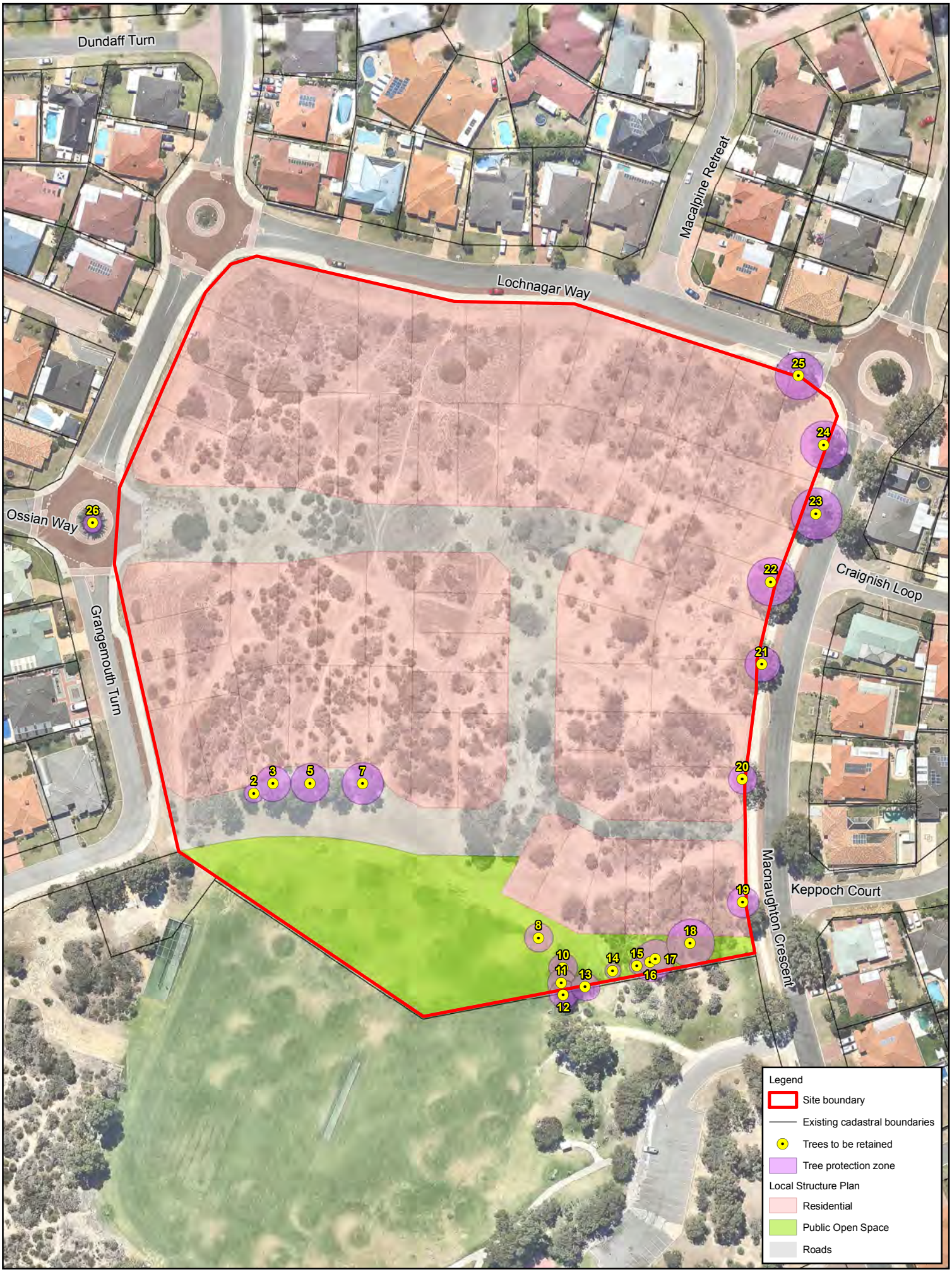

Figure 1:	**Proposed Tree Retention**
Project:	LSP Support Kinross LSP Support
Client:	Peet

Plan Number: EP15-017(02)--F21

Drawn:	KNM	Date:	15/03/2016
Approved:	DRAFT	Date:	--/--/--
Checked:	CJT	Scale:	1:1,500@A4

0 20 40 60 Metres

emerge ASSOCIATES
Integrated Science & Design

ATTACHMENT A

emerge ASSOCIATES
Integrated Science & Design

ARBORLOGIC REPORT 2015

December 22, 2015

Emerge Associates
Suite 4, 26 Railway Road
Subiaco WA 6008

Attention: **Tom Wilkinson**
Cc: **Jen Longstaff**

RE: **Preliminary Assessment of Trees in identified areas of Lot 9021 MacNaughton Crescent, Kinross**

Dear Tom,

Further to your request, the following is a brief summary of my assessment of the trees within the identified areas of Lot 9021 MacNaughton Crescent, Kinross.

Should you have any queries regarding the findings of this report, or if I can be of any further assistance in the management of the identified trees, please do not hesitate to contact me.

Yours sincerely

JASON ROYAL

Dip. Arboriculture (UK)
Tech. Arbor A

Preliminary Assessment of Trees in areas of Lot 9021 MacNaughton Crescent, Kinross

Prepared For

Emerge Associates

Prepared By

ARBOR logic

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Attachments to the Report

Attachment 1; Tree Location Guide

Attachment 2; Company Information & Disclaimer

1. Particulars to the Assessment

1.1 Terms Used

The following terms have been used in this report:

'Site'	meaning the identified areas of Lot 9021 MacNaughton Crescent, Kinross that were included in this particular assessment
'Tree'	meaning any tree identified on Site and included in the assessment
'AS 4970'	meaning Australian Standards guideline 4970 (2009); Protection of trees on development sites
'AS 4373'	meaning Australian Standards guideline 4373 (2007); Pruning of amenity trees
'TPZ'	meaning Tree Protection Zone; the area where the majority of the given Tree's root mass is considered likely to be found, and the area that is recommended to be protected during any development or landscape activity

1.2 Limitations and Particulars of this Assessment

The information and opinions provided in this document are based on the findings from the visual observations of the Trees on the Site during the inspections undertaken November 20, 2015.

All observations of all of the Trees were undertaken from ground level.

Viewing conditions at the time of assessment were fine.

No exploratory excavations were undertaken as part of this particular assessment to verify the actual root spread of any given Tree.

As such the allocation of TPZ for each Tree has at this stage been based on AS 4970 guidelines, with some amendments being made for the physical size and canopy dimensions of the Tree, its condition, the known root zone morphology of its given species in the sort of soil profile considered to be typical to this area of Western Australia.

2. Scope of Works

At the request of Emerge Associates I have been commissioned to undertake an inspection of all of the Trees found on the Site.

The purpose of the inspection was to:

- Undertake an inspection of the Trees in the identified areas of the Site,
- Provide comment on the current condition of each tree; species, height, DBH, canopy spread, health and structural condition, and any comments pertinent to the identified tree
- Provide any canopy management (pruning) recommendations for each tree as considered necessary in view of risk management responsibilities.
- Provide any recommendations for protection requirements during the development of the POS area based on the plans and information provided.

3. Tree Assessment Methodology

3.1 Methodology of the Assessment

All of the Trees identified on the Site were visually inspected from ground level.

3.2 Health Condition

The overall health of each Tree was adjudged from an inspection of its leaf, overall percentage of leaf mass present in the canopy of the Tree, and the presence (or absence) of any pest or disease factor that could have an effect on the overall health of the Tree.

3.3 Structural Condition

The structural integrity of each Tree was determined from a visual inspection of its main stem, primary (and secondary) branch unions to determine the presence of any areas considered to be a structural 'defect' or 'imperfection' such as unions with included bark, swelling, or noticeable splitting at them.

Symptoms of decay, growth patterns and defects are identified and assessed as to their potential to cause whole tree, part tree or branch failure, and where considered necessary further investigation by way of the use of sounding techniques was utilised to determine the presence and general extent of any areas of cavity or associated decay within a tree's main stem structure.

The Tree's root plate area was also inspected to identify any visible signs of root plate, movement, cracking or heave from which a determination of the in-ground stability of the Tree can be ascertained. It is however important to note that there are limitations in verifying the in-ground stability of a tree based on a 'one-off' cursory visual observation; particularly in a forest type habitat where ground cover and leaf litter prevent or limit visual observations, and particularly if the inspection is undertaken during a period of 'fine' weather with little to no wind; as was the case over the period of this assessment.

3.4 Known Species Traits

Species suitability for use in an urban area and if the identified specimen is of a species that can be subject to the sudden branch failure phenomenon or is known to be potentially problematic in terms of self-sowing (weed) issues, was also considered as part of the assessment process.

With regards to any future development the known natural species traits of the given tree and its ability to cope with disturbances to its root zone that typically occur as part of a development process, as well as its ability to cope with the new parameters that are commonly created by an urban development (i.e. decreased soil oxygen due to compaction, increased un-seasonal watering from irrigation, increased pollution, increased radiated heat/light from urban infrastructure (roads, walls, buildings etc.) are all also taken into consideration.

The known root zone morphology of the species was taken into consideration when allocating the recommended TPZ for each of the identified trees. Note: Whilst some reference and acknowledgment is given to the guidelines set down in AS 4970, the TPZ for each Tree has been based on the known typical root zone morphology for specimens of their species, the condition of the given Tree, and the known tolerance to root zone disturbance of the given species.

4. Summary of Key Findings of the Assessment

4.1 No of Trees Identified

A total of nine individual Trees were identified during the assessment.

4.2 Health Condition

Majority of the Trees showed good health based on the condition and volume of leaf mass present.

I could see no visible evidence of any pest or disease pathogen that could have a major impact to the health of the Trees on this Site at the time of my inspection.

4.3 Structural Condition

The majority of the trees showed to have (what is considered to be) typical structural forms for specimens of their given species.

Whilst a number of the Trees showed to have what are considered to be 'structural defects' such as bi-furcated unions with signs of swelling and included bark (which are considered to potentially have an increased likelihood for failure than other forms of branch unions) for the most part any structural defect or imperfections were not considered to be of any major concern at this time; particularly as the Trees are proposed to be incorporated into areas of POS where targets (i.e. people, structures) are typically less compared to a streetscape situation.

4.4 Suitability for inclusion into an area of Development

In many respects all of the identified Trees were considered suitable for retention and inclusion into an area of development.

Retention of some of the Trees will however be somewhat dependent on aspects of detailed design and what potential targets (people, structures etc.) will be introduced into the fall zone of the Trees as part of development in view of the risk management responsibilities that are generally associated with trees.

5. Table of the Findings of the Assessment

The following pages provide a table of further information on each of the identified Trees.

Explanation of Fields of Information in the Table

Tree No. Provides an identification number for the identified Tree

Species Provides the botanical and most commonly used species name of the Tree.

Estimated Height Provides an estimated height (in metres).

Estimated Trunk Calliper (DBH) Provides an estimated trunk calliper of the Tree (in mm, and generally measured at 1.4 metres ("DBH") above ground level as per the industry standard). Should lower canopy formation start below 1.4 metres above ground level, the DBH is estimated at the point below the furcation of its main stem.

In instances where the tree has multiple main stem structures, the DBH of all has been provided.

Estimated Canopy Spread Provides an estimated spread of the Tree's canopy; provided in metres diameter. Both north-south and east – west canopy dimensions have been provided.

Health Condition Provides a view of the Tree's health/vigour condition at the time of inspection based on a number of predetermined criteria.

Health Rating	Explanation
Excellent	Shows to have typical foliage condition and amount of foliage mass for a specimen of the species. May have a minor amount of deadwood, but no signs of any pest or disease factor that may affect its health.
Good	Shows to have typical foliage condition. Canopy foliage may be slightly chlorotic, or it may have a slightly higher percentage of deadwood than usual, or exhibit signs of being affected by environmental conditions. May have a minor pest or disease present that could start to affect its health.
Fair	Shows to have a relatively high percentage of deadwood than considered typical for a specimen of the given species and/or a low volume of live canopy leaf mass for a specimen of the given species. Apical sections of the canopy (may also be) dead. Signs of a pest or disease factor evident.
Poor	Canopy mass and foliage condition shows to be in a poor state for a specimen of the species. Has a high percentage of deadwood material in its canopy and a low volume of live canopy mass (typically <20%).
Dead	Shows to have either no live tissue within its structure, or at best has <5% live foliage mass remaining in its canopy.

5. Table of the Findings of the Assessment

Explanation of Fields of Information in the Table

Structural Form

Provides a view of the Tree's structural form at the time of inspection based on a number of predetermined criteria.

Structure Rating	Explanation
Good	Shows typical structural form for a specimen of the species. Branch unions show typical form at the point of attachment. May have a small number of minor structural defects; but are within the scope of tree surgery management to rectify. Shows to be root-stable.
Acceptable	Shows an acceptable form, but may have a number of structural defects present i.e. bi-furcation (but with no major swelling or movement), or areas of stem cavities, but structure remains within the scope of management at this stage; albeit with a higher risk/management requirement. Can include previously lopped trees that are known to have good points of attachment of any regrowth that occurs.
Questionable	Shows an undesirable structure for a specimen of the species. Structural condition likely to cause future issues in regards to the potential for branch or even complete tree failure to occur. Generally includes previously lopped trees, trees with large areas of cavity and/or associated decay that may be starting to affect its structural integrity, trees with bi-furcated unions with notable included bark and swelling that are considered to have an increased potential to fail.
Poor	Major structural defects evident. May have very large stem cavities, extensive termite damage, or noticeable movement in main stem, branch unions or root plate area.

Comment

Provides any additional information (seen as relevant in the context of this report) to the Tree.

Comments are (generally) self-explanatory.

TPZ

Meaning the Tree's protection zone; the area where the majority of the given Tree's root mass is considered likely to be found, and the area that is recommended to be protected during any development activity.

TPZ are given as a metre **radius** of the base of the Tree's main stem (trunk).

Tree ID	Species	Approx Height (metres)	DBH (cm)	Canopy Spread N/S	Canopy Spread E/W	Health	Structure	Age Class	Value (Helliwell Method)	Image	Comments	TPZ (metres radius)
1	Tuart (*Eucalyptus gomphocephala*)	13	51	6-8	6-8	Excellent	Good	semi-mature	21,600		Good specimen. Shows good health and structural form. Estimated 20-30 years old	5
2	Tuart (*Eucalyptus gomphocephala*)	13	30	2-4	2-4	Excellent	Good	semi-mature	18000		Good specimen. Shows good health and structural form. Estimated 20-30 years old	3
3	Tuart (*Eucalyptus gomphocephala*)	16	55	6-8	6-8	Excellent	Acceptable - Good	semi-mature	10,800		Reasonably good specimen. Estimated 20-30 years old. Shows good health and reasonably good strucutral form. Its main stem bi-furcates and evidence of included bark at the union. Union looks to be ok at this time but may cause issues longer term	5.5
4	Tuart (*Eucalyptus gomphocephala*)	17	56	8-10	6-8	Excellent	Acceptable	semi-mature	12600		Reasonably good specimen. Estimated 20-30 years old. Shows good health and reasonably good strucutral form. Main stem bi-furcates and evidence of swelling at the union. Union looks to be ok at this time but likely to cause issues longer term	5.5
5	Tuart (*Eucalyptus gomphocephala*)	17	59	8-10	8-10	Excellent	Acceptable - Good	semi-mature	25200		Reasonably good specimen. Estimated 20-30 years old. Shows good health and reasonably good strucutral form. Main stem furcates into four first order branch structures. Unions look to be ok at this time	6
6	Tuart (*Eucalyptus gomphocephala*)	14	49	8-10	6-8	Excellent	Acceptable	semi-mature	9000		Reasonably good specimen. Estimated 20-30 years old. Main stem bi-furcates and evidence of included bark at the union. Union looks to be ok at this time but likely to cause issues longer term	5

Tree ID	Species	Approx Height (metres)	DBH (cm)	Canopy Spread N/S	Canopy Spread E/W	Health	Structure	Age Class	Value (Helliwell Method)	Image	Comments	TPZ (metres radius)
7	Tuart (*Eucalyptus gomphocephala*)	16	66	10-12	8-10	Good	Acceptable	semi-mature	25200		Reasonably good specimen. Estimated 20-30 years old. Canopy is slightly sparse but what leaf mass is present shows good condition and form. Bark canker noted. Main stem bi furcates but union looks to be ok at this time	6.5
8	Jarrah (*Eucalyptus marginata*)	8	57	8-10	6-8	Fair	Acceptable - Good	mature	9000		Ok mature specimen. Possibly in the order of 50-60 years old. Canopy is slightly sparse and suggests that it may be starting to decline in health to some degree. Area of decay and cavity noted but not of a major concern at this time in terms of its structural integrity	5.5

6. Further Considerations; Development Design and Construction

6.1 Protection of Trees as part of Development

It is difficult to provide any further specific comments for each Tree as to the potential of the impact from the development of this Site at this stage, as much of the impact caused will be very much dependent on the detailed design aspects of any proposed development.

The retention of the existing current ground level and soil profile within a Tree's designated TPZ will however be of paramount and key importance in the success of the retention of any Tree.

Effective tree protection must also begin with good design and specifications, so that protection during the construction/landscape stages of a development will be achievable and practicably possible.

As an initial recommendation **the TPZ of each Tree is strongly recommended to be overlaid onto all drawings and designs of the proposed development**.

Where encroachments into a designated TPZ are found to be required, further discussion with an experienced independent arboricultural consultant is an important part of the tree protection process.

This is not to say that some encroachment and development activity would not be permitted to be undertaken within a TPZ area as part of a development process.

However any encroachment required/proposed will require further input and discussion with the arboricultural consultant as part of any detailed design process to determine what the potential impact on the given Tree will be, and what design modifications or measures may need to be implemented to mitigate any potential negative impact on the given Tree.

If considered necessary, some exploratory excavation works may also be required to verify actual root spread and determine what impact could occur.

Aspects such as resulting levels, delineation of any underground service pipework, drainage, sewerage etc. can all have (potentially) a major impact on a tree's root zone, and in turn its future health and potential lifespan.

During the design process further arboricultural input will likely be required to discuss:

- Current existing ground levels and proposed resulting levels of the various areas of the Site. Note: As previously mentioned, retaining and maintaining current existing ground levels within the designated TPZ of any tree is of paramount importance to the success of tree retention.
- Delineation of <u>any</u> underground services pipework including drainage, sewerage, water, gas, electricity, telecommunications and the like; specifically should they pass through any designated TPZ.
- Location of any drainage near to the Trees and their TPZ.
- Any site remediation requirements within TPZ areas as part of the Site clearing process.
- Proximity of buildings and any other built structures to each Tree and its TPZ and the methodology of its construction.
- Final landscape of the area around any Tree selected for retention (including any irrigation pipework, underground services, hardscape structures, and even soft-scape landscaping).

6. Further Considerations; Development Design and Construction

6.2 Physical Protection of Trees during Development

Physical protection measures in accordance with AS 4970 will also be required for any Tree selected for retention; details of any measures to be implemented will be very much dependent on the final detailed design.

It will be of critical importance that the appropriate protection measures are set up and maintained from the outset; i.e. before any Site clearing/demolition works commence.

Implementing tree protection measures after damage has occurred from works is often of little to no value other than affording some protection from further damages occurring.

6.3 Canopy Works

Canopy works may be required on a number of the Trees.

The extent of canopy works on each Tree is however very much dependent on the eventual landscape around the Tree and what potential targets (people, structures etc.) may eventually be within the given Tree's projected fall zone.

At this stage canopy works are likely to be restricted to the removal of any larger diameter deadwood (i.e. any dead branches 50mm or greater in diameter) and/or the raising of canopy's where necessary to provide clearances for future footpaths, structures and/or roads.

Other canopy works may be required pending results of detailed design and what targets will be within the given Tree's projected fall zone.

All canopy works are recommended to be undertaken by suitably qualified and experienced tree surgeons, who possess a minimum qualification of AQF certificate 3 arboriculture, or recognised equivalent qualification.

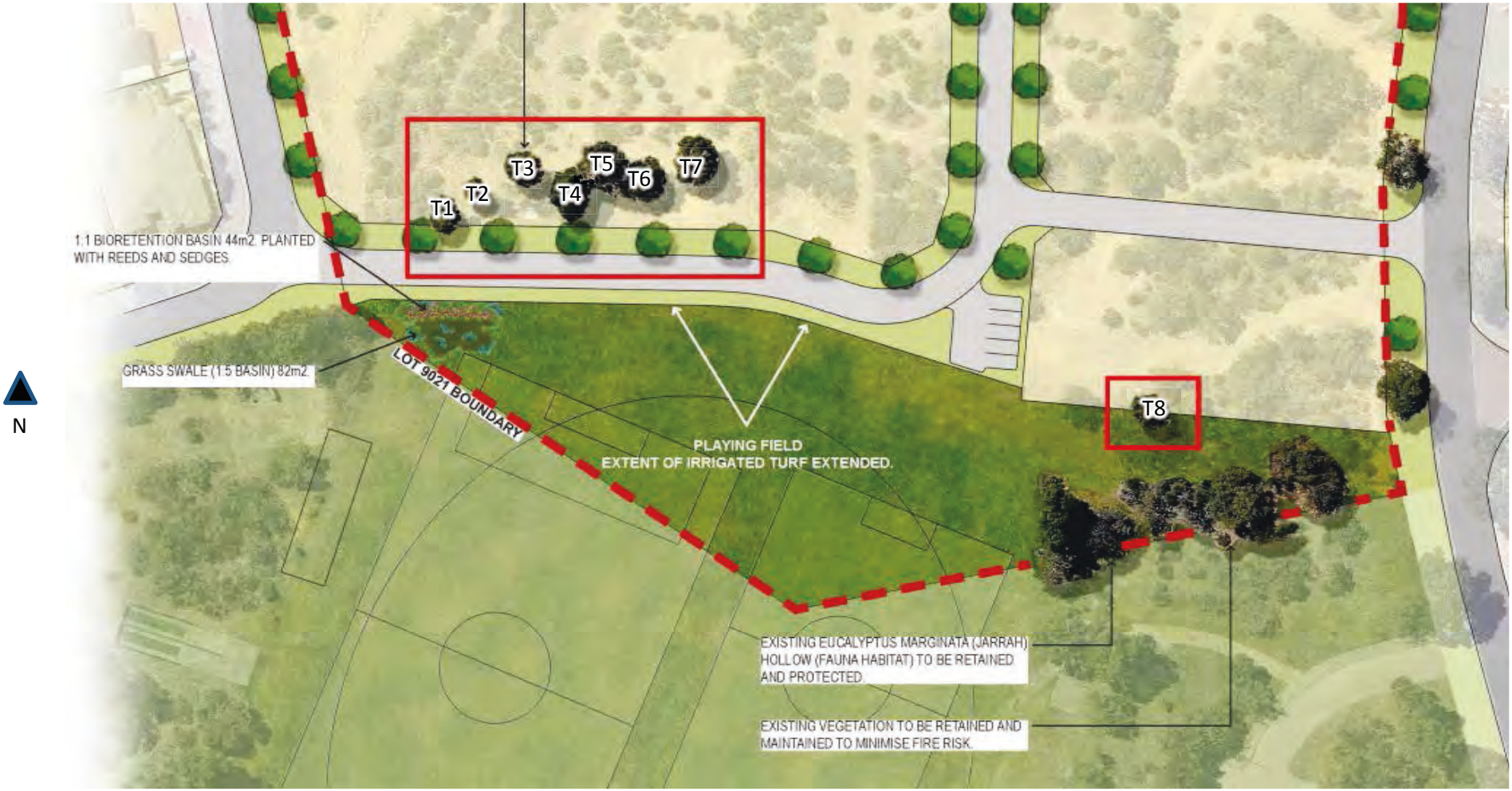
All canopy pruning works must also comply with Australian Standards 4373; Pruning of Amenity Trees.

Attachments to this Report

Attachment 1; Tree Location Guide

Attachment 2; Company Information & Disclaimer

Attachment 1; Tree Location Guide


T1
T2
T3
T4
T5
T6
T7
T8
1:1 BIORETENTION BASIN 44m2. PLANTED WITH REEDS AND SEDGES.
GRASS SWALE (1:5 BASIN) 82m2.
LOT 9021 BOUNDARY
PLAYING FIELD
EXTENT OF IRRIGATED TURF EXTENDED.
EXISTING EUCALYPTUS MARGINATA (JARRAH) HOLLOW (FAUNA HABITAT) TO BE RETAINED AND PROTECTED.
EXISTING VEGETATION TO BE RETAINED AND MAINTAINED TO MINIMISE FIRE RISK.
N

Attachment 2; Company Information & Disclaimer

Company Name:	ARBOR logic
A.C.N.:	107 194 061
A.B.N.:	66 566 369 687

Insurance Details:

General Liability;	Zurich	$20 million
Professional Indemnity;	Vero	$5 million
Personal Protection;	Macquarie, Asteron	

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Disclaimer

This Report has been provided in good faith and based upon the material information provided by the Client to Arbor logic, and/or based on the visual inspection of the tree(s) at the time this advice was prepared.

The contents of this Report should be read in full, and at no time shall any part of the Report be referred to unless taken in full context with the remainder of the document.

The contents of this Report may not be reissued to another party or published in part or full without Arbor logic's written permission.

Arbor logic does not accept liability arising out of loss or damage that results from: -

- Material information not being provided by the Client to Arbor logic at the time this advice was prepared.
- The provision of misleading or incorrect information by the Client or any other party to Arbor logic upon which this advice was prepared.
- This advice being used by the Client or any other party in circumstances or situations other than the specific subject of this advice.
- Failure by the Client to follow this advice.
- The action(s) or inaction(s) of the Client or any other party that gives rise to the loss of, or damage to, the tree(s) that are the subject of this advice.

It is also important to take into consideration that all trees are living organisms and as such there are many variables that can affect their health and structural properties that remain beyond the scope of reasonable management practices or the advice provided in this Report based on the visual inspection of the tree(s).

As such a degree of risk will still remain with any given tree(s) despite the adoption of any best management practices or recommendations made in this Report.

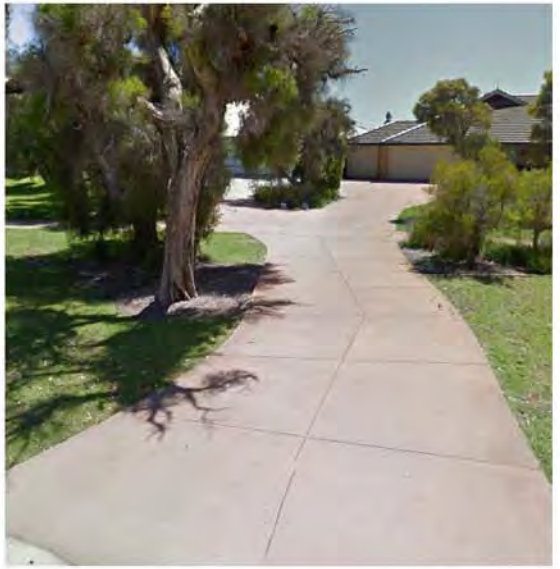
TreeID	Species	Approx Height (metres)	DBH Height (metres)	DBH (cm)	Canopy Spread N/S	Canopy Spread E/W	Health	Structure	Age Class	Comments	TPZ (metres radius)	GPS Date	Easting	Northing
1	Tuart (*Eucalyptus gomphocephala*)	13	1.3	51	6-8	6-8	Excellent	Good	semi-mature	Good specimen. Estimated 20-30 years old	5	11/20/15	380716.12	6490380.546
2	Tuart (*Eucalyptus gomphocephala*)	13	1.3	30	2-4	2-4	Excellent	Good	semi-mature	Good specimen. Estimated 20-30 years old	3	11/20/15	380723.88	6490386.466
3	Tuart (*Eucalyptus gomphocephala*)	16	1.3	55	6-8	6-8	Excellent	Acceptable - Good	semi-mature	Reasonably good specimen. Estimated 20-30 years old. Main stem bi-furcates and evidence of included bark at the union. Union looks to be ok at this time but may cause issues longer term	5.5	11/20/15	380729.89	6490389.437
4	Tuart (*Eucalyptus gomphocephala*)	17	1.3	56	8-10	6-8	Excellent	Acceptable	semi-mature	Reasonably good specimen. Estimated 20-30 years old. Main stem bi-furcates and evidence of swelling at the union. Union looks to be ok at this time but likely to cause issues longer term	5.5	11/20/15	380735.95	6490384.688
5	Tuart (*Eucalyptus gomphocephala*)	17	1.3	59	8-10	8-10	Excellent	Acceptable - Good	semi-mature	Reasonably good specimen. Estimated 20-30 years old. Main stem furcates into four first order branch structures. Unions look to be ok at this time	6	11/20/15	380741.57	6490389.639
6	Tuart (*Eucalyptus gomphocephala*)	14	1.3	49	8-10	6-8	Excellent	Acceptable	semi-mature	Reasonably good specimen. Estimated 20-30 years old. Main stem bi-furcates and evidence of included bark at the union. Union looks to be ok at this time but likely to cause issues longer term	5	11/20/15	380750.21	6490387.969
7	Tuart (*Eucalyptus gomphocephala*)	16	1.3	66	10-12	8-10	Good	Acceptable	semi-mature	Reasonably good specimen. Estimated 20-30 years old. Canopy is slightly sparse but what leaf mass is present shows good condition and form. Bark canker noted. Main stem bi furcates but union looks to be ok at this time	6.5	11/20/15	380758.08	6490389.452
8	Red Flowering Gum (*Corymbia ficifolia*)	7	1.3	45	6-8	6-8	Excellent	Good	mature	Good mature specimen. Estimated 20-30 years old. Some signs of Marri Canker but looks to be having little to no impact at this time. Low canopy spread should be retained to maintain aesthetics and integrity	4.5	11/20/15	380808.08	6490340.894
9	Jarrah (*Eucalyptus marginata*)	8	1.3	57	8-10	6-8	Fair	Acceptable - Good	mature	Ok mature specimen. Possibly in the order of 50-60 years old. Canopy is slightly sparse and suggests that it may be starting to decline in health to some degree. Area of decay and cavity noted but not of a major concern at	5.5	11/20/15	380838.25	6490341.894
10	Tuart (*Eucalyptus gomphocephala*)	20	1.3	45	8-10	8-10	Good	Acceptable	semi-mature	Ok mature specimen. Estimated 20-30 years old. Canopy is slightly sparse but what leaf mass is present shows good condition and form. Main stem bi-furcates but union looks to be Ok at this stage. Effectively forms the one canopy with the adjacent tree. Relatively leggy canopy form with limited lower canopy structure	4.5	11/20/15	380820.98	6490331.714
11	Tuart (*Eucalyptus gomphocephala*)	18	1.3	45	8-10	8-10	Excellent	Acceptable - Good	semi-mature	Reasonably good specimen. Estimated 20-30 years old. Effectively forms the one canopy with the adjacent tree. Relatively leggy canopy form with limited lower canopy structure	4.5	11/20/15	380820.49	6490326.9
12	Coastal Banksia (*Banksia attenuata*)	7	0.4	46	6-8	4-6	Poor	Good	post-mature	Canopy is sparse and suggests it may have limited life span remaining	4.5	11/20/15	380821.08	6490323.233
13	Coastal Banksia (*Banksia attenuata*)	7	0.4	50	6-8	4-6	Poor	Acceptable - Good	post-mature	Canopy is sparse and suggests it may have limited life span remaining. Main stem bi-furcates and evidence of included bark at the union but not of any concerns at this time	4.5	11/20/15	380827.96	6490325.571
14	Coastal Banksia (*Banksia attenuata*)	5	1.3	25, 18	4-6	2-4	Poor	Acceptable	post-mature	Multi-stemmed from near ground level. Canopy is sparse and suggests it may have limited life span remaining	2.5	11/20/15	380836.6	6490330.697

TreeID	Species	Approx Height (metres)	DBH Height (metres)	DBH (cm)	Canopy Spread N/S	Canopy Spread E/W	Health	Structure	Age Class	Comments	TPZ (metres radius)	GPS Date	Easting	Northing
15	Coastal Banksia (*Banksia attenuata*)	6	1	35	4-6	2-4	Dead	Poor	post-mature	Dead tree		11/20/15	380844.16	6490332.193
16	Coastal Banksia (*Banksia attenuata*)	7	1.4	25	4-6	2-4	Poor	Acceptable - Good	post-mature	Canopy is sparse and suggests it may have limited life span remaining.	2.5	11/20/15	380848.39	6490333.411
17	Prickly Bark (*Eucalyptus todtiana*)	8	1.4	35, 19x3	10-12	10-12	Excellent	Good	mature	Good mature specimen. Good aesthetic form/value. Multi-stemmed from ground level; possibly regrowth	6	11/20/15	380850	6490334.428
18	Prickly Bark (*Eucalyptus todtiana*)	8	1.4	40, 32 x2	8-10	12-14	Excellent	Good	mature	Good mature specimens. Three trees in close proximity that effectively form the one canopy. Treat as one for purposes of preservation and protection. Good aesthetic form/value	7.5	11/20/15	380860.93	6490339.318
19	Tuart (*Eucalyptus gomphocephala*)	12	1.4	51	8-10	6-8	Excellent	Good	semi-mature	Good specimen. Estimated 20-30 years old. Bark canker noted but otherwise ok	5	11/20/15	380877.39	6490352.251
20	Tuart (*Eucalyptus gomphocephala*)	12	1.4	43	8-10	6-8	Fair	Acceptable - Good	semi-mature	Estimated 20-30 years old. Canopy is reasonably sparse and suggests that it may be starting to decline in health. Bark canker noted. Main stem bi-furcates but union looks to be Ok at this stage	4.5	11/20/15	380877.3	6490390.814
21	Tuart (*Eucalyptus gomphocephala*)	11	1.4	55	14-16	10-12	Excellent	Acceptable - Good	semi-mature	Reasonably good specimen. Estimated 20-30 years old. Main stem bi-furcates and evidence of included bark at the union. Union looks to be ok at this time	5.5	11/20/15	380883.45	6490426.906
22	Tuart (*Eucalyptus gomphocephala*)	11	1.4	73	14-16	12-14	Excellent	Good	semi-mature	Good specimen. Estimated 20-30 years old. Good aesthetic form/value	7.5	11/20/15	380886.2	6490452.792
23	Tuart (*Eucalyptus gomphocephala*)	13	1.4	82	12-14	12-14	Excellent	Good	semi-mature	Good specimen. Estimated 20-30 years old. Main stem bi-furcates but union looks to be Ok at this stage	8	11/20/15	380900.45	6490474.21
24	Tuart (*Eucalyptus gomphocephala*)	15	1.4	76	10-12	8-10	Excellent	Acceptable - Good	semi-mature	Good specimen. Estimated 20-30 years old. Main stem bi-furcates and evidence of included bark at the union. Union looks to be ok at this time but may cause issues longer term	7.5	11/20/15	380902.79	6490495.803
25	Tuart (*Eucalyptus gomphocephala*)	14	1.4	73	12-14	12-14	Good	Good	semi-mature	Reasonably good specimen. Estimated 20-30 years old. Canopy is slightly sparse and suggests that it may be starting to decline in health. Bark canker noted	7.5	11/20/15	380894.99	6490517.508
26	Norfolk Island Pine (*Araucaria heterophylla*)	11	1.3	35	6-8	6-8	Excellent	Good	semi-mature	Good specimen. Estimated 15-20 years old. Main stem bi-furcates higher up on main stem but union looks to be Ok at this stage	3.5	11/20/15	380673.26	6490471.317

ATTACHMENT B

emerge ASSOCIATES
Integrated Science & Design

CREATIVE PLANNING AND DESIGN- SHARED CROSSOVER CONCEPT



02 May 2016
PACBB/Images/160406 Driveway Sketch

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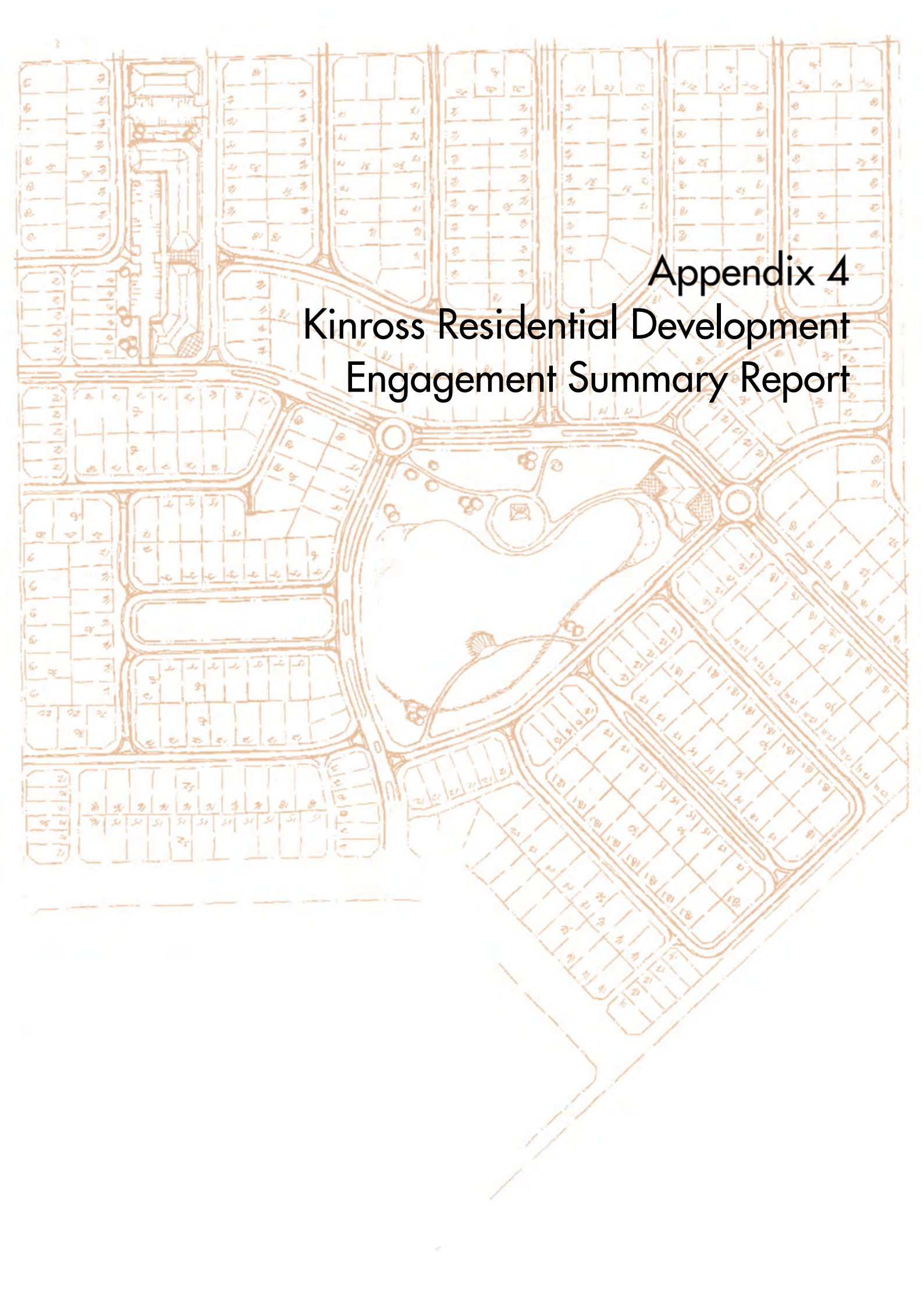
Creative DESIGN+PLANNING



Appendix 4
Kinross Residential Development Engagement Summary Report

Kinross Residential Development Engagement Summary Report

PEET LIMITED

FINAL REPORT | OCTOBER 2015

Creating Communities

PROJECT DETAILS

Client	Peet Limited
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Prepared By	Creating Communities Pty Ltd
Project Team	Angela Vurens van Es **Consultant** Andrew Watt **Senior Consultant**
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Email	angela@creatingcommunities.com.au

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1. INTRODUCTION 1
2. METHODOLOGY 2
3. COMMUNITY OPEN DAY 4
4. APPENDICES 8

1. INTRODUCTION

1.1. Project Background

The proposed residential development site at Lot 9021 MacNaughton Crescent Kinross is 4.03 hectares in size and aims to deliver a quality infill development to the suburb of Kinross.

A team of expert consultants have been appointed by project managers Peet Limited (Peet). in the areas of town planning, urban design, environmental design, traffic management, engineering, landscape architecture and community engagement - to commence work on residential development plans for the site.

Consultation with the City of Joondalup has informed the approach to broader community consultation.

1.2. Site Context

Lot 9021 is located in the north-eastern quadrant of Kinross and approximately 250 metres from the common boundary between the Cities of Joondalup and Wanneroo. The site is bounded on three of its four sides by Grangemouth Turn (west), Lochnagar Way (north) and MacNaughton Crescent (east). MacNaughton Park adjoins the site along its southern Boundary.

The site is located within a well-established residential area with Residential Design Code densities ranging from R20 to R25. To the south of the site, beyond MacNaughton Park, is the Kinross Central Shopping Centre.

The site was originally zoned in part 'Residential' and also in part 'Local Reserve – Public Use (Primary School)' under the City of Joondalup District Planning Scheme No.2. The site was initially required for a public primary school during the planning of the suburb Kinross. In 2013, the Department of Education confirmed the site was no longer required for educational purposes.

It is not uncommon for the Department of Education not to utilise all sites that are allocated for primary schools in initial urban plans. The decision to develop all sites depends on the current and future demographics of an area, with it being decided that there was already sufficient existing school facilities to meet current and future local need.

Following the divestment of the site by the Department of Education, a Scheme Amendment process commenced in February 2014 to rezone the land from 'Public Use' to 'Urban Development' under the City of Joondalup's District Planning Scheme. The Scheme Amendment was advertised for public comment for a period of 42 days and closed on 6 August 2014, with a total of 23 submissions being received. The matter was considered by Council at their meeting in September 2014, with the decision being to zone the site as 'Urban Development'. Subsequently the Scheme Amendment was approved by the WA Planning Commission (WAPC) and Minister for Planning in February 2015.

1.3. Design Principles

In developing the site, there are some key design principles have been adopted to ensure a quality outcome for the Kinross neighbourhood:

- A seamless interface with the local neighbourhood;
- Quality public open space (including tree retention);
- Efficient movement systems and connectivity;
- Effective drainage and stormwater management; and
- Responsiveness to local landforms and environment.

2. METHODOLOGY

2.1. Aim of Consultation

Peet are committed to effectively engage stakeholders and the community to ensure the plans for the development respond appropriately to local issues and aspirations, while also ensuring the value of this important asset is realised. With this in mind, expert consultants Creating Communities were engaged to facilitate the community consultation process.

Purpose: To seek input and support for the redevelopment of the former Kinross Primary School site.

Core Objective: To actively involve the Kinross community, local organisations, stakeholders and the project team in building beneficial relationships that will enable the effective development of the former Kinross Primary School site

Key outcomes sought by the community engagement process include:

- Successful management of key messages.
- Supporting Kinross residents to identify the benefits of developing the school site.
- Generating an informed understanding of the proposed development.
- Identifying key stakeholders and community members who will be able to make knowledgeable comment and input regarding the proposed site development.
- Establishing effective communication channels and foster positive relationships between the community and the developer.
- Recognising key issues, concerns, opportunities and aspirations related to the site.
- Early community "buy-in" and advocacy for the development.

2.2. Stages of Consultation

2.1 STAGE ONE: Engagement in the Planning of the Development

The following strategies have been undertaken in the preparatory phases, to effectively engage the community in the planning processes for the redevelopment of the site, in order to seek their support and acceptance for the future proposal.

- Meetings with the City of Joondalup (ongoing).
- Meetings with the Kinross Residents Association.
- A Community Open Day on Saturday 13 June where local residents and stakeholders had the opportunity to meet the project team.
- A community response form made available at the Community Engagement Day to seek specific feedback.
- An opportunity for follow up contact with the project team where required.

See overview of Stage One consultation in Table 1. The City of Joondalup were involved in determining the approach undertaken for engagement and had opportunity to comment on all communications materials prior to distribution.

2.2 STAGE TWO: Post Development Approval

After development approval is granted, it will be important to maintain positive connections with stakeholders and local community members where possible. This may include ongoing engagement and relationship management.

The table below provides an overview of the strategies and tasks associated with Stage 1 of the Kinross Residential Development consultation.

TABLE 1: STAGE 1 CONSULTATION OVERVIEW

Strategy	Description	Timing
1. Inception Meeting	Collaborated with Project team to: determine agreed approach - identify and confirm key project messages - confirm delivery timelines	March 2015
2. Community Profiling	Identified key stakeholders to be consulted	March - May
3. Communications	Community and stakeholder database developed for ongoing community engagement.	March - Ongoing
4. Invited Stakeholders	Invitation to local sporting clubs, neighbours and other relevant stakeholders (via letter and email) to engage in an Open Day. Actions undertaken included: • Flyer to Kinross suburb • Banner installed on site • Advertisement in Joondalup Times newspaper • Advertisement via Kinross Residents Association Facebook page • Westside Football Club and Kinross Residents Association secured to be involved on the day See Appendix 2.	Invitations distributed two weeks prior to event
5. Developed Communications Materials	Produced Information Booklet and Frequently Asked Questions sheet to provide information to interested community members. General information included: • Project background • Site location / description • Design principles • Benefits for community • Proposed key features • Development timeline and considerations inc. traffic, earth works, retention of vegetation etc. • Commitment to consultation See Appendix 3.	Materials developed one week prior to event
6. Facilitated Open Day	Conducted an interactive community open day at MacNaughton Club rooms on Saturday 13 June, 12,30pm - 2.30pm. • Project team on hand to discuss and answer questions relevant to the opportunities and constraints for the site • Developed displays, information boards and materials with principal exhibits showing the site plan, key design principles, and opportunities/ constraints • Provided a written feedback sheet and record anecdotal comments.	Saturday 13 June

3. COMMUNITY OPEN DAY

3.1. Event Overview

The Kinross Residential Development Community Engagement Session was held on Saturday 13 June between 12.30pm and 2.30pm and provided interested residents and stakeholders with an opportunity to drop in, discuss development opportunities for the site and provide feedback. Representatives from Peet and their project team including planners, traffic and environmental specialists were on hand to answer community questions.

Displays included a site context plan, summary of opportunities and constraints and overview of design principles (see Appendix 1).

Over 55 community members attended on the day and the Kinross Residents Association and Westside Football Club provided tea, coffee and a free sausage sizzle.

3.2. Summary Findings

Anecdotal feedback from the approximately 55 individuals engaged in face-to-face discussions was generally positive in regards to the residential development. However, there were some clear priorities which were frequently raised including:

- Any future residential densities in line with surrounding suburb
- Integration with Public Open Space; and
- Retention of natural bushland where possible.

Of the 55 plus individuals engaged, 29 also completed a response form (see Appendix 2). Responses from the forms have been themed under key headings below.

3.2.1. Demographic of Attendees

Of the 29 attendees who provided formal feedback, all were residential property owners, with three also being representatives from local sporting/ community organisations.

Of these 29 attendees, 21 responded to a question concerning their place of residence. Majority live in the suburb of Kinross, with many living either directly facing or in the street surrounding the site.

Place of Residence	No. of Attendees
In a street close to the site but not directly facing it	11
In a street facing the site	6
Elsewhere in suburb of Kinross	3
Don't reside in suburb of Kinross or City of Joondalup	1

3.2.2. Priorities

Specific feedback was gathered on the top priorities to be reflected in any future subdivision design of the site. The following themes were common amongst attendees and respondents:

Theme	Description
Density (25 responses)	• Low density residential – 3-600sqm favoured • Would like limit of 2 storey (requirement for 2 storey on smaller lots to eliminate 'slum' dwellings) • Development to reflect lot size similar to adjacent/ surrounding area (R25) • Preference for single residential lots, rather than apartments, townhouses or units • Minimal preference for variety of lot sizes • Large lot interface with existing residents (landowner adjacent to site)
Retention of Natural Environment (10 responses)	• Preserve as much green space / natural bushland / trees as possible • Implement appropriate flora and fauna management and rehabilitation as required
Integration with existing Public Open Space (9 responses)	• Priority to preserve functionality of existing oval • Maximise greenspace in development
Consistent built form and landscaping (9 responses)	• Maintain consistent appeal with adjacent built form and landscaping including roofs, fencing and rendering
Other	• Manage impact of increased traffic through appropriate siting of roads • Avoid cheaper housing that may attract a "lower socio-economic" demographic that may in turn create poor social cohesion / decrease community safety

3.2.3. Important Outcomes

Attendees were asked to list the most important positive outcomes that they think can achieved for the Kinross Community though the planning of a high quality residential development. The following themes were common amongst attendees and respondents:

Theme	Description
Increased infrastructure/ amenity/ maintenance (8 responses)	• Provision of increased infrastructure and amenity to the local area, including roads and footpaths • Effective management of traffic, with recognition that traffic levels will be lower than would be with previously planned Primary School • Maintenance of roads and surrounding amenity • Split views on road or retaining wall interface with POS • Retaining wall will help frame park
Positive community engagement/ outcomes (5 responses)	• Potential for positive social outcomes to be achieved through ongoing engagement with local residents and support for local community organisations, including sporting and residents associations
Reduction/ prevention of anti-social behaviour (5 responses)	• Improved safety of local area through increased passive surveillance, lighting etc. • Avoid cheaper housing that may attract a "lower socio-economic" demographic that may in turn create poor social cohesion / decrease community safety

No positive aspects of development (4 responses)	• View that there will be no positive outcomes • Concern over traffic and loss of open space
Affordability (3 responses)	• Increased affordability to buy into the neighbourhood • Opportunity to downsize and for ageing in place
Positive impact on property values (3 responses)	• Increase property value for surrounding owners and Kinross suburb
Other	• Opportunity to 'get it right' • Increased utilisation of MacNaughton Park • Reduced bush fire risk

3.2.4. Issues/ Concerns

Theme	Description
Traffic/ parking (13 responses)	• Increased volume of traffic compared to current levels • Overload of existing road infrastructure • Traffic access point required from east and west • Shortage of parking on MacNaughton Drive may be exacerbated • General recognition that traffic will be less than anticipated if a Primary School was developed
Loss of natural bush and habitat (11 responses)	• Loss of natural bushland as a result of development • Need for appropriate wildlife protection
Anti-social behaviour (10 responses)	• Concern that development will incorporate social housing • Increased population may result in more anti-social behaviour • Loitering and graffiti • Concern over existing antisocial behaviour at skate park and community centre
Construction impact management (9 responses)	• Manage dust/noise/traffic/workers/safety (especially in relation to children) during construction
Negative impact on property values (4 responses)	• Increased supply of housing, or inappropriately priced lots may impact existing property values
Other	• Preference to avoid high density • Damage/ loss of functionality of oval • Lack of community amenity included in development

3.3. Recommendations

Recommendations in regards to the Peet Kinross Residential development are:

Recommendation 1: Use the Consultation Findings to Inform Future Development Planning and Design

Key findings from initial engagement with the Residents Association informed the development of a clear set of Design Principles. Further feedback gathered at the Open Day should be used to inform the Local Structure Plan for the site so as to harness identified opportunities and address concerns in the key areas of:

- Cohesiveness with surrounding suburb (density and built form)
- Integration with existing oval facility
- Retention of vegetation where possible
- Enhancing safety and security through design

Recommendation 2: Manage Construction Impacts via an Interface Management Plan

Consultation findings indicate that there is concern among some community members regarding disruption during the construction stage of the proposed development. There is particular concern among neighbouring residents about direct impacts such as noise and traffic.

It is recommended that an Interface Management Plan is produced, which acknowledges that inconveniences will be caused to residents at various stages of a project, but puts in place mitigations to minimise any disruption. Such a plan should outline a defined process for collecting and responding to community feedback regarding the impacts of a project's construction activities and put in place pre-emptive strategies to minimise any impacts.
4.3
Recommendation 3: Develop and Implement a Flora and Fauna Management Plan

A clear theme of consultation was around the loss of natural flora and fauna as a result of development. Given that the project site's environmental assets are highly valued in the community it is recommended that a Flora and Fauna Management Plan be developed, communicated and implemented.

Recommendation 4: Ensure Seamless Integration with the Surrounding Local Streetscape

Consultation findings indicated that Integration (ensuring the development is in keeping with the existing local buildings and amenities), is very important to many stakeholders, particularly those that live in the Kinross and neighbouring residents. With this in mind there should be a strong commitment to prioritise integration as part of any implementation plan for the facility.

4. APPENDICES

4.1. Static Displays

4.2. Event Flyer

4.3. Information Booklet and FAQS

4.4. Feedback Form

KINROSS RESIDENTIAL DEVELOPMENT

Design Principles

A seamless interface with the local neighbourhood

Quality public open space (including tree retention)

Efficient movement systems and connectivity

Effective drainage and stormwater management

Responsiveness to local landforms and environment

PEET

KINROSS RESIDENTIAL DEVELOPMENT

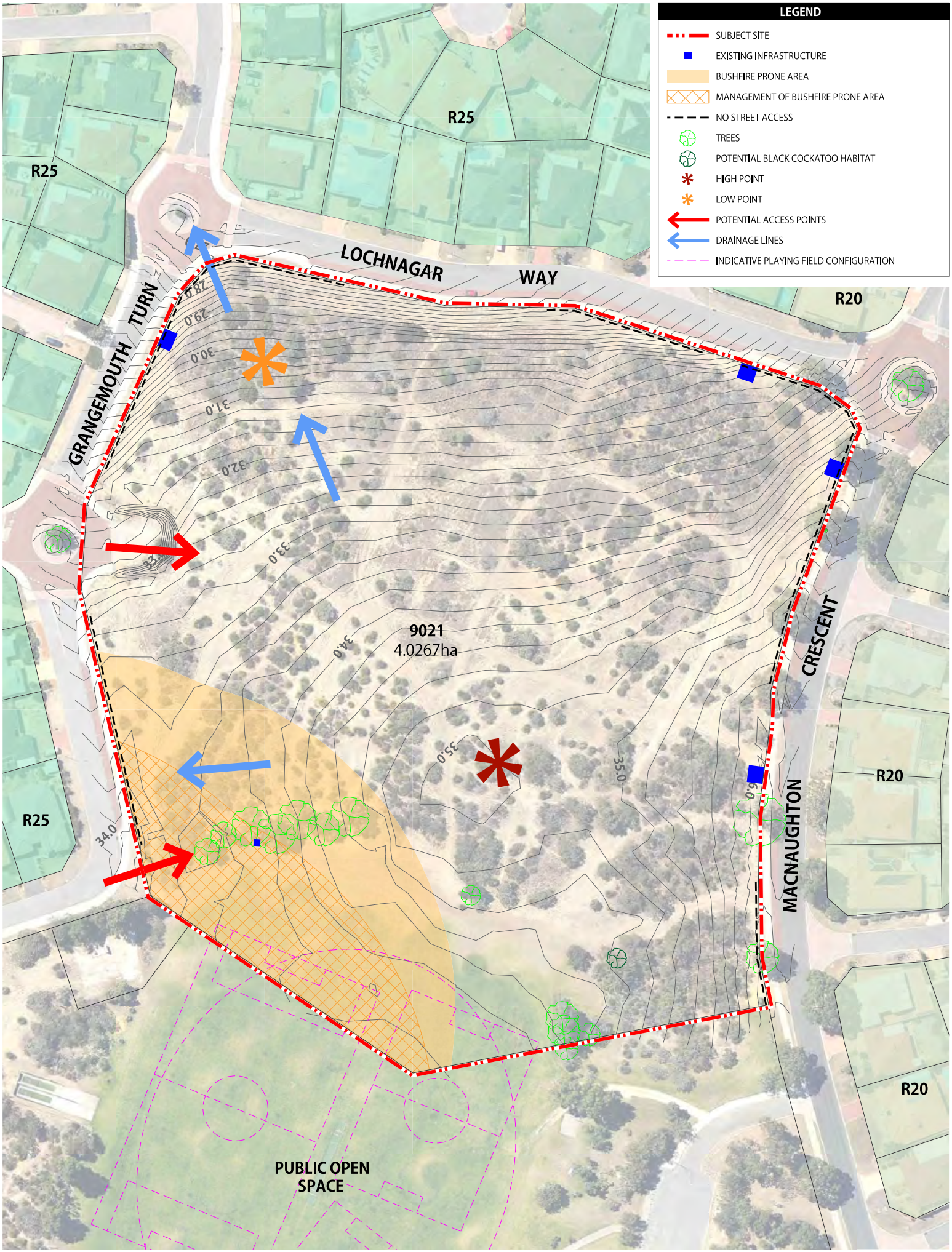
Opportunities & Constraints

OPPORTUNITIES

- Multiple potential access points
- Potential for a range of housing types including single dwellings, grouped and multiple dwellings
- East – West Road linkages
- Landscape elements to support Crime Prevention through Environmental Design (CPTED) Principles
- Integration of existing POS to allow a range of sporting and recreational functions to occur

CONSTRAINTS

- Typography of site requiring earthworks
- Earthworks may impact ability to retain vegetation



LOT 9021 MACNAUGHTON CRESCENT KINROSS

Opportunities and Constraints

SCALE

0m 10m 20m 30m

LOT 9021 MACNAUGHTON CRESCENT KINROSS

Site Context

SCALE

0 50 100 150 200 metres

Appendix 4.2 - Event Flyer

You're Invited

KINROSS RESIDENTIAL DEVELOPMENT
Community Engagement Session

Saturday 13 June, 12.30PM - 2.30PM

MACNAUGHTON CLUBROOM, KINROSS

Peet Ltd welcomes the Kinross community to drop in, meet the project team, provide feedback and discuss concepts for Peet Ltd's proposed residential development abutting MacNaughton Park.

FIND OUT MORE

ASK US QUESTIONS

FOR MORE INFORMATION
Contact Angela on 9284 0910 or email angela@creatingcommunities.com.au

PEET

Appendix 4.3 - Information Booklet and Frequently Asked Questions

Kinross Residential Development

Development proposed for
Lot 9021 MacNaughton Crescent

PEET

Background Information

The proposed residential development site at Lot 9021 MacNaughton Crescent Kinross is 4.03 hectares in size and is located within the street borders of Grangemouth Turn, Lochnagar Way and MacNaughton Crescent. The site abuts MacNaughton Park on its southern boundary.

The site was originally zoned in part 'Residential' and also in part 'Local Reserve – Public Use (Primary School)' under the City of Joondalup District Planning Scheme No.2. The site, owned by Peet Ltd, was initially designated for a public primary school during the planning of the suburb Kinross. In 2013, the Department of Education confirmed the site was no longer required for educational purposes.

It is not uncommon for the Department of Education not to utilise all sites that are allocated for primary schools in initial urban plans. The decision to develop all sites depends on the current and future demographics of an area, with it being decided that there was already sufficient existing school facilities to meet current and future local need.

Following the divestment of the site by the Department of Education, a Scheme Amendment process commenced in February 2014 to rezone the land from 'Public Use' to 'Urban Development' under the City of Joondalup's District Planning Scheme. The Scheme Amendment was advertised for public comment for a period of 42 days and closed on 6 August 2014, with a total of 23 submissions being received. The matter was considered by Council at their meeting in September 2014, with the decision being to zone the site as 'Urban Development'. Subsequently the Scheme Amendment was approved by the WA Planning Commission (WAPC) and Minister for Planning in February 2015.

A team of expert consultants have been appointed by Peet Ltd. in the areas of town planning, urban design, environmental design, traffic management, engineering, landscape architecture and community engagement - to commence work on residential development plans for the site.

Community Consultation

Peet are committed to effectively engaging stakeholders and the community to ensure the plans for the development respond appropriately to local issues and aspirations, while also ensuring the value of this important asset is realised. With this in mind, expert consultants Creating Communities have been engaged to facilitate the community consultation process.

Some of the key consultation activities that have occurred already include:

- Meetings with the City of Joondalup (ongoing)
- Meetings with the Kinross Residents Association

Future consultation activities include:

- A Community Engagement Day on Saturday 13 June where local residents and stakeholders can meet the project team
- A community response form made available at the Community Engagement Day to seek specific feedback
- An opportunity for follow up contact with the project team where required
- Development of a consultation report that will be provided to the project team to help inform the planning and decision making process by Peet
- Future engagement or management with local residents if/when construction occurs

Design Principles

The design approach that is being implemented by the project team is to provide a rigorous multidisciplinary process with continuous reflection upon the purpose of the Local Structure Plan.

The key principles and considerations which are informing the development of the designs for the site include:

a. A seamless interface with the local neighbourhood
b. Quality public open space (including tree retention)
c. Efficient movement systems and connectivity
d. Effective drainage and stormwater management
e. Responsiveness to local landforms and environment

"A team of expert consultants in the areas of town planning, urban design, environmental design, traffic management, engineering, landscape architecture and community engagement, have been appointed by Peet to commence work on residential development plans for the site."

For more information

For any queries about the community consultation and opportunities to provide feedback please contact: Angela at Creating Communities on 9284 0910 or angela@creatingcommunities.com.au

For further information on the proposed planning and development of the site please contact: Peet Ltd. on 9420 1111 or customer.relations@peet.com.au

Kinross Residential Development

Frequently Asked Questions and Answers

The following frequently asked questions and answers have been provided with the aim of addressing any issues or queries you may have about the proposed residential development at Lot 9021 MacNaughton Crescent, Kinross.

Q1. Describe the type of lots that will be developed.

A1. As the site planning is still under way, the number or size of lots has not been finalised. However, the final development design will be in keeping with state planning policy.

Q2 . What type of housing is proposed?

A2. The residential density coding envisaged for the site will be similar to that of the surrounding areas (generally R20/25). Under these densities, a range of housing types are permitted in accordance with the current Residential Design Codes, including single dwellings, grouped dwellings and multiple dwellings.

Q3. What is proposed for the provision of public amenities on the site?

A3. Peet recognises the importance of maintaining quality POS for existing and future residents. Whilst future subdivision designs may alter the northern boundary dimensions of MacNaughton Park, it is their intention to maintain the existing function of the oval. This will enable a range of current sporting and recreational activities to continue.

It is also the intention to retain trees where possible, pending further advice regarding drainage and engineering.

Q4. What will the benefits be to the community from the development of this site for residential purposes?

A4. This proposed development of this site provides many benefits to the existing and future community, including:

- Potential opportunities for residents who wish to downsize their block as well as for older residents who seek to 'age-in-place'.
- The provision of varied lot sizes that provide increased choice and flexible housing options in the local area.
- The introduction of new families and community members to the area.
- The provision of housing in close proximity to the local shopping centre and other community facilities, increasing their viability.
- Decreased traffic and parking numbers, compared to if a school was developed on the site, particularly in peak hours in the morning and afternoon.

Q5. What site work is needed to develop this land?

A5. Major site work items to facilitate preparation of the land for future homes include:

- Clearing of vegetation
- Cut to fill earthworks
- Construction of retaining walls, roads, underground services
- Installation of street lights

As the site was earmarked for a primary school, there are on street parking bays that were constructed to facilitate this use. The need for these bays has now been removed given the sites' change to a residential zoning. These bays may be removed depending on subdivision design.

As there will be works undertaken on existing road, there may be an impact on road users, although temporary full road closures are not anticipated at this time.

Q6. What car, pedestrian and cycling access will there be through the site?

A6. It is envisaged that pedestrian and cycle links will be provided in an east-west orientation. A connection south is also anticipated to provide efficient access to the POS and other facilities.

Road connections are intended to integrate with surrounding road networks, and provide an east-west link through the subject land.

Q7. How will traffic compare to if a school had been developed on the site and how is the management of traffic and parking being planned for?

A7. The traffic assessment of the subject land concludes that the planned primary school would have attracted 1,118 vehicle movements per day to local streets. Depending on the final development design, indicative traffic modelling demonstrates a reduction in traffic to between 55% and 88% less than the previously planned primary school. This is a significant reduction in local traffic movements by comparison

Q8. What is the approvals process for this project?

A8. For development to occur on the site, a Local Structure Plan (LSP) is required to be approved. The approvals process for the MacNaughton Crescent LSP is generally as follows:

- Lodgement of LSP document – The LSP document will be lodged with the City of Joondalup subsequent to the completion of all consultant reports and community consultation. The applicant will work with the City to ensure their requirements are meet prior to the LSP being presented to Council.
- Advertising commences – This is an opportunity for the community to provide feedback and comments in relation to the LSP document.
- All comments and feedback will be collated and the LSP document updated to reflect the necessary changes. This will occur in collaboration with the City of Joondalup.
- Council Meeting for approval – The LSP document is presented to Council for approval.
- Forward to Western Australian Planning Commission (WAPC) for approval.
- Subdivision proposal submitted to the WAPC for approval.
- Approval from Council and service authorities to commence civil works.

Q9. How is community safety being planned for?

A9. Community safety principles that will form part of design considerations will include;

- Landscape elements to support Crime Prevention Through Environmental Design (CPTED) Principles.
- The Urban structure will be planned to support legibility while ensuring clear sightlines and limiting blind corners and isolated areas.
- Lot layouts will be planned so as to limit large blank walls and provide surveillance over POS and other existing facilities.

Q10. Is there any proposed retention of existing vegetation?

A10. Where possible trees will be retained pending further advice regarding drainage and engineering.

Q11. How will the development integrate with the surrounding neighbourhood?

A11. It is envisaged that the POS interface will be formalised to ensure passive surveillance, while the interface with the street will be in character with surrounding development. The provision of pedestrian access will seek to integrate with the surrounding footpath networks and provide efficient access to surrounding facilities.

Q12. How is the parkland/oval space being enhanced?

A12. It is the intention of Peet to position the required POS abutting the existing MacNaughton Park to enable continuation of current sport and recreational pursuits. It is intended that pedestrian access will be managed to enable efficient access to the POS.

Q13. How will impacts from construction be minimised for neighbours?

A13. Once approval is received to develop the site, Peet will ensure that there are appropriate management plans in place with appointed contractors to minimise any impacts on our neighbours.

The construction contractor engaged to carry out the construction works will need to comply with legislated requirements to avoid undue nuisance from dust, noise and vibration.

Prior to commencement of construction, all residents abutting the site will be offered the opportunity of a dilapidation survey for their home to ensure that any damage resulting from the works is rectified by the contractor.

Q14. Who will be responsible for selling the lots?

A14. Peet Ltd will appoint its own sales team to manage the sales process.

Appendix 4.4 - Feedback Form

We value your thoughts

The following questions seek feedback related to the future residential development abutting MacNaughton Park.

In completing this response sheet please first read the information sheet and frequently asked questions that are available. Please note all questions are optional and your identity will remain anonymous. You will only be contacted if you indicate that you would like further contact to be made with you by members of the project team.

Given that the site at lot 9021 MacNaughton Crescent is zoned for 'Urban Development' under the City of Joondalup's District Planning Scheme and has been approved for residential development:

Q1. Please list the top priorities to be reflected in the design of the new residential development to ensure it successfully integrates with the surrounding neighbourhood

a. _____

b. _____

c. _____

Comment: _____

Q2. Please list the most important positive outcomes that you think can achieved for the Kinross Community though the planning of a high quality residential development

a. _____

b. _____

c. _____

Comment: _____

Q3. Please list any issues or concerns that need to be considered and addressed when designing the residential development

a. _____

b. _____

c. _____

Comment: _____

PEET

General Comments

Please share with us any general comments you have regarding the proposed development, or points for consideration by the Project Team:

_____

_____

_____

_____

About You

I am:

- ◯ A residential property owner
- ◯ A commercial/ business property owner
- ◯ A representative of a local community organisation
- ◯ An interested community member

I / my business / my community group reside:

- ◯ In a street facing the site
- ◯ In a street close to the site but not facing the site
- ◯ Elsewhere in the suburb of Kinross
- ◯ Elsewhere in the City of Joondalup
- ◯ I don't reside within the suburb of Kinross or the City of Joondalup

Contact Details

Note: only complete if you want Peet Ltd. to make contact with you regarding your comments

Name: _____

Phone: _____

Address: _____

Email: _____

Returning This Form

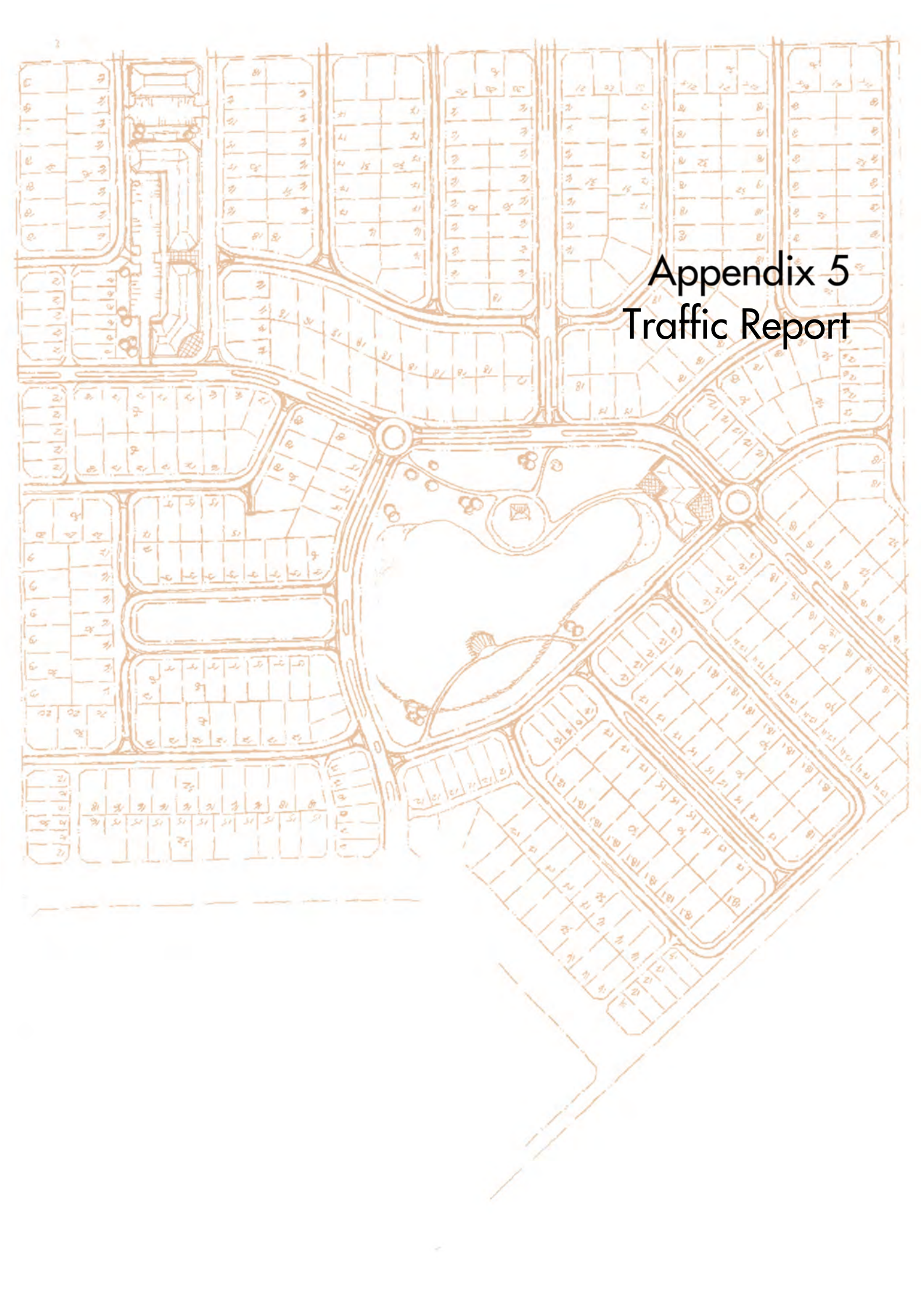
1. Please return to the box provided at Open Day session on Saturday 13 June

   OR

2. Mail to Creating Communities by Friday 19 June
   Attention: Angela Vurens Van Es
   Creating Communities Australia
   PO Box 544, Wembley, WA 6913

PEET

Creating Communities



Appendix 5
Traffic Report

PEET

LOT 9021 MACNAUGHTON CRESCENT, KINROSS.

STRUCTURE PLAN TRAFFIC REPORT

May 2015

Riley Consulting

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Issued on	9 July 2015	Amendments	Date
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1.0 EXECUTIVE SUMMARY

Riley Consulting has been commissioned by Peet Ltd to consider the traffic and transport impacts of developing a residential precinct comprising of approximately 75 dwellings on Lot 9021 MacNaughton Crescent, Kinross. The site was identified as a primary school site, but is considered surplus to Department of Education requirements. The key findings of the traffic assessment are:

- The subject land was identified for a primary school and based on standard Department of Education requirements, would have accommodated 430 students. The level of traffic generated by full occupancy of the school would be 1,118 vehicle movements per day, of which 430 movements would be expected during the morning peak period between 8am and 9am.
- The proposed development of approximately 75 dwellings can be expected to generate about 600 vehicle movements per day, of which up to 60 movements may occur during the morning peak period, likely to be 7am to 8am.
- The proposed residential land uses will have a significantly reduced traffic impact than would be expected from the originally proposed primary school.
- As a result of the proposed residential development, all affected streets are shown to operate with daily traffic flows well within target levels set by *Liveable Neighbourhoods*. Overall, the proposed development is considered to have no material traffic impact.
- Appropriate access is provided to the subject land. Affected intersections operate with acceptable Levels of Service.
- Access to the external road network will be significantly improved by 2017 with the extension of the Mitchell Freeway to Hester Avenue. The proposed development may not be complete by this time and can be considered to have no significant impact to peak period operation of access to Connolly Drive.

RECOMMENDATIONS

- There are no site-specific recommendations to be made as the planning of the structure plan has address issues raised.
- All roads are to be designed to current standards and relevant local government policies. Visibility for all road users must be provided in accordance with Austroads requirements.

2.0 THE SITE AND SURROUNDING ROAD NETWORK

The subject site is located in the locality of Kinross and is bounded by Grangemouth Turn to the west, MacNaughton Crescent to the east and Lochnagar Way to the north. To the south of the subject site is public open space / playing fields. The location of the subject site is shown in Figure 1.

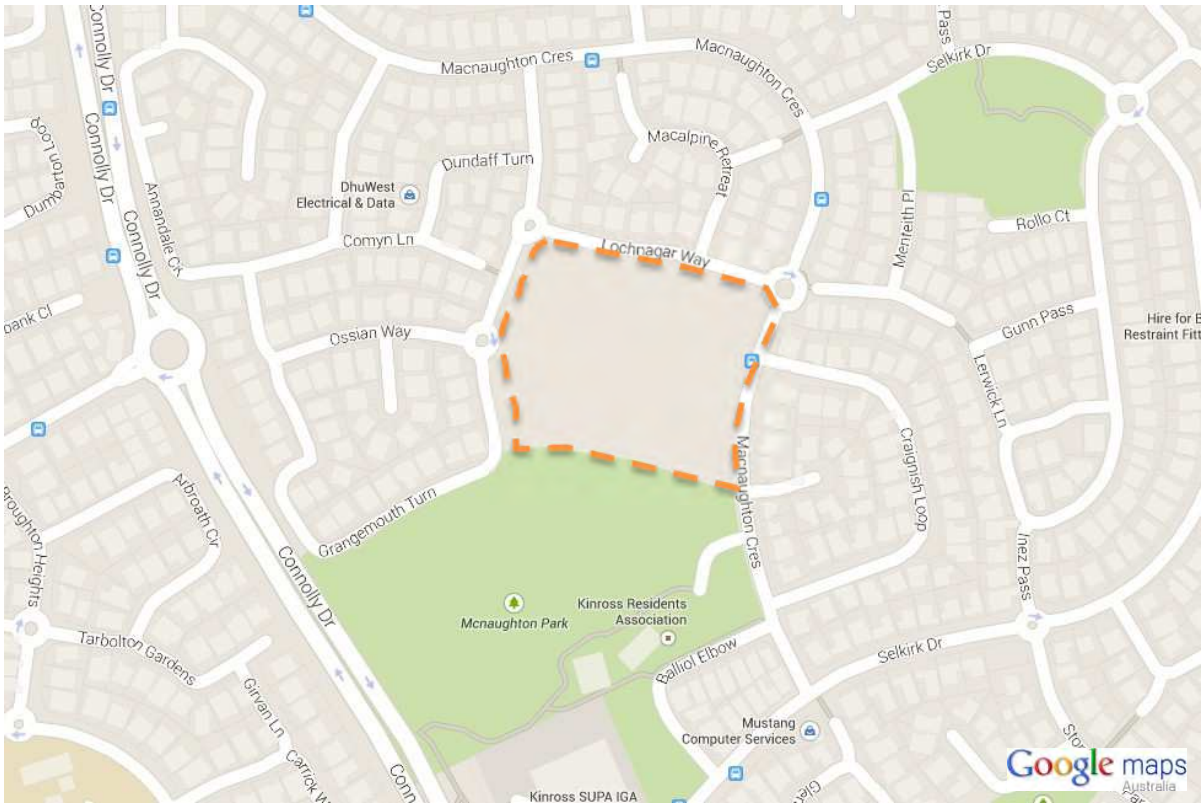

Figure 1 Site Location

Roads expected to be affected by the development of the site are considered below.

Connolly Drive

Connolly Drive is classified as a distributor type A road and is a blue road in the Metropolitan Region Scheme. It is constructed as a four lane divided road within a 50 metre road reservation. It provides an important secondary north-south link to Marmion Avenue servicing the railway stations at Currambine and Butler. Traffic data provided by the City of Joondalup shows 18,113 vehicles per day (vpd) north of MacNaughton Crescent (2010 data), 20,046vpd south of MacNaughton Crescent (2012 data) and 29,448vpd north of Burns Beach road (2012 data).

MacNaughton Crescent

MacNaughton Crescent would be considered as a neighbourhood connector B under the *Liveable Neighbourhoods* Guidelines. It is constructed with a 7.5 metre wide pavement within a 20 metre road reservation and would be considered suited to catering for a maximum demand of 3,000 vehicles per day (vpd)[1]. It forms an internal loop road to the suburb with access to Connolly Drive and Selkirk Drive.

There is no traffic data available for MacNaughton Crescent. However, based on the residential catchment it is estimated that the present day demands would be about:

- At Connolly Drive, catchment about 280 dwellings, expected demand 2,100vpd
- At Lochagar Way, catchment about 100 dwellings, expected demand 740vpd.
- At Selkirk Drive, catchment about 150 dwellings, expected demand 1,110vpd.

Selkirk Drive

Selkirk Drive would be considered as a neighbourhood connector A under the *Liveable Neighbourhoods* Guidelines. It is constructed with a 9.5 metre wide pavement within a 25 metre road reservation and would be considered suited to catering for a maximum demand of 7,000vpd. It forms an internal loop road to the suburb with access to Connolly Drive and MacNaughton Crescent. Traffic data provided by the City of Joondalup shows

- East of Connolly Drive – 3,640vpd
- East of MacNaughton Crescent - 548vpd.
- East of Clydebank Crescent – 332vpd.

Lochnagar Way

Lochnagar Way is a local access street to the north of the subject site. It is constructed with a 7.5 metre pavement within an 18 metre road reservation. It provides direct access to about 30 dwellings and acts as a link between Grangemouth Turn and MacNaughton Crescent (for access to local shops). No traffic data is available, but based on the residential catchment it can be expected to pass between 200vpd - 300vpd. The road reservation and pavement accord with access street type A under *Liveable Neighbourhoods* and would be suited to carry up to 3,000vpd.

[1] Note the LN volume is NOT the road capacity, it is a threshold flow to maintain residential amenity.

[2] ~~Primary schools in expanding suburbs are assessed with temporary classrooms to cater for up to~~

Grangemouth Turn

Grangemouth Turn is a local access street to the west of the subject site. It is constructed with a 7.5 metre pavement within an 18 metre road reservation. It provides direct access to about 28 dwellings and acts as a link between Annandale Crescent and Lochagar Way. No traffic data is available, but based on the residential catchment it can be expected to pass about 300vpd. The road reservation and pavement accord with access street type A under *Liveable Neighbourhoods* and would be suited to carry up to 3,000vpd.

Figure 2 shows the site master plan.

Figure 2 **Site Master Plan (**refer to planner for detail)

3.0 TRAFFIC GENERATION AND DISTRIBUTION

The development of the subject site needs to be considered in context to the expected use of the site. As previously discussed, structure planning for the local area considered the subject site as a primary school. Standard primary schools provide for 430 students, but can cater for up to 600 in temporary classrooms.

The Department of Education's primary schools brief sets out a trip generation rate for primary schools of 2.6 trips per student per day and 1 trip per student during the peak periods. Therefore the planned primary school would be expected to generate (430 x 2.6) 1,118 vehicle movements per day, of which 430 would be expected between 8am and 9am.

The primary school would generate 1,118 movements per day and 430 peak hour movements.

Figure 3 shows how the primary school traffic would be expected to affect the local road network.

Figure 3 School Traffic Demands (Indicative and subject to access locations)

[2] Primary schools in expanding suburbs are assessed with temporary classrooms to cater for up to 600 pupils while other schools are constructed. Thus a significant increase to traffic may be experienced in interim years.

Proposed Land Uses

The trip rate for residential dwellings varies based on access to public transport and proximity to town centre activity. A typical residential household in Kinross can be expected to generate between 6.5 and 8 vehicle movements per day. Using these trip rates, the proposed development of 75 dwellings could generate between 450 and 600 vehicle movements per day. This report is based on 500 movements per day.

Residential dwellings commonly generate 10% of the daily trips during the peak hours, indicating the proposed development can be expected to generate 50 vehicle movements in the morning peak and 50 vehicle movements in the evening peak.

When compared to the expected use of primary school on the subject site, the proposed development will generate about 50% of the forecast daily traffic movements to the local road network.

Distribution

The trips generated by the residential lots will access local schools, shops and external destinations such as Butler railway station and Perth CBD. Local shopping facilities are provided adjacent to Selkirk Drive, although Ocean Keys to the north can be expected to attract most shopping trips. For the purpose of traffic analysis it has been assumed that external traffic would be split 60% to the south and 40% to the north.

Figure 4 shows the expected traffic movements.

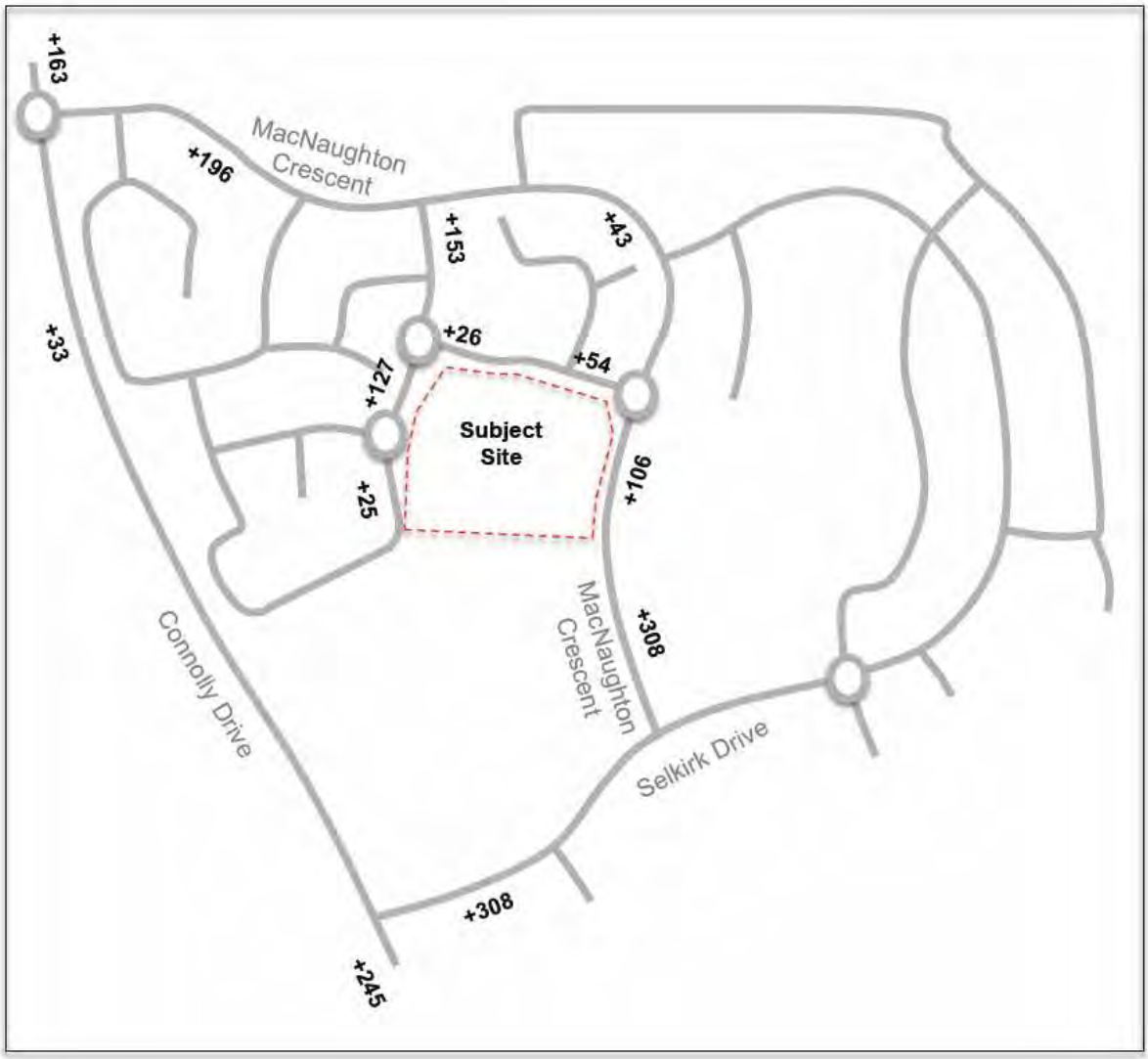

Figure 4 Proposed Development Forecast Traffic Volumes

4.0 DEVELOPMENT TRAFFIC IMPACTS

Table 1 shows the current traffic flows (which do not include any attraction to the previously proposed school) and the expected changes as a result of the proposed residential development. The last column indicates the maximum daily traffic flow identified by *Liveable Neighbourhoods* to maintain acceptable residential amenity.

Table 1 Daily Traffic Volumes and Development Increase Impacts

Road	Daily Flow	Development	%	LN Maximum
MacNaughton Crescent at Connolly Drive	2,100	+196	6.5%	3,000
MacNaughton Crescent mid	740	+43	1.4%	3,000
MacNaughton Crescent at Selkirk Drive	1,110	+308	10%	3,000
Locnhagar Way east	300*	+54	2%	3,000
Lochnagar Way west	200*	+26	<1%	3,000
Grangemouth Turn north	300*	+153	5%	3,000
Grangemouth Turn south	200*	+25	<1%	3,000
Selkirk Drive	3,640	+308	4.4%	7,000
Connolly Drive North	18,113	+163	<1%	35,000
Connolly Drive south	29,448	+245	<1%	35,000

*Derived flow based on same principles used to determine development traffic demands

Reference to the WAPC *Transport Assessment Guidelines for Developments* (Volume 4) states that:

> "*Where a traffic increase as a result of a proposed development is less than 10% of current road capacity*[3]*, it would not normally have a material impact".*

It can be seen from Table 1 that there are no road sections that would experience an increase greater than 10% of the *Liveable Neighbourhoods* maximum target demand figure. However, as an existing residential area, it is considered pertinent to consider the forecast traffic increases more closely.

[3] The capacity of a road is significantly greater than the LN target flow used to maintain residential amenity.

McNaughton Crescent at Selkirk Drive

The increase shown to McNaughton Crescent equates to slightly over 10% of the *Liveable Neighbourhoods* target volume, but would not be considered to have a significant impact. The overall forecast traffic demand to this section of MacNaughton Crescent is 1,418vpd, which is less than half the acceptable daily traffic flows for the street type. When the primary school use of the land is considered, the school would have been expected to attract 828vpd to this section of MacNaughton Crescent. It can be seen that the proposed residential development would result in significantly less impact than the proposed primary school.

MacNaughton Crescent is not detrimentally affected by the proposed development.

Grangemouth Turn

The increase shown to Grangemouth Turn are less than 5% of the *Liveable Neighbourhoods* target volume and may be considered to have no impact. The overall forecast traffic demand to this section of Grangemouth Turn is in the order of 453vpd, which is less than half the acceptable daily traffic flows for the lowest order of access street. The proposed development would not therefore be considered to have a detrimental impact to the residential amenity of this street.

When considered in terms of the peak hour traffic demands, the proposed development could increase the existing traffic flows by an additional vehicle every 4 minutes. It is likely that most residents would not be significantly affected by such a low increase.

Grangemouth Turn is not detrimentally affected by the proposed development.

Overall the proposed residential development of the subject site will maintain local traffic flows well within levels set out by *Liveable Neighbourhoods*. As a result the development can be concluded to have no material traffic impact.

The proposed development is considered to have no material traffic impact.

Long term Impacts

It is normal when considering developments to assess the possible impacts on a 10 year planning horizon. However, within a discrete residential area such as Kinross, traffic movements would not be expected to increase on an annual basis, unless major through movements occur. Local roads east of Connolly Drive would not be subject to annual traffic increases and thus the impacts in 10 years will be as shown for the present day.

The impact of the current Mitchell Freeway extension to Hester Avenue is discussed later in this report.

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5.0 ACCESS

Figure 5 shows where access can be provided in accordance with current planning guidelines. Access to the subject site is proposed at three locations as shown in Figure 2. All access locations accord to current planning guideline requirements.

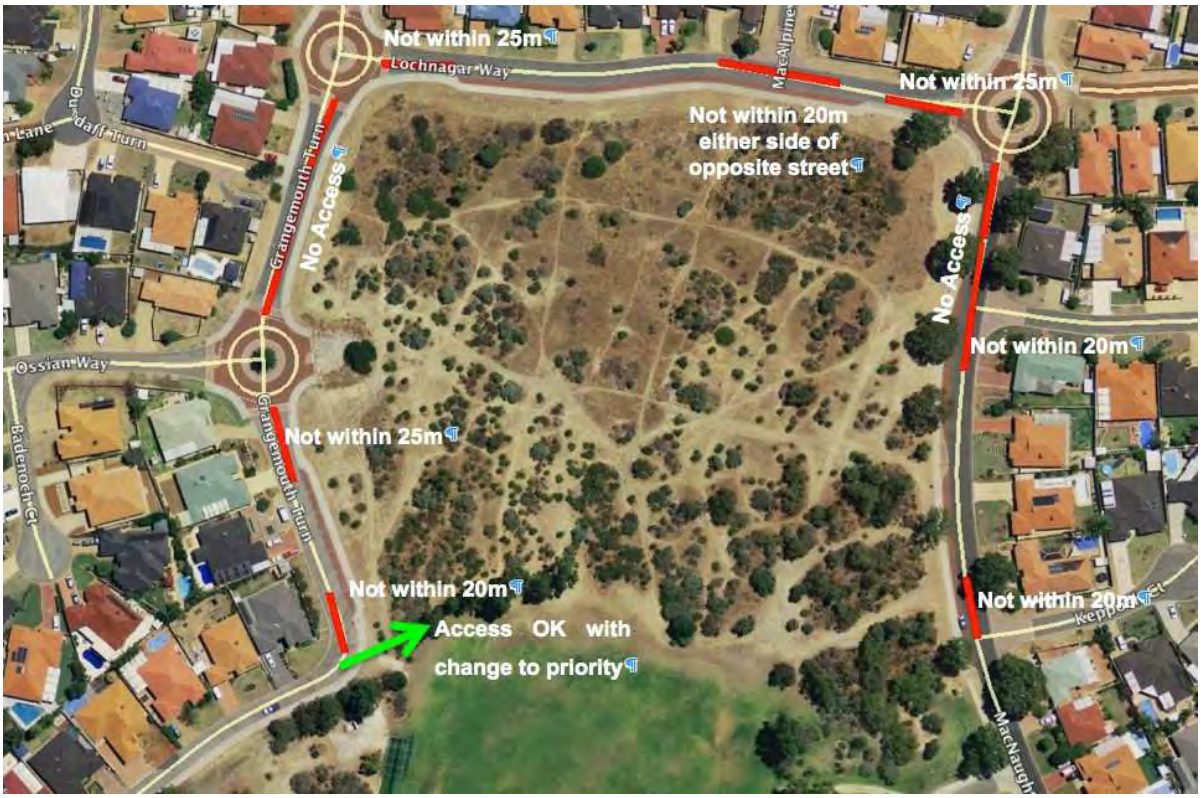


Figure 5 Access Restrictions

The proposed development is shown to generate 504 daily vehicle movements of which 50 can be expected during the peak periods. McNaughton Crescent has the highest traffic flows of any adjacent street with approximately 800vpd passing the subject site. Thus peak hour traffic flows are likely to be in the order of 80 vehicles.

Table 4.1 — Intersection Capacity - Uninterrupted Flow Conditions

Major Road Type[1]	Major Road Flow (vph)[2]	Minor Road Flow (vph)[3]
Two-lane	400	250
	500	200
	650	100
Four-lane	1000	100
	1500	50
	2000	25

Notes:

1. Major road is through road (i.e. has priority).
2. Major road design volumes include through and turning movements.
3. Minor road design volumes include through and turning volumes.

Reference to Austroads Table 4.1 (reproduced) indicates that the forecast demand of 50 vehicles opposed by 80 vehicles would result in uninterrupted flow conditions. Austroads advises that in such circumstances no further analysis is warranted.

Given the busiest access operates with uninterrupted flow conditions, it is safe to assume that all accesses will operate in a similar manner and good Levels of Service will be provided.

External Intersection Impacts

Traffic generated by the proposed subdivision is estimated to generate 50 additional peak hour movements that will impact the intersections of Connolly Drive with Selkirk Drive and McNaughton Crescent. Based on the expected distribution of traffic over the network, MacNaughton Crescent would experience a peak direction flow increase of about 16 vehicles turning right to Connolly Drive. Selkirk Drive would experience an increase of about 25 vehicle turning left to Connolly Drive[4].

To provide an understanding of how much traffic could be absorbed by existing intersections, reference is made to Austroads figure 6.5, reproduced as Figure 6. The Austroads figure shows the practical absorption capacity of unsignalised intersections.

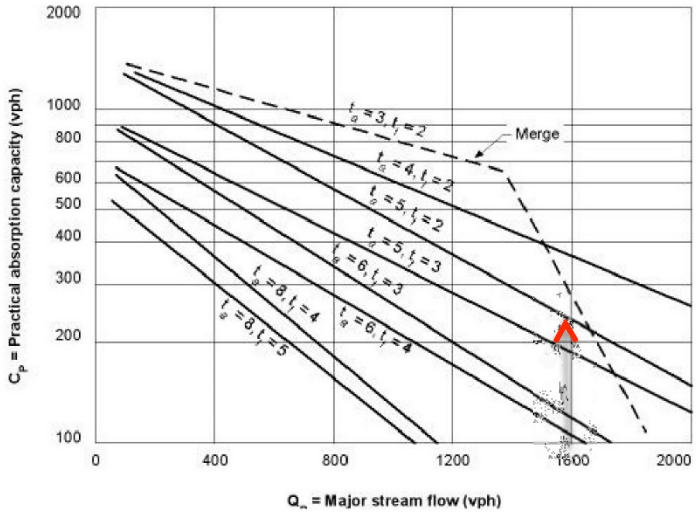


Figure 6 Austroads Figure 6.5

Based on current traffic data, it is derived that MacNaughton Crescent has a peak flow of about 210 movements, of which 168 would be expected to be accessing Connolly Drive. Connolly Drive is presently passing about 1,600 vehicles per hour during the morning peak and in the order of 2,700 vehicles in the evening peak. Reference to Figure 6 indicates that

[4] It is feasible that traffic may redistribute to the MacNaughton Crescent intersection with Connolly Drive to head south if delays at Selkirk Drive become too long.

during the morning Connolly Drive could absorb up to 250 vehicles from the side road. The forecast increase of 16 vehicles to the current demand of 168 vehicles would therefore be accommodated by the current intersection. However, queues and delays may be marginally affected.

Selkirk Drive is shown to carry 3,460vpd and thus a morning peak demand of 277 vehicles accessing Connolly Drive can be expected. This peak demand could increase to about 302 vehicles with the proposed development. It can be seen therefore that with present traffic demands, the intersection of Connolly Drive and Selkirk Drive is most likely operating with very poor Levels of Service. Conditions would deteriorate with the proposed development. Under these conditions it would be expected that development traffic would redistribute to MacNaughton Crescent access to Connolly Drive.

However, the proposed extension to the Mitchell Freeway has commenced and will be completed by 2017. The proposed extension will link Burns Beach Road to Hester Avenue. As a result traffic flows on Connolly Drive can be expected to reduce significantly. By comparison, traffic data supplied by Main Roads shows that traffic demands on Connolly Drive north of Shenton Avenue are less than 10,000vpd with a peak demand of 1,000 vehicles. It is not unrealistic to expect similar reductions to Connolly Drive through Kinross. Reference to Figure 6 indicates an absorption capacity of about 400 vehicles, which will provide ample capacity to accommodate the proposed development and significantly reduce present day delays at MacNaughton Crescent and Selkirk Drive.

The construction of the Mitchell Freeway to Hester Avenue will remove present day access issues to Connolly Drive.

6.0 THE INTERNAL ROAD NETWORK

The forecast traffic flows provide a basis to develop an internal road hierarchy and the flows are referenced to advice set out in *Liveable Neighbourhoods* as indicated by Table 2. It is noted that no internal street is forecast to carry more than 300 vehicle movements per day and therefore the lowest classification of Access Street D may be used.

Table 2 *Liveable Neighbourhoods* Road Hierarchy

Designation	Target flow*	Street Characteristics
Access Street D	< 1,000vpd	Narrower access streets (5.5 to 6m) may be appropriate in locations further away from centres and activity where traffic flows are less than 1,000vpd and a low on-street parking demand exists.
Access Streets A - C	<3,000vpd	Wider access streets (7 to 7.5m) cater for higher traffic volumes and are located closer to neighbourhood centres.
Neighbourhood Connectors	<7,000vpd	Generally 2-lane undivided. These are 'special' streets and their design needs to have regard to context, function and adjacent land uses.

* Function of streets needs to be considered as well as traffic volume.

Access Streets

All access streets within the subject site have daily flows less than 1,000 vehicles and are suited to an Access Road type D reservation requirement providing a 6.0 metre carriageway within a 14.2 metre road reservation. It is proposed that the subdivision will provide a 6m pavement within a 15 metre road reservation. Figure 7 shows a typical road cross section.

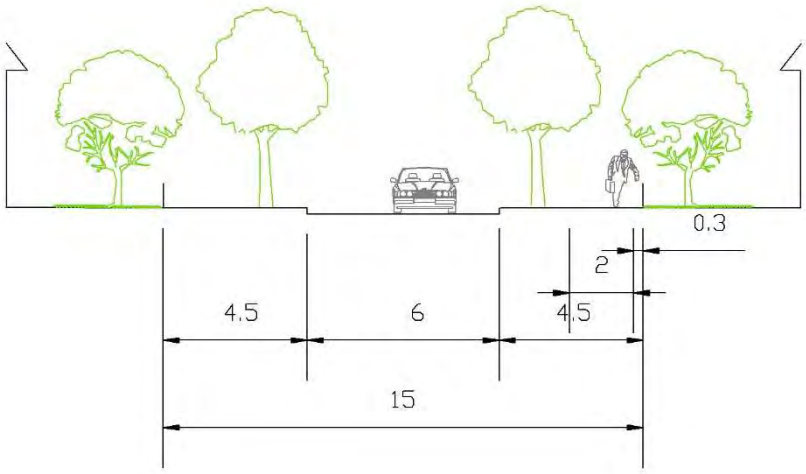


Figure 7 Access Street 15 Metre Road Reservation

Corner Treatments

To reduce the opportunity for speeding it is recommended that corner radii advised by *Liveable Neighbourhoods* be used within the subdivision. The recommended radii are:

- 6.0 metres - access street / access street intersections
- 9.0 metres - access street / neighbourhood connector

Traffic Management

Liveable Neighbourhoods sets out that street lengths should be limited to less than 600 metres for neighbourhood connector roads and less than 350 metres for access streets. Where street lengths exceed these lengths, traffic calming features should be considered.

The proposed subdivision road layout is relatively tight and constrained with all roads having lengths less than 120 metres. No supplementary traffic management measures would be warranted.

7.0 PEDESTRIANS, CYCLISTS AND PUBLIC TRANSPORT

Current planning guidelines suggest that all streets should be provided with a footpath wherever possible. Where traffic flows exceed 1,000 vehicles per day, a footpath to both sides of the road is desirable. Within the subject site a footpath to one side of each street would be considered appropriate.

The subject site is located about 300 metres from the Kinross shopping centre and would be an easy and pleasant walk through the playing fields. Currambine railway station is 1.5km, approximately a 20 minute walk, which is more convenient than current public transport. The existing primary school is located to the west and due to the need to cross Connelly Drive, it is unlikely parents will walk their children to school.

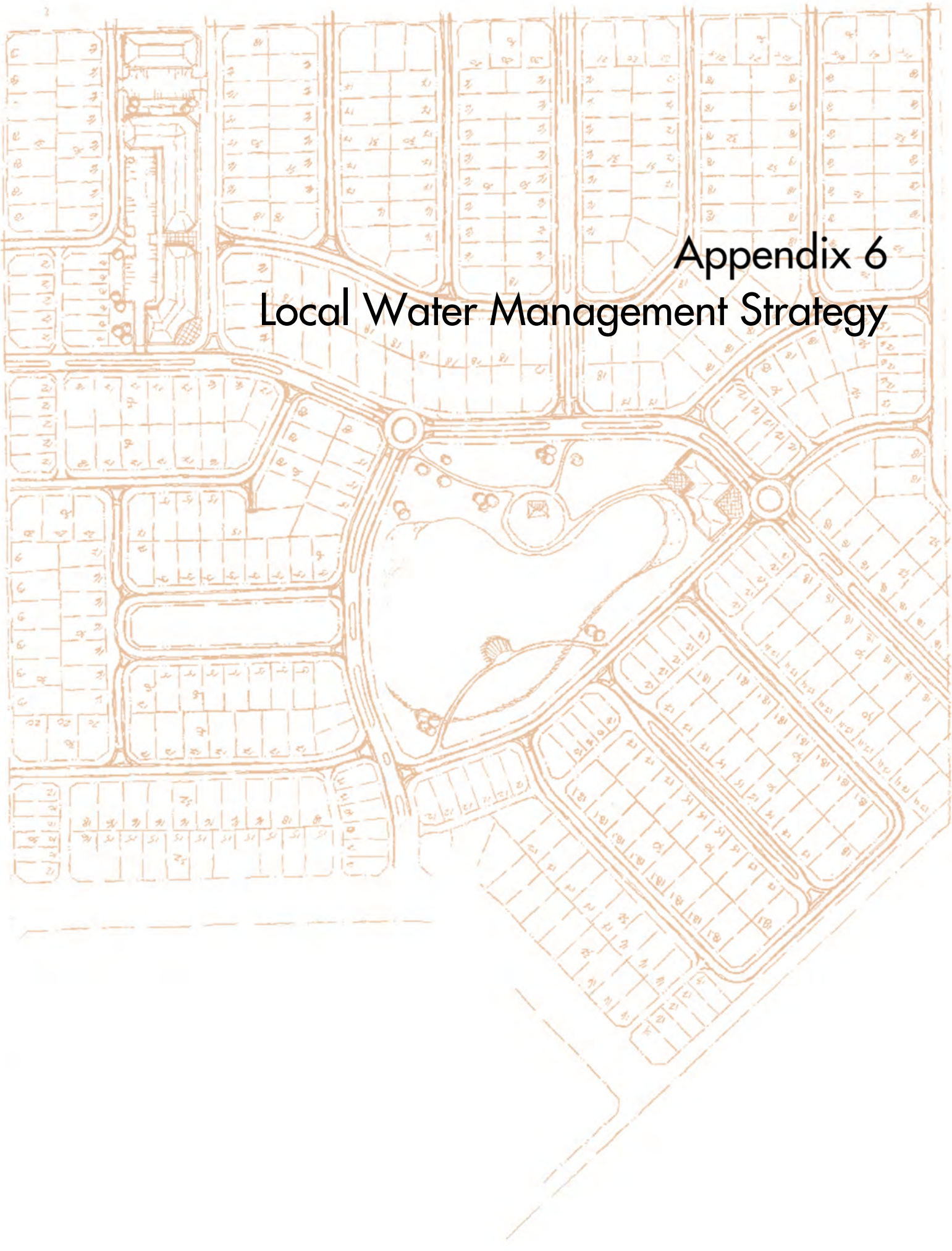
Cycling

Cycling would be safe on the majority of local streets where traffic flows are less than 3,000 vehicles per day. Internally to the subdivision traffic flows are very low and a very good cycling environment is provided. Burns Beach is about 3km and an easy cycle ride, although crossing of Marmion Avenue can only be safely undertaken at the Burns Beach Road traffic signals, which adds 1km to the travel distance. Easy access to the Mitchell Freeway cycle lanes is provided at Currambine railway station.

Public Transport

Two bus routes currently use MacNaughton Crescent. Routes 473 and 474 provide connections to Butler and Joondalup railway stations. These bus routes also pass by Currambine station. However, the services do not provide a good level of accessibility to Currambine station due to the need to cross Burns Beach Road. Based on the current PTA timetable there is one bus per hour during peak periods and thus bus services provided are not convenient for commuter use. Figure 8 shows the bus routes.

Figure 8 Local Bus Services



Appendix 6
Local Water Management Strategy

emerge ASSOCIATES
Integrated Science & Design

LOCAL WATER MANAGEMENT STRATEGY

LOT 9021 MACNAUGHTON CRESCENT LOCAL STRUCTURE PLAN, KINROSS

Project Number EP15-017

Prepared for Peet Ltd
October 2015

Document Control

DOC NAME	LOT 9021 MACNAUGHTON CRESCENT LOCAL STRUCTURE PLAN KINROSS LWMS				
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Executive Summary

Peet Ltd (the 'proponent') proposes to develop Lot 9021 MacNaughton Crescent, Kinross (referred to herein as 'the site') for residential purposes. The site is situated 32 km north of Perth Central Business District, within the City of Joondalup (CoJ).

The site is currently zoned 'Urban' under the Metropolitan Region Scheme (MRS) and 'Urban Development' under the District Planning Scheme Number 2 (DPS 2).

The LWMS has been developed to support the Lot 9021 MacNaughton Crescent Local Structure Plan (LSP) in consideration of the objectives and principles detailed in *'Better Urban Water Management*', *State Planning Policy 2.9 Water Resources* and *Planning Bulletin 92 Urban Water Management*. Water will be managed using an integrated water cycle approach, which has been developed using philosophies and design approaches described in the *Stormwater Management Manual for Western Australia*.

The first step in applying integrated water cycle management in urban catchments is to establish agreed environmental values for receiving waters and their ecosystems. Characteristics of the existing environment within the site have been investigated. In summary, the environmental investigations conducted to date indicate that:

- The site receives 729 mm of average annual rainfall with the majority of rainfall received in June and July.
- The site topography ranges between 29 and 36 m Australian height datum (AHD) with a general slope from south east to north west.
- The majority of the site is underlain by Tamala Limestone, with a small portion of sand along the western boundary.
- Acid sulfate soils (ASS) risk mapping classifies the entire site as having no known risk of encountering ASS within 3 m of the surface.
- There are no wetlands within the site.
- High permeability of the underlying sands suggests that surface water is largely retained and infiltrated within the site.
- The site is located in the Lochy Close sump catchment.
- A connection to the local drainage network exists immediately adjacent to the site at Grangemouth Turn, opposite Ossian Way. No other connections have been allowed for in the existing and surrounding pipe design.
- Depth to groundwater ranges between 25.5 m and 32.5 m with a historical maximum groundwater level (MGL) of approximately 3.5 m AHD. Groundwater underlying the site flows towards the Indian Ocean.
- The site is currently vacant and unused with the exception of local recreation use such as dog walkers who utilise the site.

The Lot 9021 MacNaughton Crescent LSP covers approximately 4.02 ha and will allow for the creation of lot densities ranging between R20 and R40. The site incorporates 4,000 m^2 of public open space (POS) which is located adjacent to the existing MacNaughton Park POS.

The overall objective for integrated water cycle management for the development is to mimic the existing hydrological regime of the site.

The design objectives seek to deliver best practice outcomes using a Water Sensitive Urban Design (WSUD) approach, including management approaches for:

- Water conservation
- Stormwater quality management
- Flood mitigation
- Groundwater management.

The criteria proposed within this LWMS are based on the characteristics of the existing environment and a contemporary best-practice approach to integrated water cycle management.

The overall approach to water conservation is to reduce the amount of scheme water required within the development at both a lot and estate scale. Within the lot, potable water consumption will be reduced by promoting water efficient fixtures and appliances (WEFA) and water wise gardening (WWG) principles within lot gardens. On an estate scale, groundwater will be utilised for irrigation of landscaped areas within POS areas which will also utilise WWG principles.

Surface water runoff will integrate with the existing local drainage network utilising existing infrastructure where available. Catchments that do not connect to the existing pipe network will retain the 5 year Average Recurrence Interval (ARI) event in a flood storage areas (FSA) located in POS. Lots will retain the 100 year ARI event on lot within soakwells and permeable areas, consistent with other developments in the local area.

Surface water quality will be addressed using a treatment train approach, which incorporates lot scale retention, sub-surface storage, a bio-retention area (BRA) within POS (for minor events). Further non-structural measures will also be adopted and will be detailed in the future Urban

Groundwater management focusses on protecting groundwater quality and recharging the aquifer. The substantial clearance to groundwater across the majority of the site and high permeability of the underlying soils indicates that inundation from groundwater is unlikely. Groundwater quality will be maintained by reducing total nutrient loads originating from the development, treating surface water runoff as close to source as possible and using high nutrient uptake soils and vegetation within drainage infrastructure. Measures to address groundwater quality are consistent with those proposed for surface water quality. Recharging the aquifer will be achieved through the retention and infiltration of runoff from lots at source through lot retention, sub-surface storage, a BRA and FSA.

The proposed criteria and the manner in which they are proposed to be achieved are presented in **Table E1**. This table provides a readily auditable summary of the required outcomes which can be used in the future detailed design stage to demonstrate that the agreed objectives for water management across the site have actually been achieved.

This LWMS demonstrates that by following the recommendations detailed in the report the site is capable of being developed.

Table E 1 Water management criteria and compliance summary

Management Aspect	Criteria number	Criteria description	Manner in which compliance will be achieved	Responsibility for implementation	When implemented
Water conservation	WC 1	Non-potable water consumption target of 6,750 kL/ha/year for POS areas	Water wise gardening (WWG) practices in POS	Proponent	Landscape implementation
			Retain native vegetation where possible	Proponent	Landscape implementation
	WC 2	Potable water consumption target of 100 kL/person/year for residential areas with no more than 40-60 kL/person/year of scheme water	Promotion of rainwater tanks	Proponent	Point of sale
			Use of rainwater tanks	Lot owner	Ongoing
			Promotion of WWG practices	Proponent	At point of sale
			Use of WWG practices.	Lot owner	Ongoing
			Promotion of water efficient appliances	Proponent	Point of sale
			Use water efficient appliances	Lot owner	Ongoing
			Use of water efficient fittings	Lot owner	Construction
Stormwater management	SW1	Maintain the 5 year ARI event peak flow rate consistent with the capacity of the existing downstream network	Lots will retain the 100 year ARI event on lot	Lot owner	Building construction
			The flow capacity of the existing drainage system is 0.08 m^3/s. The 5 year ARI peak flow rate leaving the site is 0.03 m^3/s.	Proponent	Detailed drainage design
	SW2	Provide a flow path to convey the 100 year ARI event runoff to the downstream drainage network	The earthworks concept plan provided in **Appendix E** shows that the road network will be graded towards the adjacent existing road, thus providing a flow path to the downstream drainage network	Proponent	Detailed civil design
	SW3	Maintain 300 mm clearance between habitable floor levels and the 100 year ARI top water levels (TWL) within onsite storage areas (BRA and FSA)	A minimum clearance of 300 mm will be provided between finished floor levels and the TWL within the BRA and FSA	Proponent	Detailed drainage design

Management Aspect	Criteria number	Criteria description	Manner in which compliance will be achieved	Responsibility for implementation	When implemented
	SW4	Minor roads must remain passable in the 5 year ARI rainfall event	The stormwater pipe network will be designed to convey the 5 year ARI event flows	Proponent	Detailed drainage design
	SW5	Retain and treat the 1 year 1 hour ARI event on site	Lots will retain the 100 year ARI event on lot within soakwells and pervious garden areas	Lot owner	Building construction
			Road reserve runoff up to the 1 year 1 hour ARI event will be retained within subsurface storage and a BRA	Proponent	Detailed drainage design
	SW6	Treatment areas to be sized to at least 2% of the total connected impervious area	The BRA provided onsite is 5.3% of the connected impervious area (road pavement and impervious verges).	Proponent	Detailed drainage design
	SW7	Utilise appropriate structural and non-structural measures to reduce nutrient loads	Structural measures include soakwells, sub-surface storage and BRAs	Proponent	Detailed drainage design
			WWG practice	Proponent / Lot owner	Landscape implementation / Ongoing
			Maintenance of POS and drainage areas	Proponent / CoJ	Proponent for first two years then CoJ
			Street sweeping	Proponent / CoJ	Proponent for first two years then CoJ
			Minimise fertiliser use in POS and road verges	Proponent	Landscape implementation
			Use roll-on, drought tolerant turf species	Proponent	Landscape implementation
			Education of residents	Proponent	At point of sale
Groundwater management	GW1	Treat stormwater runoff before discharging to groundwater	Direct 1 year 1 hour ARI event runoff to BRA or subsurface storage	Proponent	Detailed drainage design
			BRA will be underlain with a 300 mm layer of soil media suitable for nutrient removal	Proponent	Landscape implementation

Management Aspect	Criteria number	Criteria description	Manner in which compliance will be achieved	Responsibility for implementation	When implemented
			Minimise fertiliser use in POS and road verges	Proponent	Landscape implementation
			Use roll-on, drought tolerant turf species	Proponent	Landscape implementation
	GW2	Use water sensitive design approaches to recharge the superficial aquifer	Infiltrate runoff from lots at source in soakwells and pervious garden areas	Lot owner	Building construction
			Retain and infiltrate road reserve runoff in subsurface storage, BRA and FSA	Proponent	Detailed drainage design

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1 Introduction

1.1 Background

Peet Ltd (the 'proponent') proposes to develop Lot 9021 MacNaughton Crescent, Kinross (referred to herein as 'the site') for residential purposes.

The site is situated 32 km north of Perth Central Business District, within the City of Joondalup (CoJ).

The location of the site is shown in **Figure 1**. An aerial photograph showing the current condition and cadastral boundaries of the site is also shown in **Figure 2**.

1.2 Town planning context

The site is located within a well-established residential area of Kinross. The site was set aside for a future primary school in the structure planning for the Kinross locality in the early 1990's however the Department of Education subsequently determined that the site will not be required for a primary school.

The site is currently zoned 'Urban' under the Metropolitan Region Scheme (MRS) (WAPC 2015) and 'Urban Development' under the District Planning Scheme Number 2 (DPS 2) (CoJ 2015).

1.3 Purpose of this report

It is important that the manner in which stormwater runoff from urban zoned areas is to be managed to avoid flooding and protect the environment is clearly documented early in the planning process. This approach provides the framework for actions and measures to achieve the desired outcomes at subdivision and development stages. This Local Water Management Strategy (LWMS) details the water management approach to support the Lot 9021 MacNaughton Crescent Local Structure Plan (LSP area) and is intended to satisfy the requirement to prepare a LWMS in accordance with *Better Urban Water Management* (WAPC 2008).

1.4 Policy framework

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

- *State Water Strategy* (Government of WA 2003a)
- *State Planning Policy 2.9 Water Resources* (WAPC 2006)
- *Guidance Statement No. 33: Environmental Guidance for Planning and Development* (EPA 2008)
- *Liveable Neighbourhoods Edition 4* (WAPC 2007)
- *Planning Bulletin No. 64: Acid Sulfate Soils* (WAPC 2009)
- *Gnangara Sustainability Strategy* (Government of WA 2009)
- *Local Planning Strategy* (CoJ 2014).

In addition to the above policies, there are a number of published guidelines and standards available that provide direction regarding the water discharge characteristics that urban developments should aim to achieve.

These are key inputs that relate either directly or indirectly to the site and include:

- *Better Urban Water Management* (WAPC 2008)
- *Australian Runoff Quality* (Engineers Australia 2006)
- *Australian Rainfall and Runoff (*Engineers Australia 1987*)*
- *Decision Process for Stormwater Management in Western Australia* (DoW 2009)
- *Stormwater Management Manual for Western Australia* (DoW 2007)
- *National Water Quality Management Strategy* (ANZECC 2000)
- *Development Design Specification JD5: Stormwater Drainage Design (*CoJ 1998*)*
- *Policy 6-3: Stormwater Drainage* (CoJ 2007)
- *Stormwater Management Policy* (CoJ 2012)
- *City Water Plan 2012-2015 (*CoJ 2011*)*.

The guidance documents listed indicate a need for accurate baseline data prior to urban development. This will ensure that any future development is able to fulfil the stormwater management requirements of the Department of Water (DoW) and engineering standards specified by the CoJ, but will also ensure that realistic water management criteria that are practically achievable are adopted.

1.5 LWMS objectives

This LWMS has been developed in consideration of the objectives and principles detailed in *Better Urban Water Management* (WAPC 2008). It is intended to support the Lot 9021 MacNaughton Crescent LSP and is further based on the following major objectives:

- Provide a broad level stormwater management framework to support future urban development.
- Incorporate appropriate best management practices (BMPs) into the drainage system that address the environmental and stormwater management issues identified.
- Minimise development construction costs, which will result in reduced land costs for future home owners.
- Minimise ongoing operation and maintenance costs for the land owners and CoJ.
- Develop a water supply and conservation strategy for the site that will aim to meet water use targets.
- Protect water quality to the underlying aquifer.
- Protect existing and proposed residences from flood risk.
- Gain support from DoW and CoJ for the proposed method to manage stormwater within the site and potential impacts on downstream areas.

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

2 Proposed Development

The Lot 9021 MacNaughton Crescent LSP covers approximately 4.02 ha and will allow for the creation of lot densities ranging from R20 to R40. The site incorporates 4,000 m^2 of public open space (POS) which is located adjacent to the existing MacNaughton Park POS.

Stormwater from the site will be catered for through a combination of onsite detention, retention and connection to the existing local drainage network (discussed further in **Sections 3.5.3** and **6**).

The Lot 9021 MacNaughton Crescent LSP is shown in **Appendix A**. Landscape concept plans illustrating the integration with the adjacent MacNaughton POS and proposed drainage infrastructure are provided in **Appendix B.**

3 Pre-development Environment

3.1 Sources of information

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

- *National Water Quality Management Strategy* (NWQMS) (ANZECC 2000)
- *Perth Metropolitan Region 1:50, 000 Environmental Geology Series (*Gozzard 1982*)*
- *WA Atlas* (Landgate 2015)
- *Water Register* (DoW 2015b)
- *Perth Groundwater Atlas* (DoW 2015a)
- *Weather and Climate Statistics data* (Bureau of Meteorology 2015).

In addition to the above information, site-specific investigations have been conducted aimed at providing more detail to the existing regional information. These site-specific investigations include an *Environmental assessment and management strategy* (Emerge Associates 2015) and site visits carried out by Emerge Associates in 2015 to ascertain any existing hydrological constraints. This is important, as it can have implications for the stormwater management measures and the extent of earthworks that may be required to facilitate subdivision.

3.2 Climate

The site experiences a dry Mediterranean climate of hot dry summers and cool wet winters. Long term climatic averages indicate that the site is located in an area of moderate to high rainfall, receiving 728 mm on average annually (Bureau of Meteorology 2015) with the majority of rainfall received in June and July. The region experiences rainfall for 80 days annually (on average).

3.3 Geotechnical conditions

3.3.1 Topography

The site ranges from 29 m AHD in the north west corner to 36 m AHD in the south east corner, as shown in **Figure 3**.

3.3.2 Soils

The Yanchep sheet of the 1:50,000 scale Environmental Geology series map (Gozzard 1982) indicates that the area is largely underlain with Tamala Limestone (LS_1) with a small portion of Sand (S_1) along the western boundary.

Geological mapping for the site is shown in **Figure 4**.

3.3.3 Acid sulfate soils

The *WA Atlas* (Landgate 2015) Acid Sulfate Soil (ASS) risk mapping classifies the entire site as having ‘no known risk of ASS occurring within 3 m of natural soil surface’.

3.4 Wetlands

The there are no geomorphic wetlands within the site (DoW 2015a).

3.5 Hydrology

3.5.1 Surface water quantity

No surface water bodies or channels are observed within the site. It is assumed that surface water infiltrates freely across the site due to the high permeability of the underlying sands, as discussed in **Section 3.3.2**.

3.5.2 Surface water quality

Given that there are no defined surface water bodies or channels, there is no surface water quality data available for the site.

3.5.3 Existing drainage

The site is located within the Lochy Close sump catchment of the greater CoJ drainage network, as shown in the existing network construction designs and plans provided in **Appendix C**. Surface runoff from the catchment that is not retained at source is discharged to the Lochy Close drainage sump, located approximately 250 m north of the site. Runoff is conveyed to the sump either via the piped drainage network (flows up to the 5 year ARI event) or via overland flow within the road network.

The Lochy sump has been designed to retain 100 year ARI, 24 hour duration event runoff from the impermeable contributing area and has a total storage capacity of 14,600 m^3 (see drawing 4269-C051-0 in **Appendix C**).

The site was allowed for in the design of Lochy Sump however it is unclear how much impermeable area from the site was included in the calculations. A 375 mm connection pipe exists at the proposed main entry road to the site from Grangemouth Turn, opposite Ossian Way (see drawing 4269-C927-1 in **Appendix C**). Advice from the CoJ has confirmed that flows equivalent to 67% of the capacity of a 300 mm pipe can be assumed at this location (Whithers G. [CoJ] 2015, pers. comm. 12 May). This equates to 0.08 m^3/s. No other connections to the local pipe network have been provided for the site.

3.5.4 Groundwater levels

Groundwater beneath the site is a multi-layered system comprised of the following:

- Perth - Superficial (unconfined) aquifer
- Perth - Leederville (confined) aquifer
- Perth - Yarragadee North (confined) aquifer.

The Superficial aquifer is considered to be the primary aquifer of interest in relation to this LWMS as this is the aquifer most likely impacted by water management practices within the site, and also most likely accessed for local use.

The *Perth Groundwater Atlas* (DoW 2015a) indicates regional historical maximum groundwater levels (MGL) of approximately 3.5 m AHD. This equates to an approximate depth to groundwater of between 25.5 and 32.5 m.

3.5.5 Groundwater quality

Groundwater quality monitoring has not been carried out across the site due to the significant depth to groundwater.

3.6 Current and historical land uses

The site is currently vacant and unused with the exception of local recreation use such as dog walkers who utilise the site. A search of the Department of Environment Regulation's (DER) Contaminated Sites Database (DER 2015) found there to be no registered sites within, or in close proximity to, the site.

There does not appear to be any historic evidence of any activities (e.g. market gardening) within the site that would raise concerns in relation to potential soil and/or groundwater contamination.

3.7 Summary of existing environment

In summary, the environmental investigations conducted to date indicate that:

- The site receives 729 mm of average annual rainfall with the majority of rainfall received in June and July.
- The site topography ranges between 29 and 36 m AHD with a general slope from south east to north west.
- The majority of the site is underlain by Tamala Limestone, with a small portion of sand along the western boundary.
- ASS risk mapping classifies the entire site as having no known risk of encountering ASS within 3 m of the surface.
- There are no wetlands within the site.
- High permeability of the underlying sands suggests that surface water is largely retained and infiltrated within the site.
- The site is located in the Lochy Close sump catchment.
- A connection to the local drainage network exists immediately adjacent to the site at Grangemouth Turn, opposite Ossian Way with a peak capacity of 0.08 m^3/s. No other connections have been allowed for in the existing and surrounding pipe design.
- Depth to groundwater ranges between 25.5 m and 32.5 m with a historical MGL of approximately 3.5 m AHD. Groundwater underlying the site flows towards the Indian Ocean.
- The site is currently vacant and unused with the exception of local recreation use such as dog walkers who utilise the site.

4 Design Criteria and Objectives

This section outlines the objectives and design criteria that this LWMS and future management plans must achieve. The water management strategy covers water consumption, groundwater management and stormwater management.

4.1 Integrated water cycle management

The *State Water Strategy* (Government of WA 2003b) endorses the promotion of integrated water cycle management and application of Water Sensitive Urban Design (WSUD) principles to provide improvements in the management of stormwater, and to increase the efficient use of other existing water supplies.

The key principles of integrated water cycle management include:

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

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

- Potable water supply and consumption
- Flood mitigation
- Groundwater management.

The first step in applying integrated water cycle management in residential catchments is to establish agreed environmental values for receiving environments. The existing environmental context of the site has been discussed in **Section 3** of this document. Guidance regarding environmental values and criteria is provided by a number of National and State policies and guidelines and site specific studies undertaken in and around the site development. These were detailed in **Sections 1.4** and **3.1**.

The design criteria discussed in the following sections are based on the assessment of the existing environment within the site, with the aim of achieving the integrated water cycle outcomes discussed above.

4.2 Water conservation

This LWMS proposes the following water conservation criteria:

Criteria WC 1 Non-potable water consumption target of 6,750 kL/ha/year for POS areas.

Criteria WC 2 Potable water consumption target of 100 kL/person/year for residential areas with no more than 40-60 kL/person/year of scheme water.

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

4.3 Stormwater management

The principle behind stormwater management at the site is to mimic the pre-development hydrological conditions, as described in **Section 3.5**. This principle and the guidance documents discussed in **Section 3** have guided the surface water management criteria.

This LWMS proposes the following stormwater design criteria:

Criteria SW1 Maintain the 5 year ARI event peak flow rate consistent with the capacity of the existing downstream network.

Criteria SW2 Provide a flow path to convey the 100 year ARI event runoff to the downstream drainage network.

Criteria SW3 Maintain 300 mm clearance between habitable floor levels and the 100 year ARI top water levels (TWL) within onsite storage areas (bio-retention areas (BRAs) and flood storage areas (FSAs)).

Criteria SW4 Minor roads must remain passable in the 5 year ARI rainfall event.

Criteria SW5 Retain and treat the 1 year 1 hour ARI event onsite.

Criteria SW6 BRAs to be sized to at least 2% of the total connected impervious area.

Criteria SW7 Utilise appropriate structural and non-structural measures to reduce nutrient loads.

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

4.4 Groundwater management

The principle behind the groundwater management strategy is to maintain the existing groundwater hydrology. Due to the significant depth to groundwater (as detailed in **Section 3.5.4**) the groundwater management criteria are integrally linked to stormwater management. This LWMS proposes the following groundwater management criteria:

Criteria GW1: Treat stormwater runoff before discharging to groundwater.

Criteria GW2: Use water sensitive design approaches to recharge the superficial aquifer.

The manner in which these objectives will be achieved is further detailed in **Section 7**. The management approach to achieve groundwater quality aims are consistent with those proposed for surface water. In order to reduce unnecessary duplication these management approaches are not proposed as groundwater criteria.

5 Water Source Allocation, Infrastructure and Fit-For-Purpose

5.1 Fit for purpose water use

Conservation of water through fit-for-purpose use and best management practices is encouraged so that scheme water is not wasted. Fit-for-purpose principles have been utilised in the water conservation strategy for the site.

5.1.1 Scheme water

The site is located within, and will connect to, the Water Corporation (WC) integrated water supply scheme (IWSS) network. Scheme water is proposed to be used for all in-house potable uses, and where ex-house uses cannot be serviced by other supplies or approaches, it would also satisfy ex-house requirements.

5.1.2 Groundwater

Groundwater is proposed to be used for irrigation of POS areas. Assuming an average irrigation rate of 6,750 kL/ha/year, a total 2,700 kL/year will be required to irrigate the POS area. The status of groundwater allocation applications is detailed in **Section 5.4**.

5.1.3 Rainwater tanks

Harvested rainwater can be used in lots for some irrigation requirements however this will need to be supplemented with scheme water during the lower rainfall months. During the higher rainfall months, the majority of the harvested rainwater could be used to supplement internal building non-potable uses.

The use of rainwater tanks will not be mandated with the development however they will be promoted by the proponent at point of sale.

5.2 Water conservation measures

The development will utilise groundwater for POS irrigation, active POS irrigation management, Rainwater Tanks (RWT), waterwise gardening (WWG) principles for lot scale gardens and within estate landscaping and Water Efficient Fixtures and Appliances (WEFA) to ensure that the development minimises the use of water. Details of these measures are further discussed in the following sections.

5.2.1 Rainwater tanks

This water efficiency strategy recommends that the rainwater is used in washing machines, toilets and hot water systems where rainwater tanks are implemented. The stormwater quantity management strategy does not rely on the use of rainwater tanks, and they are therefore only considered to be a water conservation measure. It is assumed (for the purposes of the water balance analysis) that, where installed, rainwater tanks will have at least 3 kL of storage capacity. The lot water balance described in Section 5.3 assumes an uptake rate of 9 %, informed by ABS studies (ABS 2013b).

5.2.2 Water efficient fixtures and appliances

Significant reduction in in-house water uses will be achieved with the use of water efficient fixtures and appliances (WEFA) (WC 2003).

The water conservation strategy assumes that all dwellings will use water efficient fixtures and that approximately 35% of homes will install water efficient appliances (ABS 2013b). The uptake of water efficient fixtures will be mandated through the building licence, while the uptake of water efficient appliances will be encouraged by state government rebates, as well as education from the proponent at point of sale. Further details will be provided within the future UWMP.

5.2.3 Waterwise gardens

Reductions in water use for irrigation by employing water efficiency measures can significantly reduce the total water usage (WC 2003). The development will undertake a variety of measures to limit water use into the future within POS and the private residential landscape works under the control of the proponent. A variety of methods and approaches will be considered including any or all of the following:

- The adoption of water wise species, with a focus on using local native species or if necessary species from regions with similar climates.
- Where required, existing site soil may be improved with soil conditioner certified to Australian Standard AS 4454 to a minimum depth of 150 mm where turf is to be planted and a minimum depth of 300 mm for garden beds.
- The irrigation system is proposed to be designed and installed according to best water efficient practices including consideration of hydro zone design solutions.
- The amount of turfed areas will be controlled while also being designed to meet community needs.
- Garden beds will be mulched to 75 mm with a product certified to Australian Standard AS 4454.
- The POS design will cater for efficient water requirements during maintenance. This will be achieved by implementing an appropriate management and maintenance program for POS areas that will be further detailed at the UWMP (Urban Water Management Plan) stage.

WWG principles will be implemented within the POS and road verges. Lot owners will be provided front of lot landscape packages with a requirement to implement WWG principles. In relation to the lot water balance discussed in **Section 5.3**, WWG principles have been assumed to be utilised in 75% of private lots (as informed by relevant studies (ABS 2013b) and provision of front of lot landscape packages).

5.2.4 Educational material

Educational material will be provided to lot purchasers to provide information on water efficiency and quality protection measures that they can implement within lots. Specific water conservation and protection topics that will be addressed include:

- Water use reduction
- Water efficient technologies
- Recycling systems
- Fertiliser use
- Planting species.

Provision of educational material will assist in achieving **Criteria WC2** and **GW3**.

5.3 Lot water balance

A water balance analysis has been undertaken to demonstrate the effectiveness of the water conservation strategy proposed. The analysis considers realistic uptakes of non-mandatory water conservation measures including WEFA, RWTs and WWG. Uptake rate and population assumptions are calculated using data from the Australian Bureau of Statistics (ABS) (ABS 2013b, a). A comparison with a scenario where 100% of all proposed measures are utilised is also provided.

1. Scenario 1 – % uptake of water conservation strategy (WCS) (75% WWG, 9% RWT, 100% WE Fixtures, 35% WE Appliances)
2. Scenario 2 – Full WCS (100% of all measures).

The water balance analysis has been based on the rates and calculation methodology presented in the Water Corporation Spreadsheet *AltWaterSupply_Water_Use_Model.xls* (WC 2011). The water balance analysis assumes an average of 2.6 people per lot for single dwellings. Values are calculated from data provided by the ABS for new housing developments in Perth (ABS 2013a). This spreadsheet has been adapted to model the effects of using RWT, WWG and WEFA. The lot scale water consumption comparison for the two water conservation scenarios is presented in **Table 1**.

Table 1 Lot 9021 MacNaughton Crescent LSP lot water consumption

Scheme	Scenario 1 % uptake of WCS	Scenario 2 Full WCS
Total scheme water required (ML/year)	24.8	20.8
Scheme water per capita (kL/year/person)	52.4	26.2

The results of the water balance indicate that on average, if households in the development adopt the proposed water conservation measures at typical uptake rates, they will use 52.4 kL/year/person. This achieves the state water consumption target of no more than 100 kL/year/person and the *Better Urban Water Management* aspirational goal of 40-60 kL/year/person, and satisfies **Criteria WC1**.

5.4 Estate scale water usage

Water usage at an estate scale has been determined by the amount of POS provided and any additional areas which will require irrigation.

The LSP provides 4,000 m^2 of POS which, based on an average irrigation rate of 6,750 kL/ha/annum, equates to approximately 2,700 kL/annum. The proposed POS area is currently partially irrigated by CoJ as part of the adjacent MacNaughton Park POS irrigation system. The City's operations branch has advised that they are willing to provide ongoing irrigation to the Lot 9021 POS area from their existing groundwater allocation subject to the proponent carrying out improvements to the existing irrigation system and landscaping of MacNaughton Park POS to obtain efficiencies in water use (G. Young [CoJ] 2015, pers. comm. June). The efficiencies would result in no overall increase to the groundwater volume used from the City's allocation following incorporation of the Lot 9021 POS area.

Streetscapes will include the provision of a street tree with basic landscaping and irrigation installed as part of the front landscaping package provided by the proponent to each residential lot. Irrigation for residential lot front landscaping and verges is to be provided from the lot. Any additional landscaping to residential verges will be the responsibility of the lot owner. Where landscaping is proposed to streetscapes that include medians and/or verges that do not have direct residential frontage and are ultimately to be maintained by CoJ, irrigation is to be installed in accordance with CoJ irrigation specifications and irrigated for a maximum of two years for establishment purposes prior to being switched off.

A temporary groundwater allocation application has been submitted to DoW for 22,700 kL/year. This allocation will be used for irrigation of POS and streetscapes not irrigated from lot during a two year establishment phase and for works during construction. The status of the temporary licence application and agreements between CoJ and the proponent relating to the permanent irrigation of the development POS area will be provided in the future UWMP.

The above measures will assist in achieving **Criteria WC2**.

5.5 Wastewater management

The site is located within, and will be connected to, the Water Corporation deep sewer network.

5.6 Water conservation criteria compliance summary

A summary of the proposed water conservation design criteria, and how these are addressed within the Lot 9021 MacNaughton Crescent LSP, is provided in **Table 2**.

Table 2 Water conservation criteria compliance

Criteria number	Criteria description	Manner in which compliance will be achieved
WC 1	Non-potable water consumption target of 6,750 kL/ha/year for POS areas.	WWG practices in POS
		Retain native vegetation where possible
WC 2	Potable water consumption target of 100 kL/person/year for residential areas with no more than 40-60 kL/person/year of scheme water.	Promotion/use of rainwater tanks
		Promotion/use of WWG practices
		Promotion/use water efficient appliances
		Water efficient fittings

6 Stormwater Management Strategy

The principle behind the stormwater management strategy for the Lot 9021 MacNaughton Crescent LSP is to infiltrate stormwater runoff as close to source as possible and to utilise existing infrastructure which has been planned and installed to cater for runoff from the site. The utilisation of various WSUD strategies within the development drainage system along with connection to the existing local drainage network will achieve the design criteria stated in **Section 4.3**. WSUD techniques utilised in the stormwater management strategy include:

- Soakwells
- Sub-surface storage
- BRAs
- FSAs.

These measures are further discussed in the subsequent sections.

6.1 Stormwater management approach

The development drainage system has been designed to achieve the objectives and criteria stated in **Section 4.3**. Surface runoff modelling undertaken using XPSWMM has been used to inform the design of stormwater infrastructure as detailed below. Modelling assumptions are provided in **Appendix D**. The post-development catchments across the Lot 9021 MacNaughton Crescent LSP are shown in **Figure 5**.

6.1.1 Lot drainage

Lots are assumed to retain the 100 year ARI event on lot within soakwells, RWTs where they are installed, and pervious garden areas. Where RWTs are to be used for stormwater storage a low flow outlet will be required to ensure there is adequate capacity within the tank during a rainfall event.

It is the lot owner's responsibility to ensure that adequate storage is provided for the 100 year ARI event runoff from lot. The retention of runoff on lot will assist in achieving **Criteria SW1**, **SW5**, **SW7** and **GW2**.

6.1.2 Sub-surface storage

The 1 year 1 hour ARI event runoff from the road network within Catchment 1 will be retained in sub-surface storage (a storage volume of 20 m^3 is required). There are a number of sub-surface storage products available (e.g. EcoAid) and the specific design and configuration of the sub-surface storage will be determined at detailed design and presented in the future UWMP.

The use of sub-surface storage will assist in achieving **Criteria SW1**, **SW5**, **SW7** and **GW2**.

6.1.3 Bio-retention areas

The 1 year 1 hour ARI event runoff from the road network within Catchment 2 will be retained within a BRA located in POS. The BRA has a storage capacity of 10 m^3, a maximum depth of 300 mm and 1:3 side slopes.

Rainfall events greater than the 1 year 1 hour ARI event will be conveyed by weir structure or pipe to the adjacent FSA (detailed in **Section 6.1.4**). An indicative location and area for the BRA is provided in **Figure 5**.

The BRA will be underlain with a 300 mm layer of soil media suitable for nutrient removal. The soil media can be comprised of naturally found soils with a high PRI (>10) or an engineered media with appropriate specification (e.g. Eco media). The exact media to be used will be confirmed at UWMP stage.

The total size of the BRA is 5.3 % of the connected impervious area (road pavement and impervious verges).

The use and design of the BRA will assist in achieving **Criteria SW1**, **SW3**, **SW5**, **SW6**, **SW7, GW1** and **GW2**.

6.1.4 Flood storage areas

A FSA will be utilised to retain up to the 5 year ARI event runoff from Catchment 2. The FSA has a storage capacity of 20 m^3, a maximum depth of 500 mm and 1:6 side slopes. An indicative location and area for the FSA is provided within **Figure 5**.

The FSA will be designed to ensure a minimum 300 mm clearance is maintained between habitable floor levels and the 100 year ARI top water levels within the basin.

The use and design of FSAs will assist in achieving **Criteria SW1**, **SW3**, **SW5**, **SW7 and GW2**.

The number and configuration of sub-surface storage cells, BRAs and FSAs can be modified at detailed design stage provided the assumed storages detailed above are maintained. The Landscape Masterplan, provided in **Appendix B**, shows how the development is intended to be landscaped. Note that the BRA and FSA characteristics are nominal, and will need to be confirmed/revised following outcomes of any geotechnical investigation, the development of the detailed earthworks strategy and detailed civil designs.

6.1.5 Piped drainage network

The piped drainage network within the site will be sized to convey the 5 year ARI event runoff from the road network.

As detailed in **Section 3.5.3**, a connection to the existing drainage network has been provided to the site at the proposed main entry road (indicated as Discharge 1 in **Figure 5**). Flows from Catchment 1, above the 1 year 1 hour ARI event, will be conveyed to the downstream drainage network via the pipe network (for the 5 year ARI event) and overland flow within road pavements (up to the 100 year ARI event). The peak flow rate leaving the site at Discharge 1 in a 5 year ARI event is 0.03 m^3/s which is within the maximum allowable capacity of the existing pipe infrastructure of 0.08 m^3/s.

The use and design of the piped network will assist in achieving **Criteria SW1 and SW4**.

6.2 Compliance summary

A summary of the proposed surface water design criteria and how these are addressed within the Lot 9021 MacNaughton Crescent LSP development is provided in **Table 3**.

Table 3 Surface water management criteria compliance

Criteria number	Criteria description	Manner in which compliance will be achieved
SW1	Maintain the 5 year ARI event peak flow rate consistent with the capacity of the existing downstream network	Lots will retain the 100 year ARI event runoff from lot within soakwells, RWTs where implemented, and pervious garden areas
		Runoff from roads will be retained in subsurface storage, a BRA and a FSA
SW2	Provide a flow path to convey the 100 year ARI event runoff to the downstream drainage network	The earthworks concept plan (provided in **Appendix E**) shows that the road network will be graded towards the adjacent existing roads, thus providing a flow path to the downstream drainage network
SW2	Maintain 300 mm clearance between finished floor levels and the 100 year ARI TWL within onsite storage areas (BRAs and FSAs).	A minimum 300 mm clearance between finished floor levels and the 100 year ARI TWL in the BRA and FSA will be maintained
SW3	Minor roads must remain passable in the 5 year ARI rainfall event.	The stormwater pipe network will be designed to convey the 5 year ARI rainfall event from the road network
SW4	Retain and treat the 1 year 1 hour ARI event as close to source as possible.	Lots will retain the 1 year 1 hour ARI event runoff from the lot within soakwells and pervious garden areas
		The 1 year 1 hour ARI event runoff from roads will be retained in subsurface storage and a BRA
SW5	Treatment areas to be sized to at least 2% of the total connected impervious area.	The total size of the BRA is 5.3 % of the connected impervious area (road pavement, impervious verges and front of lots)
SW6	Utilise appropriate structural and non-structural measures to reduce nutrient loads.	Structural measures include soakwells, subsurface storage and a vegetated BRA
		WWG practices
		Maintenance of POS and drainage areas
		Street sweeping
		Education of residents

7 Groundwater Management Strategy

The development drainage system has been designed to achieve the objectives and criteria stated in **Section 4.4**. The preliminary earthworks levels shown in **Appendix E** indicate that the proposed development will have more than 20 m separation to underlying groundwater, therefore groundwater management criteria concentrate on groundwater quality.

7.1 Groundwater quality management

The main objective of the management of groundwater quality is to maintain or improve the existing groundwater quality. This can be achieved by reducing the total nutrient load to groundwater from sources within the development and by improving the groundwater via treatment of surface runoff prior to infiltrating to groundwater.

The reduction of nutrient loads to groundwater will be achieved by the following measures:

- Direct stormwater to a vegetated BRA.
- BRA will be underlain with a 300 mm layer of soil media suitable for nutrient removal. The soil media can be comprised of naturally occurring soils with a high PRI (>10) or an engineered media with appropriate specification (e.g Eco media). The exact media to be used will be confirmed at UWMP stage.
- Minimising fertiliser use to establish and maintain vegetation within POS areas and road verges.
- Utilising drought tolerant turf species that require minimal water and nutrients.
- Roll-on turf will be used within POS areas to prevent the high nutrient input requirement during establishment of turf.

The above measures will improve the quality of the water prior to it infiltrating into the underlying groundwater, and will assist in achieving **Criteria GW1** and **Criteria GW2**.

7.2 Groundwater criteria compliance summary

A summary of the proposed groundwater quantity design criteria and how these are addressed within the Lot 9021 MacNaughton Crescent LSP development is provided in **Table 4**.

Table 4 Groundwater management criteria compliance

Criteria number	Criteria description	Manner in which compliance will be achieved
GW1	Treat stormwater runoff before discharging to groundwater	Direct 1 year 1 hour ARI event runoff to subsurface storage and the vegetated BRA
		BRA will be underlain with a 300 mm layer of soil media suitable for nutrient removal
		Minimise fertiliser use in POS and road verges
		Use roll-on, drought tolerant turf species
GW2	Use water sensitive design approaches to recharge the superficial aquifer	Infiltrate runoff from lots at source in soakwells and pervious garden areas

Criteria number	Criteria description	Manner in which compliance will be achieved
		Retain and infiltrate road reserve runoff in subsurface storage, BRA and FSA

8 Matters to be addressed in the UWMP

While strategies have been provided within this LWMS that address planning for water management within the site, it is a logical progression that future subdivision designs and supportive UWMPs will clarify details not provided within the LWMS. The main areas that will require further clarification within future UWMPs include:

- Detailed drainage design
- Implementation of water conservation strategies
- Non-structural water quality improvement measures
- Management and maintenance requirements
- Construction period management strategy
- Groundwater license status
- Subsurface infrastructure design
- Geotechnical report.

8.1 Detailed drainage design

While the Lot 9021 MacNaughton Crescent LSP drainage catchments have been defined based on the earthworks concept plan (presented in **Appendix E**), it is possible that these could undergo some change to accommodate stakeholder feedback prior to final subdivision design. It is also expected that the civil drainage designs will be progressed to a level that provides detailed cross-sections, sizes of storage areas, pipe sizes, inverts, etc. The ultimate aim of revising the hydrological model will be to confirm that the post-development runoff volumes are able to meet the performance criteria proposed in **Section 4** of this LWMS. The design of the drainage system to date has been undertaken at an appropriate level for LSP and runoff-routing computer modelling of the stormwater drainage system will be reviewed once detailed drainage design has commenced for the area. The exact location and shape of the stormwater management infrastructure will still need to be specified and presented within the future UWMP.

The exception to the requirement to revise the surface runoff modelling is if the catchment details, sub-surface storage, BRA and FSA designs are consistent with the assumptions made in this LWMS. If this were the case it would be acceptable to provide design calculations for the concrete pipe network and detention/retention areas to demonstrate compliance with the LWMS.

8.2 Implementation of water conservation strategies

A number of potential measures to conserve water have been presented within this LWMS. These water conservation strategies will be incorporated into the design and the ongoing maintenance of the POS area. Landscape design measures that will be incorporated into the water conservation strategy will be further detailed within the future UWMP. The manner in which the proponent intends to promote water conservation measures discussed in this LWMS to future lot owners will also be discussed within the future UWMP.

8.3 Non-structural water quality improvement measures

Guidance for the development and implementation of non-structural water quality improvement measures is provided within the *Stormwater Management Manual for Western Australia* (DoW 2007). Some measures will be more appropriately implemented at a local government level, such as street sweeping, however many can be implemented relatively easily within the design and maintenance of the subdivision and the POS area. The future UWMP will provide reference to measures such as public education (through measures such as signage that may be implemented to raise awareness).

8.4 Management and maintenance requirements

The measures implemented to address surface and groundwater quality, such as the use of subsurface storage and BRAs, will require ongoing maintenance. It is therefore expected that future UWMPs will provide detailed management and maintenance plans that will set out maintenance actions (e.g. gross pollutant removal), timing (e.g. how often it will occur), locations (e.g. exactly where it will occur) and responsibilities (e.g. who will be responsible for carrying out the actions). Given that approval from the CoJ and DoW will be sought for the proposed measures, it is anticipated that consultation with these agencies will be undertaken and referral to guiding policies and documents will be made.

8.5 Construction period management strategy

It is anticipated that the construction stage will require some management of various aspects (e.g. dust, surface runoff, noise, traffic etc.). The management measures undertaken for construction management will be addressed either in the future UWMP or a separate Construction Management Plan (CMP).

8.6 Groundwater license status

An application has been submitted for a temporary groundwater allocation for both irrigation and construction purposes, as discussed in **Section 5.4**. This licence will be used for establishment irrigation of POS and streetscapes, and dust suppression during construction. The current status of any groundwater licence application will be provided at UWMP stage.

The permanent irrigation of the development POS area will be provided by CoJ following upgrade works to the existing irrigation infrastructure and landscaping of the adjacent MacNaughton Park POS. Details of the works to be carried out and confirmation of the agreement to provide groundwater allocation for the development POS area will be provided in the future UWMP.

8.7 Subsurface infrastructure design

Numerous proprietary subsurface storage products are available for use within the context discussed in this LWMS. The selection and design of specific subsurface storage infrastructure will be detailed at UWMP stage. The management and maintenance requirements of such infrastructure will also be detailed at the subsequent UWMP stage.

8.8 Geotechnical report

A geotechnical investigation of the site is required to inform subdivision design and confirm the underlying soil conditions across the site. The full geotechnical report will be provided and summarised in the future UWMP.

9 Monitoring

9.1 Condition monitoring

It is proposed that the overall condition of the development will be monitored on a bi-annual basis. This monitoring will be implemented after the completion of the civil and landscaping works and will continue for a period of two years.

A visual assessment will be undertaken to monitor the overall condition of the development, with the aim to ascertain that the maintenance activities are achieving the overall management objectives for the development. The parameters that will be monitored include:

- Gross pollutants
- Terrestrial weeds
- Irrigation
- Vegetation density
- Paths, benches, walkways and other infrastructure.

The management and maintenance objectives will be detailed within the future UWMP.

It should be noted that site specific post-development groundwater monitoring is not proposed due to the significant (>25 m) depth to groundwater.

9.2 Reporting

A post-development monitoring report will be prepared on conclusion of the two year monitoring period, and will be provided to the CoJ. Interim results (spreadsheet) can be provided to CoJ on request during the monitoring program.

10 Implementation

This LWMS is a key supportive document for the Lot 9021 MacNaughton Crescent LSP. The development of this LWMS has been undertaken with the intention of providing a structure within which subsequent development can occur consistent with an integrated water cycle management approach. It is also intended to provide overall guidance to the general stormwater management principles for the site and to guide the development of the future UWMP.

10.1 Roles and responsibility

This LWMS provides a framework that the developer can utilise to assist in establishing stormwater management methods that have been based upon site-specific investigations, are consistent with relevant State policies and have been endorsed by the CoJ. The responsibility for working within the framework established within the LWMS rests with the proponent, although it is anticipated that the future UWMP will be developed in consultation with the CoJ and DoW as these will be the ultimate approval agencies.

It will be the responsibility of the proponent to prepare detailed designs and the supportive UWMP. It is also the responsibility of the proponent to demonstrate that the proposed detailed civil designs and the supportive UWMP comply with the objectives and management approaches provided in this LWMS.

10.2 Funding

As the site constitutes a single landholding, the management strategies outlined in this LWMS will be borne solely by the proponent.

10.3 Recommendations

It is not anticipated that this LWMS will be reviewed, unless additional land parcels/lots are added to the Lot 9021 MacNaughton Crescent LSP prior to detailed design or the Lot 9021 MacNaughton Crescent LSP undergoes significant change post-lodgement. If additional areas are required to be covered by the LWMS it is most likely that an addendum to cover these areas could be prepared. If the Lot 9021 MacNaughton Crescent LSP is substantially modified this LWMS will need to be reviewed and the criteria reviewed to ensure that all are still appropriate.

The next stages of water management are anticipated to be detailed design. Detailed civil designs should be supported by a UWMP. The UWMP is largely an extension of the LWMS, as it should provide detail to the designs proposed within this LWMS, and will demonstrate compliance with the criteria proposed in **Section 4**.

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FIGURES

Figure 1: Site location

Figure 2: Site boundary

Figure 3: Topography

Figure 4: Geological mapping

Figure 5: Stormwater management plan

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Figure 1: Site locality

Project: Local Water Management Strategy
Lot 9021 MacNaughton Crescent Local Structure Plan, Kinross

Client: Peet Limited

Plan Number: EP15-017(03)--F11

Drawn:	GRO	Date:	05/05/15
Approved:	DPC	Date:	26/06/15
Checked:	RLE	Scale:	1:3,500@A4

0 35 70 140 Metres

emerge ASSOCIATES
Integrated Science & Design

Figure 2: Site boundary

Project: Local Water Management Strategy
Lot 9021 MacNaughton Crescent Local Structure Plan, Kinross

Client: Peet Limited

Plan Number: EP15-017(03)--F12			
Drawn:	GRO	Date:	05/05/15
Approved:	DPC	Date:	26/06/15
Checked:	RLE	Scale:	1:1,500@A4

0 15 30 60 Metres

emerge ASSOCIATES
Integrated Science & Design

Figure 3: Topography

Project: Local Water Management Strategy
Lot 9021 MacNaughton Crescent Local Structure Plan, Kinross

Client: Peet Limited

Plan Number: EP15-017(03)--F13

Drawn:	GRO	Date:	05/05/15
Approved:	DPC	Date:	26/06/15
Checked:	RLE	Scale:	1:1,500@A4

0 15 30 60 Metres

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Integrated Science & Design

Sources: The following datasets were used in the production of this map: Topographic contours - Whelans (2015)

Figure 4: Geological mapping

Project: Local Water Management Strategy
Lot 9021 MacNaughton Crescent Local Structure Plan, Kinross

Client: Peet Limited

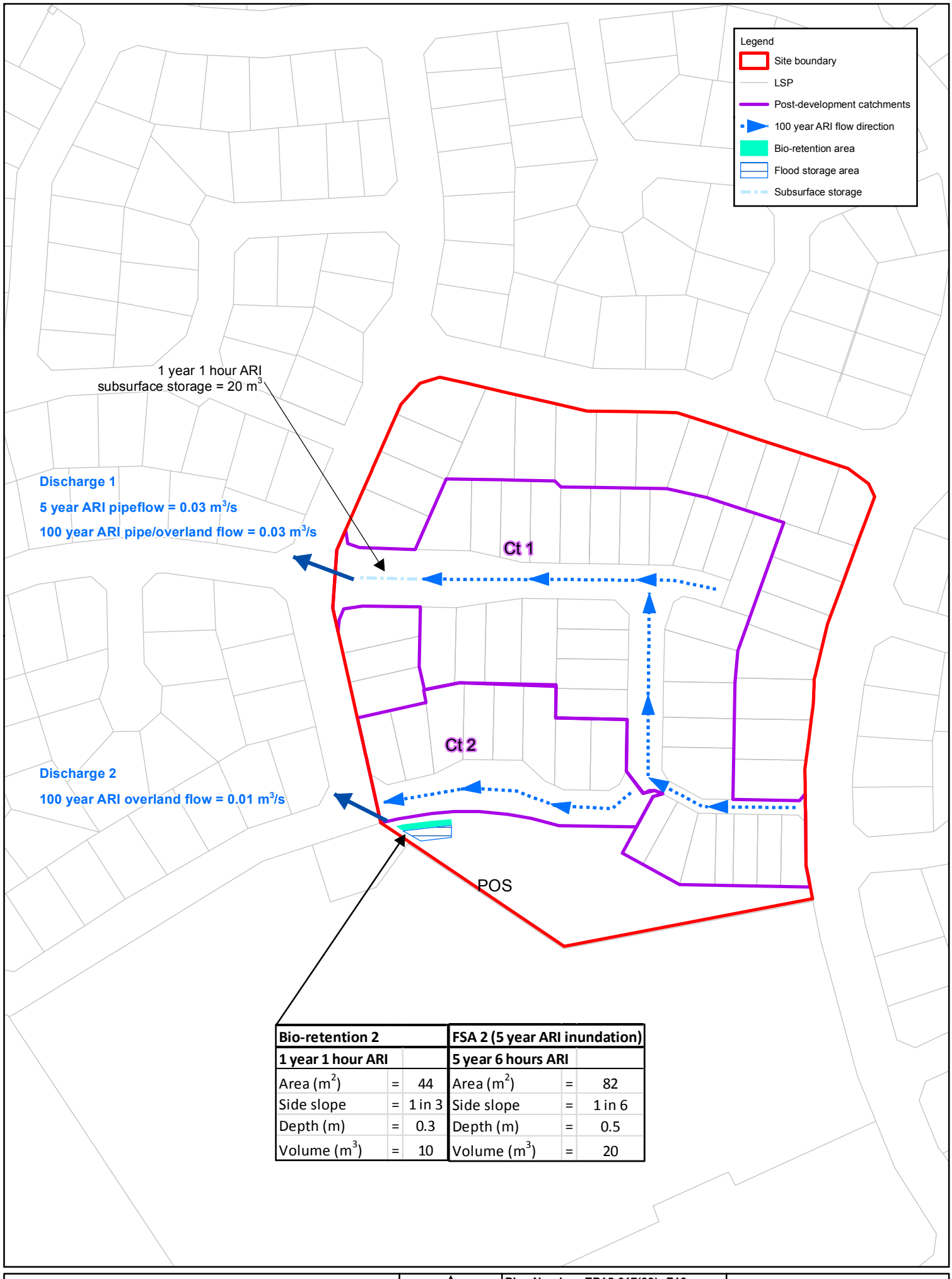
Plan Number: EP15-017(03)--F14

Drawn:	GRO	Date:	05/05/15
Approved:	DPC	Date:	26/06/15
Checked:	RLE	Scale:	1:1,500@A4

0 15 30 60 Metres

emerge ASSOCIATES
Integrated Science & Design

Sources: The following datasets were used in the production of this map: Surface soils - Gozzard (1986)



Bio-retention 2			FSA 2 (5 year ARI inundation)		
1 year 1 hour ARI			5 year 6 hours ARI		
Area (m^2)	=	44	Area (m^2)	=	82
Side slope	=	1 in 3	Side slope	=	1 in 6
Depth (m)	=	0.3	Depth (m)	=	0.5
Volume (m^3)	=	10	Volume (m^3)	=	20

Figure 5: Stormwater management plan

Project: Local Water Management Strategy
Lot 9021 MacNaughton Crescent Local Structure Plan

Client: Peet Limited

Plan Number: EP15-017(03)--F16

Drawn:	SMF	Date:	27/05/15
Approved:	DPC	Date:	26/06/15
Checked:	RLE	Scale:	1:2,000@A4

0 20 40 80 Metres

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APPENDIX A

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LOCAL STRUCTURE PLAN

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PLAN 1 - STRUCTURE PLAN

Lot 9021 MacNaughton Crescent, KINROSS

NORTH

0 10 20 30m

Scale: 1:1000@A3
Date: 04/05/2016
Plan: PACBB-2-003D

A 28 Brown St, East Perth WA 6004
P (08) 9325 0200
E info@creativedp.com.au
W creativedp.com.au

FIGURE 12 - MASTER PLAN

Lot 9021 MacNaughton Crescent, KINROSS

A Peet Project

NORTH

0 10 20 30m

Scale: 1:1200@A3
Date: 04/05/2016
Plan: PACBB-6-002A

A 28 Brown St, East Perth WA 6004
P (08) 9325 0200
E info@creativedp.com.au
W creativedp.com.au

APPENDIX B

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LANDSCAPE PLANS

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dwg • XX.XX.XX
date • MAY 15
rev • A
scale • 1:500 @ A1

0 5 10 15 m

LOT 9021 MacNaughton Crescent, KINROSS

LANDSCAPE CONCEPT PLAN

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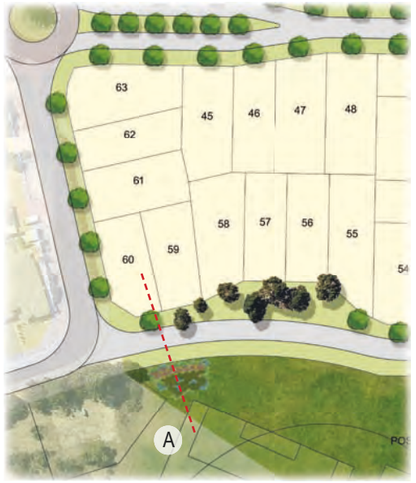

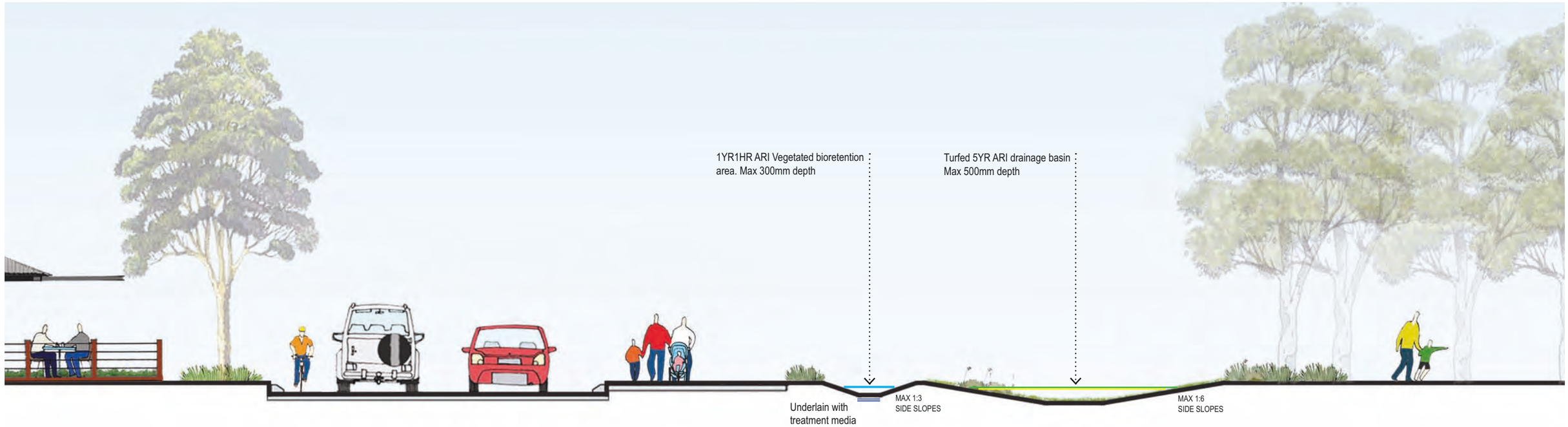

Shape of bioretention basin is organic and the width of the basin varies

Section shows retention basin. Note that the shape of swale is intended to be organic

Section A - section through 5yr ARI flood storage area in POS

dwg • XX.XX.XX
date • june 2015
rev • A
scale •

LOT 9021 MacNaughton Crescent, KINROSS

Retention Basin Section

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APPENDIX C

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EXISTING DRAINAGE DESIGNS

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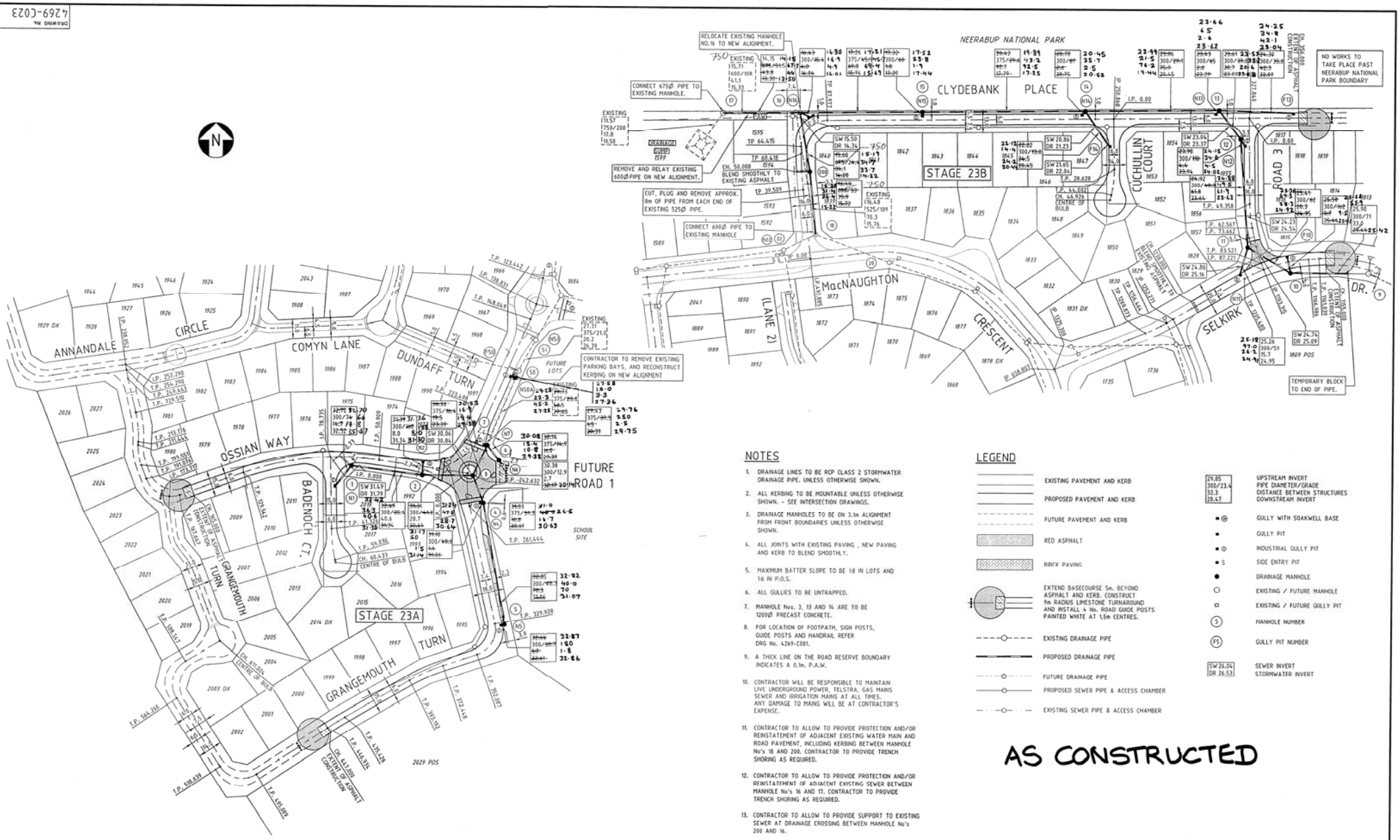
DRAWING No. 4269-C023



NOTES

1. DRAINAGE LINES TO BE RCP CLASS 2 STORMWATER DRAINAGE PIPE, UNLESS OTHERWISE SHOWN.
2. ALL KERBING TO BE MOUNTABLE UNLESS OTHERWISE SHOWN. - SEE INTERSECTION DRAWINGS.
3. DRAINAGE MANHOLES TO BE ON 3.1m ALIGNMENT FROM FRONT BOUNDARIES UNLESS OTHERWISE SHOWN.
4. ALL JOINTS WITH EXISTING PAVING , NEW PAVING AND KERB TO BLEND SMOOTHLY.
5. MAXIMUM BATTER SLOPE TO BE 1:8 IN LOTS AND 1:6 IN P.O.S.
6. ALL GULLIES TO BE UNTRAPPED.
7. MANHOLE Nos. 3, 13 AND 14 ARE TO BE 1200Ø PRECAST CONCRETE.
8. FOR LOCATION OF FOOTPATH, SIGN POSTS, GUIDE POSTS AND HANDRAIL REFER DRG No. 4269-C001.
9. A THICK LINE ON THE ROAD RESERVE BOUNDARY INDICATES A 0.1m, P.A.W.
10. CONTRACTOR WILL BE RESPONSIBLE TO MAINTAIN LIVE UNDERGROUND POWER, TELSTRA, GAS MAINS SEWER AND IRRIGATION MAINS AT ALL TIMES. ANY DAMAGE TO MAINS WILL BE AT CONTRACTOR'S EXPENSE.
11. CONTRACTOR TO ALLOW TO PROVIDE PROTECTION AND/OR REINSTATEMENT OF ADJACENT EXISTING WATER MAIN AND ROAD PAVEMENT, INCLUDING KERBING BETWEEN MANHOLE No's 18 AND 200. CONTRACTOR TO PROVIDE TRENCH SHORING AS REQUIRED.
12. CONTRACTOR TO ALLOW TO PROVIDE PROTECTION AND/OR REINSTATEMENT OF ADJACENT EXISTING SEWER BETWEEN MANHOLE No's 16 AND 17. CONTRACTOR TO PROVIDE TRENCH SHORING AS REQUIRED.
13. CONTRACTOR TO ALLOW TO PROVIDE SUPPORT TO EXISTING SEWER AT DRAINAGE CROSSING BETWEEN MANHOLE No's 200 AND 16.

LEGEND

- EXISTING PAVEMENT AND KERB
- PROPOSED PAVEMENT AND KERB
- FUTURE PAVEMENT AND KERB
- RED ASPHALT
- BRICK PAVING
- EXTEND BASECOURSE 5m. BEYOND ASPHALT AND KERB. CONSTRUCT 9m RADIUS LIMESTONE TURNAROUND AND INSTALL 4 No. ROAD GUIDE POSTS PAINTED WHITE AT 1.5m CENTRES.
- EXISTING DRAINAGE PIPE
- PROPOSED DRAINAGE PIPE
- FUTURE DRAINAGE PIPE
- PROPOSED SEWER PIPE & ACCESS CHAMBER
- EXISTING SEWER PIPE & ACCESS CHAMBER

29.85 / 300/23.4 / 32.3 / 28.47 — UPSTREAM INVERT, PIPE DIAMETER/GRADE, DISTANCE BETWEEN STRUCTURES, DOWNSTREAM INVERT

- GULLY WITH SOAKWELL BASE
- GULLY PIT
- INDUSTRIAL GULLY PIT
- SIDE ENTRY PIT
- DRAINAGE MANHOLE
- EXISTING / FUTURE MANHOLE
- EXISTING / FUTURE GULLY PIT
- (5) MANHOLE NUMBER
- (F5) GULLY PIT NUMBER

SW 26.04 / DR 26.53 — SEWER INVERT, STORMWATER INVERT

AS CONSTRUCTED

20 0 20 40 60 80 100m

SCALE 1:1000

Client: BURNS MANAGEMENT PTY. LTD.

Halpern Glick Maunsell

HGM
629 Newcastle Street, Leederville W.A. 6007
Ph. (08) 9281 6100
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11 Prinsep Street, Bunbury. 6230
Ph. (08) 9721 9676 Fax. (08) 9721 9611

HGM Proj. No.	CAD No.
CL4269X	4269C023

Project Engineer	A. GOWER
Design By	R. TAYLOR
Drawn By	
Project Name	KINROSS AT BURNS BEACH - STAGE 23A & B
Drawing Title	ROADS AND DRAINAGE AS CONSTRUCTED
99/054	
Scale	1:1000
Datum	AHD
Drawing No.	4269-C023
Dwg Size	A1
Rev.	0

DRAWING No. 4269-C051

NEERABUP NATIONAL PARK

refer to CALM for approval

FOR DETAILS OF PERIMETER FENCING AND GATES REFER TO DWG No. 4269-C082

20.0m WIDE WAWA RESERVE

EXTENT OF BATTER

1.5 BATTER (MAX)

EXISTING 11.57 900/200 14.8 11.50

EXISTING 11.57 750/200 17.8 11.50

PROPOSED CAPPED SUPER SIX FENCING PAINTED ON BOTH SIDES WITH BLOCK PIERS

5.0m WIDE PAW

LOCHY CLOSE

FUTURE PUMP STATION ASPHALT AREA

EXISTING SEWERAGE PUMP STATION SITE BASE R.L. 17.50

PROPOSED PUMP STATION GATE

FOR ACCESS LANE DETAILS REFER TO DWG No. 4269-C045

PROPOSED 1.83m HIGH SECURITY FENCING

CONSTRUCT SUMP OUTFALL STRUCTURE AND APRON. SEE CITY OF WANNEROO STANDARD DWG. No 498-3-4

CONSTRUCT SUMP OUTFALL STRUCTURE AND APRON. SEE CITY OF WANNEROO STANDARD DWG. No 498-3-4

1599 DRAINAGE SUMP BASE R.L. 11.50

CONSTRUCT BATTERS AT 1 IN 1.5 ALL AROUND

EXISTING BATTER TO BE BUILT UP AND TRIMMED TO SUIT DESIGN SURFACE

PROPOSED DRAINAGE SUMP GATE

4m WIDE ACCESS RAMP AT SLOPE OF 1 IN 4

BASE R.L. 11.80

EXISTING CAPPED SUPER SIX FENCING PAINTED ON BOTH SIDES WITH BLOCK PIERS

1595 18.26

1594 18.26

1593 19.02

1592 19.02

1591 19.02

1590 20.54

1589 20.54

1588 DX 20.54

1587 20.54

1586 20.92

1585 20.92

1584 21.30

1300

CLYDEBANK PLACE

MACNAUGHTON CRESCENT

CITY OF JOONDALUP
PLANS APPROVED SUBJECT TO ENDORSEMENTS THEREON AND TO STRICT ADHERANCE TO THE CONDITIONS LAID DOWN IN W.A. PLANNING COMMISSION APPROVAL (W.A.P.C. No. 104001) DATED 7/11/02 REGARDING ENGINEERING ASPECTS AS APPLICABLE.
MANAGER I.M.S.
DATE

SUMP BOUNDARY | 2.0 | ACCESS RAMP AT SLOPE OF 1 IN 4 | VARIES | 2.0

BATTER 1 IN 1.5 (TYP)

R.L. 17.20 MIN. TOP OF SUMP
R.L. 16.50 100 ARI (C. OF J. REQUIREMENT)
R.L. 14.30 10 ARI (C. OF J. REQUIREMENT)
R.L. 11.50 BASE OF SUMP

TYPICAL SECTION
NTS

	CITY OF WANNEROO REQUIREMENT		ACTUAL SUMP QUANTITY
	WATER LEVEL (R.L.)	QUANTITY	
SUMP AREA AT TWL	14.30	2730 m²	3000 m³
10 ARI STORM (10 HR. DURATION)	14.30	6800 m³	6800 m³
100 ARI STORM (24 HR DURATION)	16.50	14500 m²	14600 m³

IMPERMEABLE CONTRIBUTING AREA 114,006 m²

11600 (1320) = 15160 m² ?? Okanyway

99065

LEGEND
- EXISTING SEWER LINE
- PROPOSED & FUTURE DRAINAGE MANHOLE
- PROPOSED & FUTURE DRAINAGE LINE
- EXISTING RETAINING WALL

5 0 5 10 15 20 25m
SCALE 1:250

Rev.	Issue Description	Drn by	Chk'd	Proj. Eng.	Proj. Dir.	Date
0	ISSUED FOR APPROVAL AND TENDER					

Client: BURNS MANAGEMENT PTY. LTD.

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A.C.N. 009 396 516

HGM Proj. No.	CAD No.
CL4269N2	4269C051

Project Engineer
Designed by
Drawn
Project Director

Project Name: KINROSS AT BURNS BEACH - STAGE 24
Drawing Title: DRAINAGE SUMP DETAILS
Survey Information: WHELANS SURVEY AND MAPPING P/L

Scale	Dwg Size
1:250	A1
Datum: A.H.D.	
Drawing No. 4269-C051	Rev. 0
WAPC 104001/110874	

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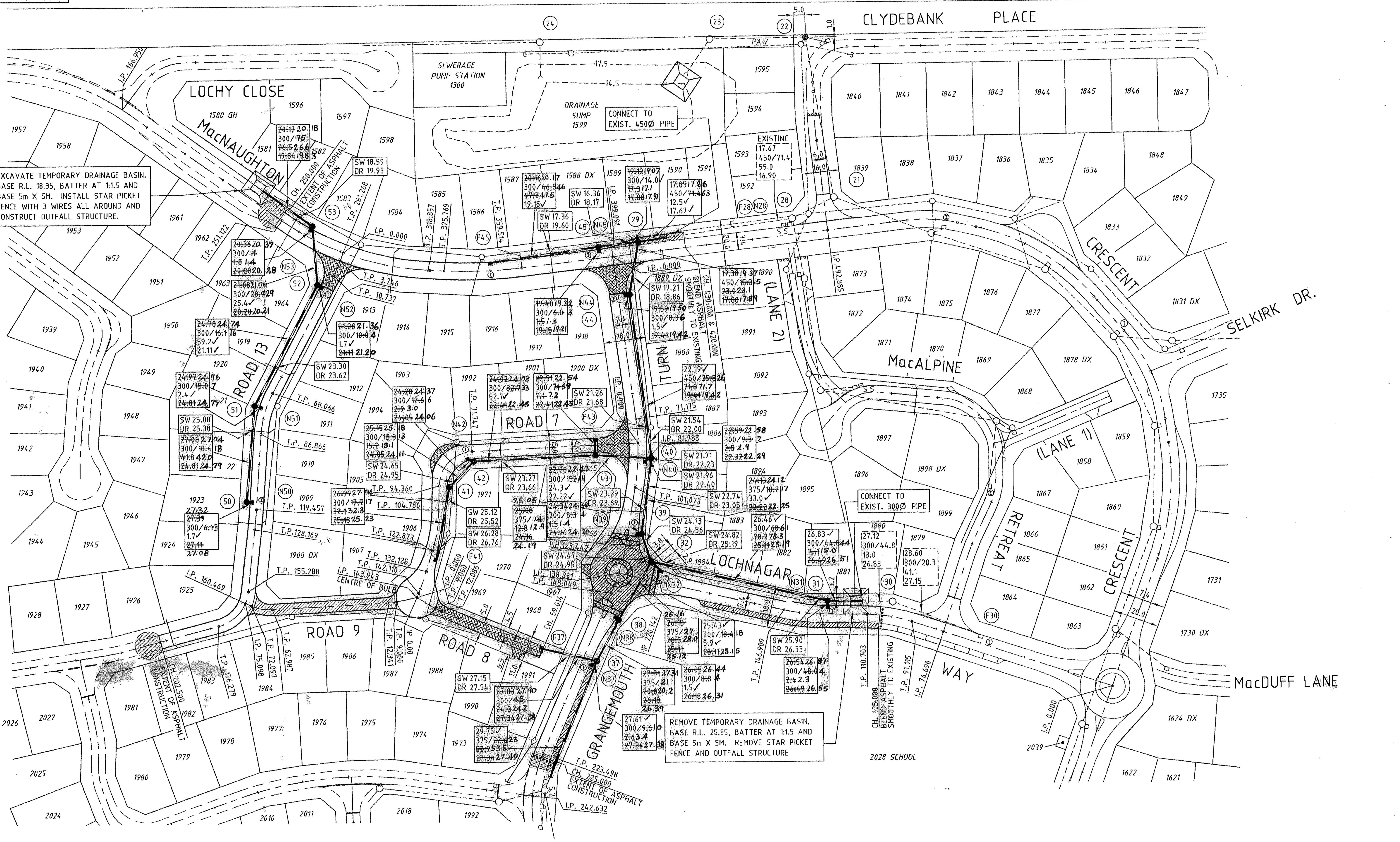
www.joondalup.wa.gov.au

Scale(A3):1:3000

Date: 12/05/2015

Lochy Close Sump Catchment



DRAWING No. 4269-C927

LEGEND

- EXISTING PAVEMENT AND KERB
- PROPOSED PAVEMENT AND KERB
- FUTURE PAVEMENT AND KERB
- RED ASPHALT
- BRICK PAVING
- EXTEND BASECOURSE 5m. BEYOND PAVEMENT AND KERB. INSTALL ROAD GUIDE POSTS PAINTED WHITE AT 1.5m CENTRES.
- EXISTING DRAINAGE PIPE
- PROPOSED DRAINAGE PIPE
- FUTURE DRAINAGE PIPE
- PROPOSED SEWER PIPE & ACCESS CHAMBER
- EXISTING SEWER PIPE & ACCESS CHAMBER
- 29.85 / 300/23.4 / 32.3 / 28.47 — UPSTREAM INVERT / PIPE DIAMETER/GRADE / DISTANCE BETWEEN STRUCTURES / DOWNSTREAM INVERT
- GULLY PIT
- INDUSTRIAL GULLY PIT
- SIDE ENTRY PIT
- DRAINAGE MANHOLE
- EXISTING / FUTURE MANHOLE
- EXISTING / FUTURE GULLY PIT
- (5) MANHOLE NUMBER
- (F5) GULLY PIT NUMBER
- SW 23.87 / DR 24.25 — SEWER INVERT / STORMWATER INVERT

'AS CONSTRUCTED'

NOTES

1. DRAINAGE LINES TO BE RCP CLASS 2 STORMWATER DRAINAGE PIPE. UNLESS OTHERWISE SHOWN.
2. ALL KERBING TO BE MOUNTABLE UNLESS OTHERWISE SHOWN. - SEE INTERSECTION DRAWINGS.
3. DRAINAGE MANHOLES TO BE ON 3.1m ALIGNMENT FROM FRONT BOUNDARIES UNLESS OTHERWISE SHOWN.
4. ALL JOINTS WITH EXISTING PAVING , NEW PAVING AND KERB TO BLEND SMOOTHLY.
5. MAXIMUM BATTER SLOPE TO BE 1:8 IN LOTS AND 1:6 IN P.O.S.
6. ALL GULLIES TO BE UNTRAPPED.
7. MANHOLE Nos. 32,37 AND 40 ARE TO BE 1200Ø PRECAST CONCRETE.
8. MANHOLE No. 29 IS TO HAVE A TRAFFICABLE GATIC COVER.
9. FOR LOCATION OF FOOTPATH, SIGN POSTS, GUIDE POSTS AND HANDRAIL REFER DRG No. CL4269-C921.
10. A THICK LINE ON THE ROAD RESERVE BOUNDARY INDICATES A 0.1m. P.A.W.

NOTE:

1. CONTRACTOR WILL BE RESPONSIBLE TO MAINTAIN LIVE UNDERGROUND POWER, TELSTRA, GAS MAINS SEWER AND IRRIGATION MAINS AT ALL TIMES. ANY DAMAGE TO MAINS WILL BE AT CONTRACTOR'S EXPENSE.

20 0 20 40 60 80 100m
SCALE 1:1000

As — constructed survey by
R. STEPHENSON (Licensed Surveyor)

Rev.	Issue Description	Drn by	Chk'd	Proj. Eng.	Proj. Dir.	Date
1	ISSUED FOR CONSTRUCTION					2/12/98
0	ISSUED FOR APPROVAL AND TENDER	R.J.T.	D.M.P.	L.C.D.	J.J.	29/10/98

Client: BURNS MANAGEMENT PTY. LTD.

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HGM Proj. No.	CAD No.
CL4269V	4269C927

Project Engineer: C. DUCASSE
Design By: N. CLEMENTS
Drawn By: S. CHOK
Project Director: J. JEFFREYS

Project Name: KINROSS AT BURNS BEACH - STAGE 21
Drawing Title: ROADS AND DRAINAGE DETAILED LAYOUT 98/064
Survey Information: WHELANS SURVEY & MAPPING P/L

Scale: 1:1000
Dwg Size: A1
Datum: AHD
Drawing No.: 4269-C927
Rev.: 1
MFP: 104001

APPENDIX D

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Integrated Science & Design

MODELLING ASSUMPTIONS

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MODELLING ASSUMPTIONS

LOT 9021 MACNAUGHTON CRESCENT, KINROSS LWMS

Project Number EP15-017

Prepared for Peet Ltd
October 2015

Document Control

DOC NAME	LOT 9021 MACNAUGHTON CRESCENT, KINROSS LWMS MODELLING ASSUMPTIONS				
DOC NO.	EP15-017(03)--005 AP				
REVISION	DATE	AUTHOR		REVIEWER	
1	June 2015	Amila Prasad	AP	Dave Coremans	DPC
	Issued as an Appendix to the LWMS				
A	October 2015	Amila Prasad	AP	Dave Coremans	DPC
	Issued as an Appendix to the LWMS				

1 Modelling Assumptions

XPSWMM hydrologic and hydraulic modelling software was used in order to calculate the surface water runoff volumes and peak flow rates from the Lot 9021 MacNaughton Crescent, Kinross Local Structure Plan (LSP) area (referred to as 'the site').

The hydrologic component of the software uses the Laurenson non-linear runoff-routing method to simulate runoff from design storm events. Key assumptions regarding the hydrologic model include:

- Runoff is proportional to slope, area, infiltration and percentage imperviousness of a catchment.
- Sub-catchment areas and slopes are determined from and bulk earthworks plans supplied by the project team.
- Infiltration rates and percentage imperviousness is based on experience with model preparation for similar soil conditions.

Runoff from each sub-catchment is routed through the catchment using the hydraulic component of XPSWMM. Assumptions associated with the hydraulic component of the model include:

- Virtual links (i.e. purely for model construction, not equivalent to flow paths onsite) between nodes within a sub-catchment are given the length of 10 m and slope of 5% to minimise the lag time of conveying the water from a sub-catchment node to a 'storage' node, a 'dummy intermediate' node or a conduit/link.
- Links between sub-catchment storages act as conveyance channels (e.g. sheet flow within roads in 100 year Average Recurrence Interval (ARI) event). These links are given lengths and slopes to represent site conditions and actual pathway lengths between catchments.
- Virtual links are designed with width of 5 m, roughness of 0.014 (Manning's 'n') and are trapezoidal in shape. This allows for easy conveyance and/or represents concrete pipes/road surfaces.
- No more than 5% of volume has been allowed to be ponded within 1 year 1 hour ARI storage nodes for events greater than the 1 year 1 hour ARI event.

2 Post Development Modelling

2.1 Post-development catchments

Post development catchments within the site were identified from the LSP provided by the project team and the expected earthworks levels of the site. Catchment boundaries are shown in Error! Reference source not found. with catchment parameters detailed in **Table 1**.

Table 1 Post-development catchment parameters

Sub-catchment	Area (ha)					
	Slope	Sub-catchment	Road reserve (Total)	Road pavement	Road verge	Lot
Ct1	0.010	1.743	0.468	0.187	0.281	1.275
Ct2	0.008	0.557	0.207	0.083	0.124	0.350
Total		2.299	0.675	0.270	0.405	1.625

2.2 Infiltration assumptions

An “initial loss - continual loss” infiltration model has been adopted to represent the post-development environment, with loss values chosen based on project team experience with similar development areas in Perth. Post-development land use characteristics are provided in **Table 2**.

Table 2 Post-development land use characteristics

Land type	Initial loss (mm)	Continual loss (mm/hr)	Manning’s number (n)
Road surface	1	0.1	0.014
Road verge	12.5	1	0.05

Other infiltration assumptions utilised in the post development model include:

- Lots have been assumed to fully retain the 100 year ARI event on lot.
- POS areas have been assumed to fully retain the 100 year ARI event.
- Road reserves have 40% bitumen and 60% verge.
- Road verge areas have assumed an impervious footpath, driveway crossovers and some parking bays. This is accounted for within the reduced initial loss for pervious ‘road verge’ shown in **Table 2**.
- There will be no infiltration on roads, pavements and driveways. There will however be some minor absorption storage loss; this is accounted for in the initial and continuing loss values.
- Bio-retention areas (BRAs) have been represented as 300 mm deep, square storage nodes with 1:3 side slopes.
- Flood storage areas (FSAs) have been represented as 500 mm deep, square storage nodes with 1:6 side slopes.
- Sub-surface storage areas have been represented as 1 m deep square storage nodes with vertical side slopes.

- All storage areas assume a 4 m/day infiltration rate in consideration of the underlying sandy soils. An additional 50% clogging factor has been applied to BRAs.
- Volumes leaving the system through evapotranspiration have been assumed to be negligible when compared to the total runoff volume and the comparatively short duration of the model run time. XPSWMM default evapotranspiration assumptions have therefore been used.

2.3 Critical duration analysis

A 5 year and 100 year ARI critical duration event analysis has been carried out using duration events varying from 10 minutes to 3 days. The 5 year ARI critical duration event analysis for Catchment 1 has been based on a peak discharge analysis, as shown in **Plate 1**. The Catchment 2 analysis has been based on a maximum storage volume analysis, as shown in **Plate 2**. The differing critical duration analysis has been informed by the outfall design requirements, discussed further in **Section 2.4**.

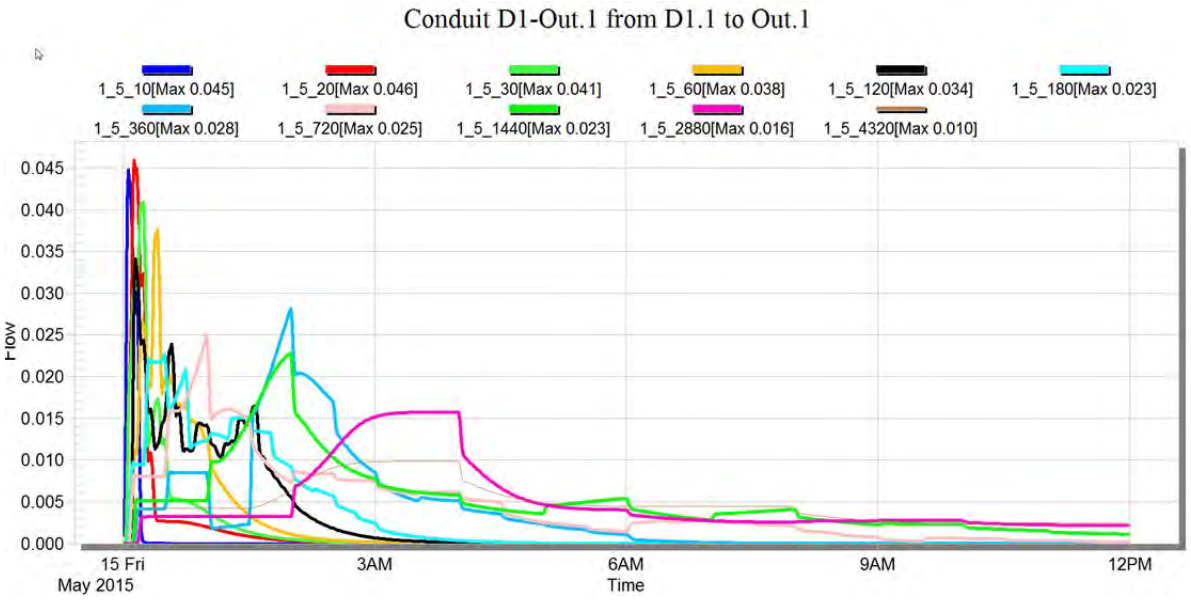

Plate 1 5 year ARI event critical duration event analysis for Catchment 1

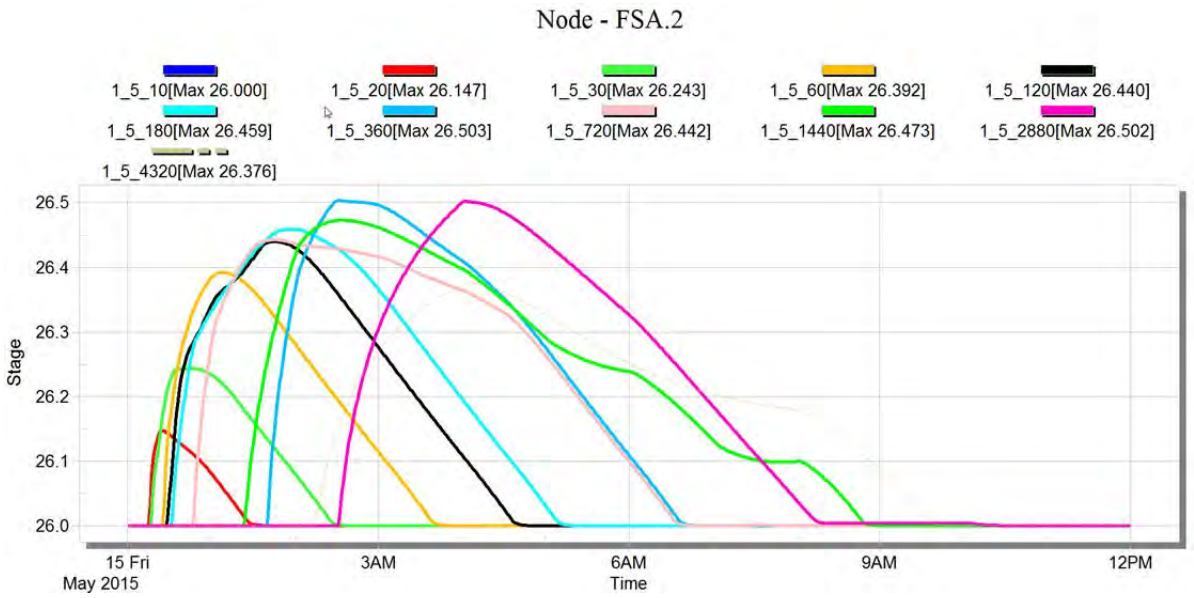

Plate 2 The 5 year ARI event critical duration event analysis for Catchment 2

Plate 1 and **Plate 2** show that the 5 year ARI critical duration event for Catchment 1 is 20 minutes and for Catchment 2 it is 6 hours. The 100 year ARI critical duration events for both catchments have been assumed to be 24 hours, consistent with design calculations used for the local existing drainage network into which the site drainage will connect.

2.4 Outflow criteria

The site is located within an existing drainage catchment that is serviced by a drainage sump located approximately 250 m north of the site, the details of which are provided in Appendix C of the *Lot 9021 MacNaughton Crescent, Kinross Local Water Management Strategy* (Emerge Associates 2015). The sump has been sized for the 100 year ARI 24 hour duration event from the contributing catchment with the connecting pipe network sized for the 5 year ARI event.

A connection has been provided to the existing drainage network at discharge point 1, shown in **Figure D 1**, to allow for flows up to the 5 year ARI event. Advice from the City of Joondalup (CoJ) has confirmed that flows equivalent to 67% of the capacity of a 300 mm pipe can be assumed at this location (Whithers G. [CoJ] 2015, pers. comm. 12 May). The allowable peak discharge from Catchment 1 therefore equates to 0.08 m^3/s, based on the diameter and length of connection pipe provided.

No connection has been provided at the discharge point from Catchment 2. Surface runoff from Catchment 2 will therefore be retained up to the 5 year ARI event. The 100 year ARI event flows will be conveyed to the drainage sump via the road pavement network.

The model results including peak flow rates leaving the site and resulting storage requirements are shown in **Figure D 1**.

FIGURES

Figure D 1: Stormwater management plan

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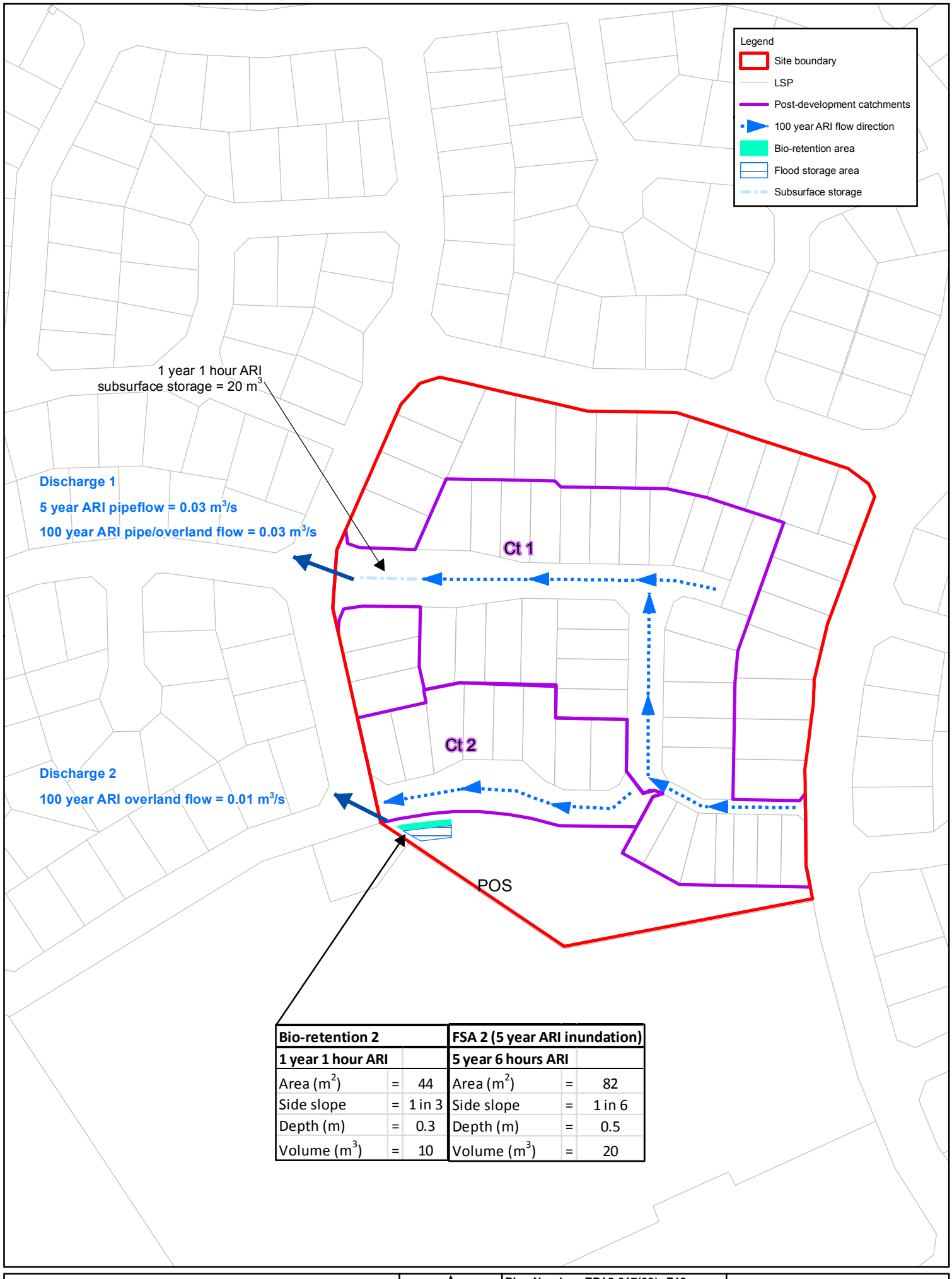

Bio-retention 2			FSA 2 (5 year ARI inundation)		
1 year 1 hour ARI			5 year 6 hours ARI		
Area (m^2)	=	44	Area (m^2)	=	82
Side slope	=	1 in 3	Side slope	=	1 in 6
Depth (m)	=	0.3	Depth (m)	=	0.5
Volume (m^3)	=	10	Volume (m^3)	=	20

Figure D1; Stormwater management plan

Project: Local Water Management Strategy
Lot 9021 MacNaughton Crescent Local Structure Plan

Client: Peet Limited

Plan Number: EP15-017(03)--F19

Drawn:	SMF	Date:	27/05/15
Approved:	DPC	Date:	27/05/15
Checked:	RLE	Scale:	1:2,000@A4

0 20 40 80 Metres

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APPENDIX E

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EARTHWORKS PLAN

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PEET

TABEC
Civil Engineering Consultants

PROJECT
Lot 9021 MacNaughton Crs Kinross

TITLE
Site Plan
Preliminary Contours - 9/7/2015

DRAWING NUMBER
S026-00-Sk01

ISSUE

1:2000 0 40 80 120

PEET

TABEC Civil Engineering Consultants

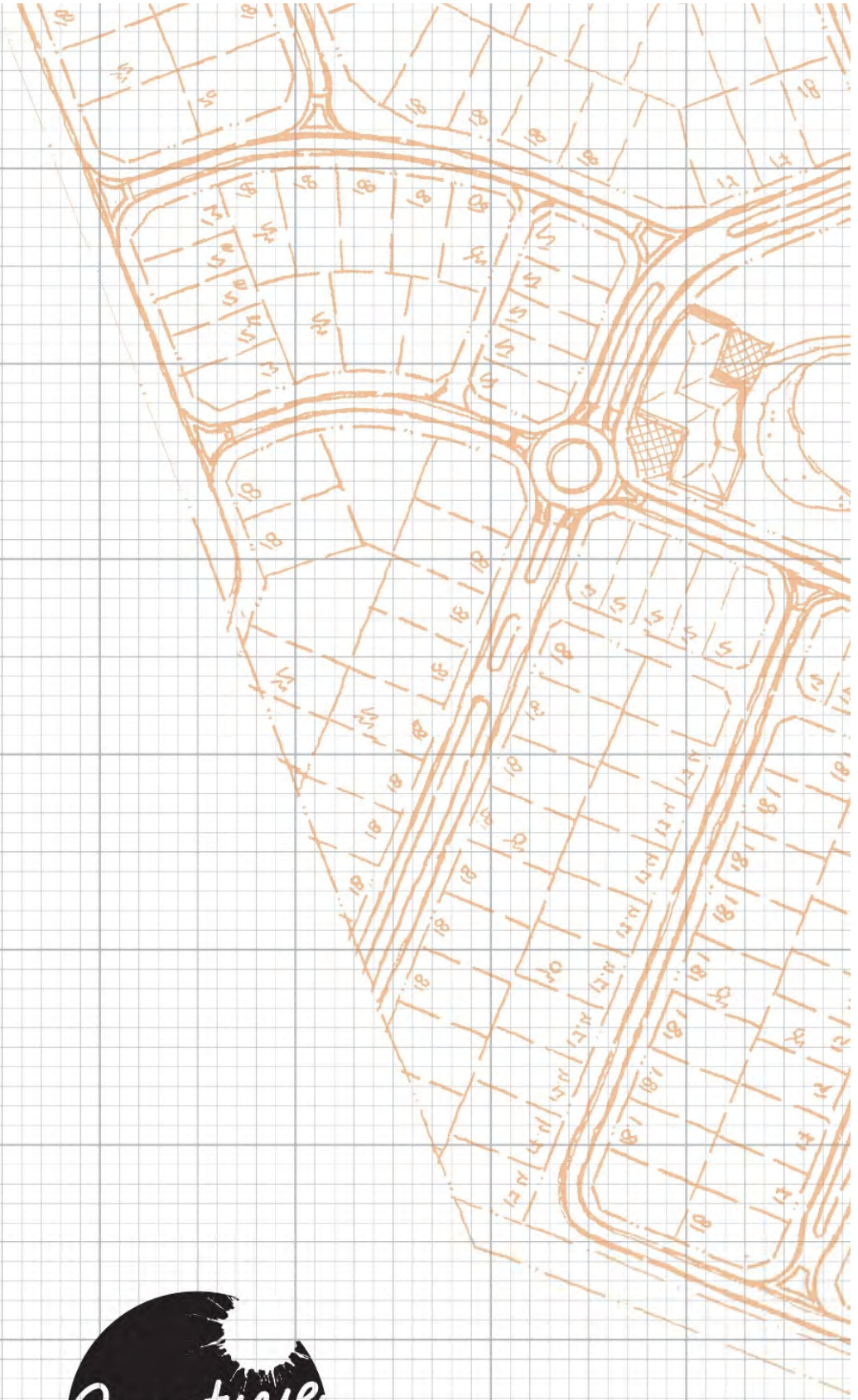
PROJECT Lot 9021 MacNaughton Crs Kinross

TITLE Site Plan
Wall Heights - 9/7/2015

DRAWING NUMBER S026-00-Sk01a

ISSUE

T:\Submissions\S026 150326 Lot 9021 MacNaughton Crs Kinross\Design\CAD\Drawings\Sketches\S026-00-Sk01 Preliminary Site Levels 150709.dwg 09/07/15 1:07:45 dgounson



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