Hammond Quarter Structure Plan

Lots 78, 80, 200, 803, 805, 813, 815 - 817, 1000, 1001, 9001 & 9002

Wattleup Road, Hammond Park

Prepared for

Qube Property Group and LWP Property Group on behalf of Primewest Pty Ltd

HATCH

Document Control	
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A	Draft for Client Review	TP	DW	15th July 2022
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C	Modify as per Council requests	TP	DW	18th November 2022
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G	Client Modifications	TP	DW	July 2024
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Endorsement Page

IT IS CERTIFIED THAT AMENDMENT NO. 1 TO HAMMOND QUARTER STRUCTURE PLAN WAS APPROVED BY RESOLUTION OF THE WESTERN AUSTRALIAN PLANNING COMMISSION ON:

25 AUGUST 2026

Signed for and on behalf of the Western Australian Planning Commission

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

Date of Expiry: 14 FEBRUARY 2034

Table of Amendments			
Amendment no.	Summary of amendment	Amendment Type	Date endorsed by WAPC
1	Addition of Lots 78, 80, 813 and 815 Wattleup Road, Hammond Park	Standard	25 AUGUST 2026

Table of Density Plans		
Density Plan no.	Area of density plan application	Date endorsed by WAPC
1		

Executive Summary

Part of the structure plan area is subject to two subdivision approvals granted by the Minister for Planning in 2020 (WAPC refs: 147987 and 148010). The purpose of this structure plan is to reflect the required conditions of the Ministerial approvals, and to integrate three homestead lots (Lots 200, 1000 and 1001), and Lot 78, 80, 803, 805, 813, 815, 816, 817, 9001, 9002 into a coordinated structure plan, which will round out development of the Hammond Park locality in the City of Cockburn.

Implementation of a Structure Plan over this 27.6786 hectare development site will provide a singular planning framework for the orderly development of the area as a co-ordinated precinct, including a design layout integrating the various multiple owners, R-Code densities and updated Structure Plan provisions as required by the site's 'Development' zoning under the City of Cockburn Town Planning Scheme No.3 (TPS3).

The Structure Plan accords with the planning objectives detailed in the Southern Suburbs District Structure Plan (Stage 3), which provides a high level development framework for the broader locality and assists in the delivery of strategic planning objectives set by the State Government and the City of Cockburn in relation to housing supply, affordability and urban development.

The Structure Plan provides for a range of residential densities and lot typologies, contributing towards the availability of diverse and affordable housing product within the South-West Sub-Region. It also includes an interconnected and legible movement network and generous provision of public open space within a number of strategically located reserves.

It is anticipated that the Structure Plan area will accommodate approximately 1,044 people in 435 dwellings on 435 lots at a density of 24.58 dwellings per residential site hectare.

The following Summary Table outlines the key planning outcomes of the Structure Plan.

Item	Data	Section number referenced within the structure plan report
Total area covered by the Structure Plan	27.6786 ha	Part 1, Section 1.0
Area of each land use proposed: **Residential** **Public Open Space**	 17.7 ha 3.4298 ha	Part 2, Section 3.0
Estimated lot yield	435 lots	Part 2, Section 3.3
Estimated number of dwellings	435 dwellings	Part 2, Section 3.3
Estimated residential site density	24.58 dwellings (per residential site hectare)	Part 2, Section 3.3
Estimated population	1,044 people	Part 2, Section 3.3
Estimated area and number: **Local parks**	 3 (3.4298ha)	 Part 2, Section 3.2

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Plan 4 Staging Plan

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Appendix no.	Document	Consultant	Referral / approval agency	Summary of modifications
A	Urban Water Management Plan	Environnivate / Hyd2o Hydrology	DWER	Addendum to include Lots 78, 80, 813 and 815 (Hydro2 Hydrology, 2024)
B	Engineering Report	Cossill & Webley		Addendum to include Lots 78, 80, 813 and 815 (C&W, 2024)
C	Landscape Masterplan	Plan-E		Addendum to include Lots 78, 80, 813 and 815 (Plan-E, 2024)
D	Bushfire Management Plan	MBS Environmental		Addendum to include Lots 78, 80, 813 and 815 (MBS Environmental, 2024)
E	Environmental Report	Emerge Associates		Addendum to include Lots 78, 80, 813 and 815 (Emerge Associates, 2024)
F	Transport Impact Assessment	Cardno / PTG Consultants		Addendum to include Lots 78, 80, 813 and 815 (PTG Consultants, 2024)
G	Transportation Noise Assessment	Lloyd George Acoustics		Addendum to include Lots 78, 80, 813 and 815 (Lloyd George Acoustics, 2024)

Part One: Implementation

1.0 Structure Plan Area

This Structure Plan (SP) applies to the land contained within the inner edge of the line denoting the SP boundary on the SP Map (Plan 1).

2.0 Operation

This SP shall come into operation on the date it is approved by the Western Australian Planning Commission (WAPC).

3.0 Staging

Staging of development will rely on key development parameters, primarily relating to:

1. The extension of available services from west to east.
2. The extraction of the sand resource at the eastern portion of the SP area in accordance with the engineering report.
3. The timing for the clearing of vegetation from adjacent lots and individual lots within the area relative to the staging of development will impact on the specified BAL ratings for future lots.
4. Construction of the proposed shared road with abutting Lot 115 may require agreement with the landowner to effect earthworks within the SP area. In the absence of agreement, if required, it is the WAPC's expectation that a minimum 4.3 metre wide road verge and a 6.0 metre wide trafficable pavement is provided within the SP area.

Indicative staging is shown in Plan 4 - Staging Plan

4.0 Subdivision and Development Requirements

4.1 Land Use Permissibility

Land Use permissibility within the SP area shall be in accordance with the SP Map (Plan 1) and corresponding Zones and Reserves under the City of Cockburn Town Planning Scheme No.3.

4.2 Notifications of Title

In respect of an application to subdivide the land within the SP area, the City of Cockburn may request the WAPC require a notification, pursuant to section 165 of the *Planning and Development Act 2005*, be placed on the certificate(s) of title of:

a) All lots:

"This lot is in close proximity to known mosquito breeding areas. The predominant mosquito species is known to carry viruses and other diseases."

b) All lots located within an area declared bushfire prone and subject to a bushfire attack risk level of 12.5 or more:

"This land is within a bushfire prone area as designated by an Order made by the Fire and Emergency Services Commissioner and is subject to a bushfire management plan. Additional planning and building requirements may apply."

c) All lots subject to transport noise levels which (according to a transport noise assessment) exceed the targets set out in the *State Planning Policy 5.4: Road and rail noise* and the associated guidelines:

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

d) All lots located within 500 metres of the Kwinana Industrial Area's (including air quality buffer), whether in whole or in part:

"This lot is located in close proximity to existing industrial development, freight routes and semi-rural activities and has the potential to be affected by transport noise, vibration and dust which may be associated with the ongoing operation of those nearby activities."

e) This lot is located within 300 metres of an operating market garden/s and has the potential to be affected by odours, noise, spray drift and dust that are associated with the continued operation of a market garden.

4.3 Restrictive Covenants

In respect of an application to subdivide the land within the SP area abutting Wattleup Road, the City of Cockburn may request the WAPC require notifications, pursuant to section 129BA of the *Transfer of Land Act 1893*, be placed on the certificate(s) of title advising of;

a) The existence of a restriction on the use of land abutting Wattleup Road and containing battering or significant retaining that will require a building exclusion zone:

"This lot contains retaining walls and/or battering to Wattleup Road. No habitable buildings or structures are to be built within any part of the retained earth battering area."

b) The existence of a restriction on the use of land within areas that been assessed as BAL-40 or BAL-Flame Zone. In accordance with the WAPC's Model subdivision Conditions Schedule, the restrictive covenant is to state:

"No habitable buildings are to be built within the areas identified as BAL-40 or BAL-Flame Zone."

4.4 Public Open Space

The provision of a minimum of 10% public open space is to be provided in accordance with *Liveable Neighbourhoods*. Public open space is to be provided generally in accordance with Plan 1.

Subdivision applications affecting land within the structure plan area should be supported by a public open space schedule prepared in accordance with *Liveable Neighbourhoods* requirements.

4.5 Movement Network

Access shall be provided generally in accordance with Local Road Reserves shown on the SP Map.

4.6 Contaminated Sites

A search of the Department of Water and Environmental Regulation Contaminated Sites Database identified no contaminated sites in the SP area.

Where any part of the site has been used as a market garden, and asbestos is found, a Site and Soil Contamination Assessment is required.

4.7 Wattleup Road

Portions of Wattleup Road have been upgraded and widened through the development of Land to the North of Wattleup Road. Where Wattleup Road has not already been widened, Wattleup Road requires upgrading to an urban standard, including to accommodate new local road intersections needed to provide access to local roads within the structure plan area. These works are to be carried out at the developer's cost. Where upgrades have already occurred, costs will be extended to development south of Wattleup Road via a claim under section 159 of the *Planning and Development Act 2005*.

The detailed design of intersections is to be finalised through the preparation of engineering drawings and specifications by the developer, and their approval by the City of Cockburn, as typically occurs through the subdivision process, in response to conditions of subdivision approval.

4.8 Rowley Road

Planning Control Area 190 (PCA 190) protects land required for the western extension of Rowley Road and abutting (not within) the southern boundary of the SP area. The development of linear public open space abutting PCA 190 will require consultation with the City of Cockburn and Main Roads WA to ensure earthworks are coordinated and agreed. It is noted that development within the Planning Control Area requires approval of the WAPC in accordance with Section 112 of the *Planning and Development Act 2005*.

4.9 Bushfire Risk

It is the responsibility of the landowner/applicant to demonstrate compliance with *State Planning Policy 3.7 Bushfire and associated Planning for Bushfire Guidelines* at each stage of subdivision. Additional information may be required when a lot is significantly affected by high levels of bushfire risk (that is, bushfire attack levels of 40 or flame zone) to demonstrate the lot can accommodate a dwelling in an area of suitably low bushfire risk.

Notifications on certificates of title will be used to advise purchasers of land affected by a bushfire attack level of 12.5 or more that the lot is located in a bushfire area, may be subject to a bushfire management plan and additional planning and building requirements may apply.

4.10 Market Gardens

The SP ensures an adequate separation distance from the market garden to the West in accordance with WAPC *State Planning Policy 2.5 Rural Planning*. Prospective purchasers of lots within 300 metres of an operating market garden will be advised with a notification on the certificate(s) of title.

4.11 Acid Sulphate Soils

A review of the Department of Water and Environmental Regulation ASS Risk Map for the South Metropolitan Region for potential acid sulphate soils (ASS) indicates the Site is classed as having a no risk of ASS potential within 3m, or deeper from the natural surface.

4.12 Earthworks

Substantial earthworks are required to achieve:

a) The necessary gradients to deliver a batter to Wattleup Road;

b) The necessary gradients to deliver the local road network;

c) Ensure that residential lots abutting Wattleup Road have a sufficiently developable area for a dwelling;

d) The linear public open space provides usable and irrigated public open space and is coordinated with PCA 190, which protects land required for the planned future western extension of Rowley Road.

Earthworks are to be carried out generally in accordance with the agreed Preliminary Earthworks plans at Appendix B and the Appendix B addendum to the SP. Substantial variations to this plan require further agreement between the City of Cockburn, impacted landowners, and the Water Corporation.

4.13 Residential Design Code Variations

The City of Cockburn 'Single House Standards for Medium Density Housing in the Development Zone' Local Planning Policy 1.16 sets out acceptable variations to the provisions of the R-Codes for lots coded R25-R60. Except in a situation where an approved LDP imposing R-Code variations applies, the standards set out in Local Planning Policy 1.16 apply to this SP.

4.14 Transport Noise

The site abuts a future freight corridor in Rowley Road. It is the responsibility of the landowner/ applicant to demonstrate compliance with *State Planning Policy 5.4 Road and Rail Noise* at each stage of subdivision, in relation to the proposed future Rowley Road extension.

A transport noise assessment is to be prepared and approved prior the commencement of subdivisional works, with satisfactory arrangements being made for the implementation of the approved plan.

Prospective purchasers of a lot deemed to be affected by transport noise will require a notification on the certificate(s) of title.

4.15 Lots Abutting Wattleup Road

Where a proposed subdivision includes lots which abut Wattleup Road:

a) Future applications to subdivide land abutting Wattleup Road should be accompanied by information indicating how the difference in ground level (between the road reserve and the developable portion of the lot) will be managed.

b) The City of Cockburn may recommend the WAPC require uniform fencing be provided abutting Wattleup Road, in accordance with City of Cockburn Local Planning Policy 5.7: Local fencing."

5.0 Residential Density

Residential densities applicable to the SP Area shall be those densities shown on the SP Map.

6.0 Local Development Plans

Local Development Plans (LDP) are required to be prepared and implemented pursuant to Part 6 of Schedule 2 of the *Planning and Development (Local Planning Schemes) Regulations 2015* for lots comprising one or more of the following site attributes:

a) Lots with an area of 260 square metres or less;

b) Lots abutting public open space;

c) Lots with laneway access;

d) Lots that propose grouped or multiple dwelling development;

e) Lots containing battering to Wattleup Road; and/or

f) Lots identified as being affected by transport noise from the proposed Rowley Road extension, as identified spatially in an approved Noise Management Plan. This includes a requirement for noise modelling for ground floor and two-storey development, as applicable."

Local Development Plans should address the following matters:

a) Vehicle access of lots accessed by a rear laneway;

b) Subject to the findings of a transport noise assessment, quiet house design and/or construction requirements;

c) Setbacks for lots containing an earthworks batter;

d) Fencing;

e) Passive surveillance;

f) Dwelling orientation;

g) Street setbacks and lot boundary setbacks.

7.0 Other Requirements

7.1 Developer Contributions

a) The SP area is subject to the requirements of Development Contribution Area 10 and Development Contribution Area 13 (Community Infrastructure).

b) The landowner/applicant shall make a pro-rata contribution towards the cost of acquiring land for a primary school site within the Hammond Park locality.

WAPC REVISED KWINANA INDUSTRIAL (INCLUDING AIR QUALITY) BUFFER RESIDENTIAL TRANSITION ZONE

FULL ACCESS

WATTLEUP ROAD

FULL ACCESS

WATTLEUP ROAD

CANARY DRIVE

CANARY PARK

MELBOU

BUILDING EXCLUSION ZONE

BUILDING EXCLUSION ZONE

POS 3
1755m²

POS 1
3744m²

1267m²

POS 2
27532m²

15m ROAD RESERVE

12.5m ROAD RESERVE

16.5m ROAD RESERVE

13m ROAD RESERVE

11.5m ROAD RESERVE

6m ROAD RESERVE

PROPOSED ROWLEY ROAD EXTENSION

KWINANA AIR QUALITY BUFFER

LEGEND

- Structure Plan Boundary
- Indicative Future Boundary
- Left-in/Left-out Only
- LDP Required

MOVEMENT NETWORK

- Access Street D (16.5m)
- Access Street D (15.0m)
- Access Street D (12.5m - 13.0m)
- Access Street D (11.5m)
- Laneway (6m)
- Footpath / Shared Path

YIELD

Residential Density

R20	31 Lots	
R30	395 Lots	
R40	9 Lots	
TOTAL	**435 Lots**	
Total Area:	**17.53 ha**	

Local Scheme Reserves

- Local Road Reserve
- Public Open Space

QUBE

primewest

CADASTRAL INFORMATION
SOURCE: LANDGATE
YYMMDD: 231027
DWG REF: LGATE-001
PROJECTION: PCG94

HATCH

SIZE A3_1:2000

0 metres 20 40 60 80 100

REV	DESCRIPTION	YYMMDD	DRAWN	APPR'D
L	UPDATES PER DPLH REQUEST	251106	RS	DW
K	ROAD WIDENING	241004	RS	TP
J	BOUNDARY EXTENSION	240515	RS/SB	TP
I	GRAPHICS MODIFICATION	240118	TG	FGH
H	ADD BUFFERS	231130	SB	TP
G	INDUSTRIAL BUFFER	231109	TD	TP
F	PER WAPC COMMENTS	231017	TD	TP

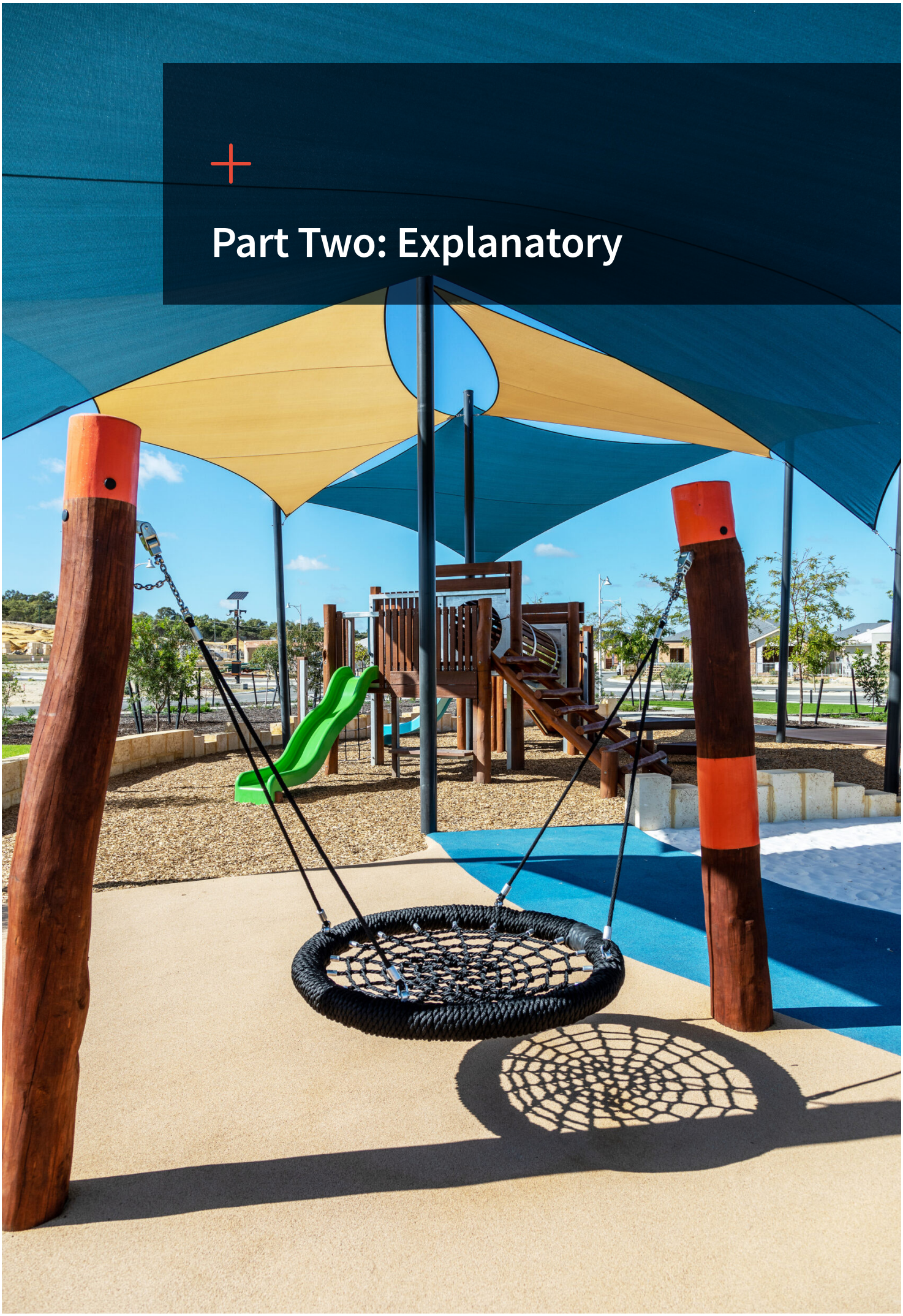
STRUCTURE PLAN
Hammond Quarter Structure Plan
City of Cockburn

JOB CODE	DRAW NO.	REV.
QUB WAT	**RD1 013**	**L**

DISCLAIMER: ISSUED FOR DESIGN INTENT ONLY. ALL AREAS AND DIMENSIONS ARE SUBJECT TO DETAIL DESIGN AND SURVEY

Plan 1 - Structure Plan

Part Two: Explanatory



1.0 Planning Background

1.1 Introduction and purpose

The Structure Plan (SP) (Amendment 1, July 2024) has been prepared by Hatch on behalf of Qube Property Group.

The purpose of the SP is to facilitate urban development of land within the SP area in accordance with the planning framework. The SP is prepared in accordance with the requirements and provisions of the *Planning and Development (Local Planning Schemes) Regulations 2015* and the Western Australian Planning Commission's SP Framework, with due consideration given to Clause 6.2 of City of Cockburn Town Planning Scheme No. 3.

Historically, two SP have been adopted by the City of Cockburn in 2008 but were not considered or endorsed by the WAPC:

- SP 27A over lots 809, 1000, 1001, 9002 and 9003 (formerly 121, 122 and 801); and
- SP 27B over lots 817 (formerly Lot 117), 200 (formerly Lot 801)and 9001 (formerly 17 and 805)

In November 2020, the Minister for Planning granted conditional approval to two subdivision applications (WAPC ref: 147987 and 148010) covering part (most) of the SP area. These are set to expire in 2026. To comply with the requirements of these approvals, the landowner prepared a 'concept plan' for the WAPC's consideration, and this has been considered and deemed acceptable for implementing changes required by these subdivision approvals. The concept plan was supported by a plan showing the indicative subdivision layout and a plan setting out anticipated residential density codes. It was anticipated that the concept plan would form the basis of any future structure planning. This SP represents the refinement of the Minister's decision, the concept plan and consultation with relevant agencies.

The approval of these subdivision applications superseded the Council endorsed SP layouts and this SP has been prepared in accordance with the agreement reached with the City of Cockburn during the assessment of the Concept Plan.

This SP ensures the facilitation of coordinated development through the consolidation of Council endorsed SP's 27A and 27B, allocation of density codes, the delivery of a co-ordinated POS network and the resolution of associated engineering and drainage matters.

In addition to the land subject to the Ministerial decision, Lots 78, 80, 801, 803, 805, 813, 815, 816, 817, 1000 & 1001 form the balance of the subject site. Lots 200, 1000 and 1001 are within the existing Council endorsed SP's 27A and 27B and Lot 805, now owned by Qube, has been included at the request of the City of Cockburn in accordance with the requirements of the SSDSP3 which identifies that future structure planning be undertaken over the subject lots.

The SP proposes the creation of approximately 435 residential lots, with a density of R20, R30 and R40. The SP design provides a diverse range of residential lot sizes and strategically located public open spaces, set within an interconnected road network that integrates the subject site with the surrounding locality. These design outcomes are informed by a range of technical reports and documentation prepared by a project team consisting of the following consultants:

Hatch - Town Planning and Design;
Environnivate and Hyde - Water Management;
Cossill & Webley - Engineering;
Cardno & PTG Consulting - Traffic;
MBS Environmental - Bushfire;
Emerge - Environmental Assessment; and
Plan E – Landscape Architecture.

1.2 Background

Lots 78, 80, 815, 805, 809, 1000, 9002, and 9003 Wattleup Road, Hammond Park comprise part of a larger group of Qube landholdings already under development in the Hammond Park locality. This wider landholding includes the lots subject to the Hammond Grove, and Hammond West SPs, which are located to the north of the SP area. Lots 817, 200 and 9001 Wattleup Road are owned by LWP Capital Pty Ltd. Homestead Lot 1001 and Lot 813 remain in private ownership.

Subdivision and development in Hammond Park, one of the last remaining large greenfield areas within the City of Cockburn, has been substantially progressed in recent years. To date, development in the locality has been undertaken in accordance with the Southern Suburbs District SP Stage 3 (SSDSP3), originally adopted in 2005. The SSDSP3 shows the broad land use framework for the locality, including major road network and neighbourhood structure, and forms the basis of co-ordinating and considering SPs.

1.2.1 Original Subdivision Applications

In May 2013, the Wattleup Road Development Company Pty Ltd lodged an application (WAPC Ref: 148010) with the Western Australian Planning Commission (WAPC) seeking approval under s. 135 of the PD Act to subdivide Lot 809, Lot 9002 and Lot 9003 Wattleup Road, Hammond Park

(which have a total area of 9.4749 hectares). The application proposes that these lots be subdivided into 147 residential lots, two public open space reserves (with a total area of 8,207 m2) and new local road reserves.

Also in May 2013, Primewest (Wattleup) Pty Ltd lodged an application (WAPC Ref: 147098) with the WAPC seeking approval under s. 135 of the PD Act to subdivide Lot 817 and Lot 9001 Wattleup Road, Hammond Park (which have a total area of 7.2974 hectares). The application proposes that these lots be subdivided into 93 residential lots, two public open space reserves (with a total area of 6,571 m2), new local road reserves and two balance lots - one (of 3,874 m2) containing the original homestead, the second (of 6,908 m2) containing land required for the western extension of Rowley Road.

Both these applications were subject to review under S.251 (1) of the *Planning and Development Act 2005* (P&D Act) by the State Administrative Tribunal (SAT).

Recognising the strategic importance of the subject lots, and taking the view that the applications raise issues of such State or regional importance that it would be appropriate for the application to be determined by the Minister, the then Minister for Planning called in the application to SAT under S.246 and S.247 of the P&D Act, whilst directing the SAT to hear the applications but, without determining them, refer them with recommendations to the Minister for determination.

The then Minister for Planning approved the applications (WAPC ref 147098 & 148010) in November 2020 with conditions. These approvals are valid until November 2026.

1.2.2 Concept Plan

Of significance to the preparation of this SP, Condition 3 of both approvals required the preparation of a Concept Plan.

The concept plan was deemed acceptable by the WAPC in May 2021. It was supported by an indicative subdivision plan and density plan. These additional plans demonstrated the intended lot yield and residential coding that is expected to be delivered.

The concept plan was expected to form the basis of a SP to be considered in due course and enable implementation of the approved subdivision applications.

1.3 Land description

1.3.1 Location

The SP area is situated within the locality of Hammond Park, which is located approximately 25 kilometres south of central Perth within the City of Cockburn. The SP area is bounded by Wattleup Road to the north, market gardens to the west, rural properties zoned for urban development to the east, to the south, land required for the planned future western extension of Rowley Road, which is protected by Planning Control Area 190 (PCA 190).

1.3.2 Area and Land Use

The SP area has a total area of 27.6786 hectares and comprises remnant vegetation, a number of dwellings, outbuildings and cleared areas. A large portion of the site has been historically cleared for market gardening and other rural uses and as a result only Lots 803 and 805 contain remnant vegetation.

Land south of the SP area and south of the planned future western extension of Rowley Road is located within the City of Kwinana is currently zoned for rural use and accommodates a range of activities such as sand mining, parking and storage, or contains bushland. The land is subject to the Mandogalup Improvement Scheme No.1 which was gazetted on 8 November 2024.

1.3.3 Legal Description and Ownership

The legal description of the subject land is provided in Table 1.

Table 1 - Legal Description of the subject land

Lot No.	Street Address	Ownership	Volume / Folio	Plan No.	Area (Ha)
78	361 Wattleup Road, Hammond Park	Qube Hammond Corner Pty Ltd	1289/655	P008190	2.673
817	415 Wattleup Rd, Hammond Park	Satterley Funds Management Pty Ltd	4022/93	P419760	3.3563
200	407 Wattleup Rd, Hammond Park	Satterley Funds Management Pty Ltd	2829/55	P400424	0.3873
80	343 Wattleup Rd, Hammond Park	Qube Hammond Corner Pty Ltd	1289/656	P008190	2.6735
803	Lot 803 Wattleup Rd, Hammond Park	Qube Wattleup Development Pty Ltd	4027/635	P419759	3.1269
805	Lot 805 Wattleup Rd, Hammond Park	Qube Hammond Quarter Pty Ltd	2917/419	P409853	3.1833
815	357 Wattleup Rd, Hammond Park	Qube Hammond Corner Pty Ltd	2954/191	PB413055	2.0408
816	Lot 816 Wattleup Rd, Hammond Park	Qube Wattleup Development Pty Ltd	44027/637	P419759	2.7281
813	365 Wattleup Rd, Hammond Park	Qube Hammond Corner Pty Ltd	2798/102	P073641	2.0414
1000	381 Wattleup Rd, Hammond Park	Qube Wattleup Development Pty Ltd	2801/395	P066290	0.4014
1001	427 Wattleup Rd, Hammond Park	Alfirevich, Dale Brian Alfirevich, Debra June	2774/94	P066291	0.2736
9001	Lot 9001 Wattleup Rd, Hammond Park	Satterley Funds Management Pty Ltd	2829/56	P400424	2.8592

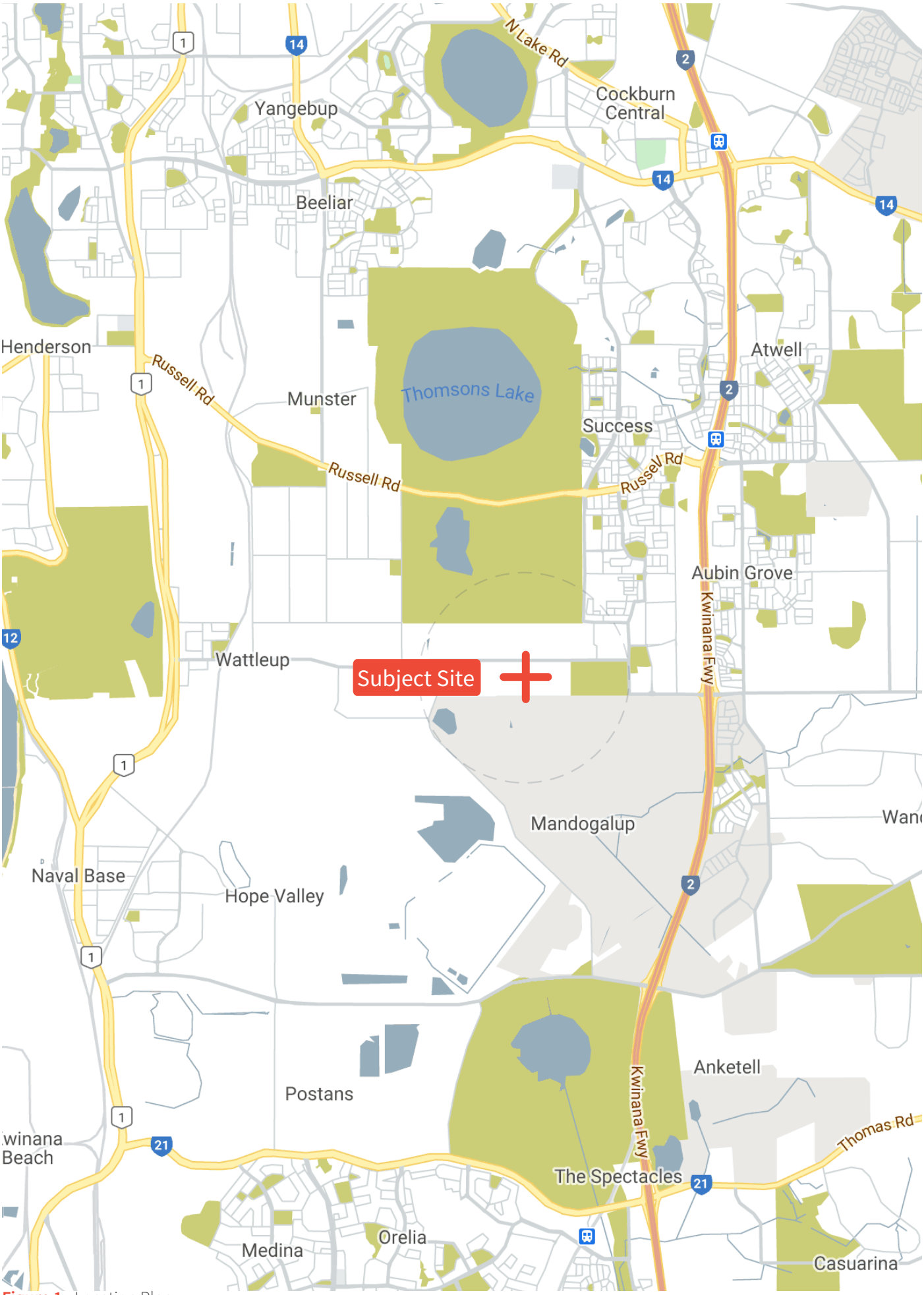


Figure 1 - Location Plan

The location of these lots is indicated in Figure 1.

1.4 Planning Framework

1.4.1 Planning Control Area 190.

Planning Control Area 190 (PCA 190) protects land required for the planned future upgrade and western extension of Rowley Road. The planning control area supersedes the zoning or reservation of the land in the regional and local planning schemes.

Refer Figure 2 - Planning Control Area 190 Map

1.4.2 Zoning and Reservations

1.4.2.1 Metropolitan Region Scheme

The SP area is zoned 'Urban' under the Metropolitan Region Scheme (MRS). The SP area abuts land zoned 'Urban' to the north and east; abuts land zoned 'Rural' to the west; and abuts land zoned 'Urban Deferred' to the south. Surrounding land to the east and west is generally zoned 'Urban'.

Refer Figure 3 - Metropolitan Region Scheme Map.

1.4.2.2 City of Cockburn Town Planning Scheme No. 3

The SP area is zoned 'Development' (Development Area 10) under the provisions of TPS3. Surrounding land is generally zoned 'Development' to the north, east and west, with a 'Parks and Recreation' local reserve to the east (Frankland Park).

Clause 4.2.1 of TPS3 states that the objective of the Development Zone is to provide for future residential, industrial and commercial development in accordance with a comprehensive SP prepared under the Scheme. As is required for land zoned 'Development' in TPS3, a SP is to be prepared prior to Council providing comment on subdivision applications and determining development applications.

Clause 15 (a) (ii) of Schedule 2 – Deemed Provisions for local planning schemes of the *Planning and Development (Local Planning Schemes) Regulations 2015* requires the preparation of a SP before any future subdivision or development is undertaken. The SP report has been prepared in accordance with the content and requirements outlined in clause 16 (1) of the Deemed provisions.

Refer Figure 4 - City of Cockburn Town Planning Scheme No. 3 Map.

1.4.3 Regional and sub-regional structure plans

1.4.3.1 Southern Suburbs District Structure Plan Stage 3

The SP area is subject to the provisions of the Southern Suburbs District SP Stage 3 (SSDSP3) prepared by the City of Cockburn. The SSDSP3 was adopted by the City of Cockburn Council in September of 2012.

The SSPDP3 provides a framework for urban land uses that integrates with the broader Sub-Regional context. SSDSP3 identifies the SP area as being subject to future structure planning. The provisions of the SSDSP3 also state that this future structure planning must provide an appropriate interface with residential development north of Wattleup Road.

The SP is consistent with the intent of the SSDSP3 in providing further structure planning over the SP area. Additionally, the SP is consistent with the SSDSP3 by ensuring future residential development does not directly abut the future Rowley Road through the provision of a 30m wide linear public open space along the south of the SP area.

Refer Figure 5 - Southern Suburbs District Structure Plan Stage 3 Map.

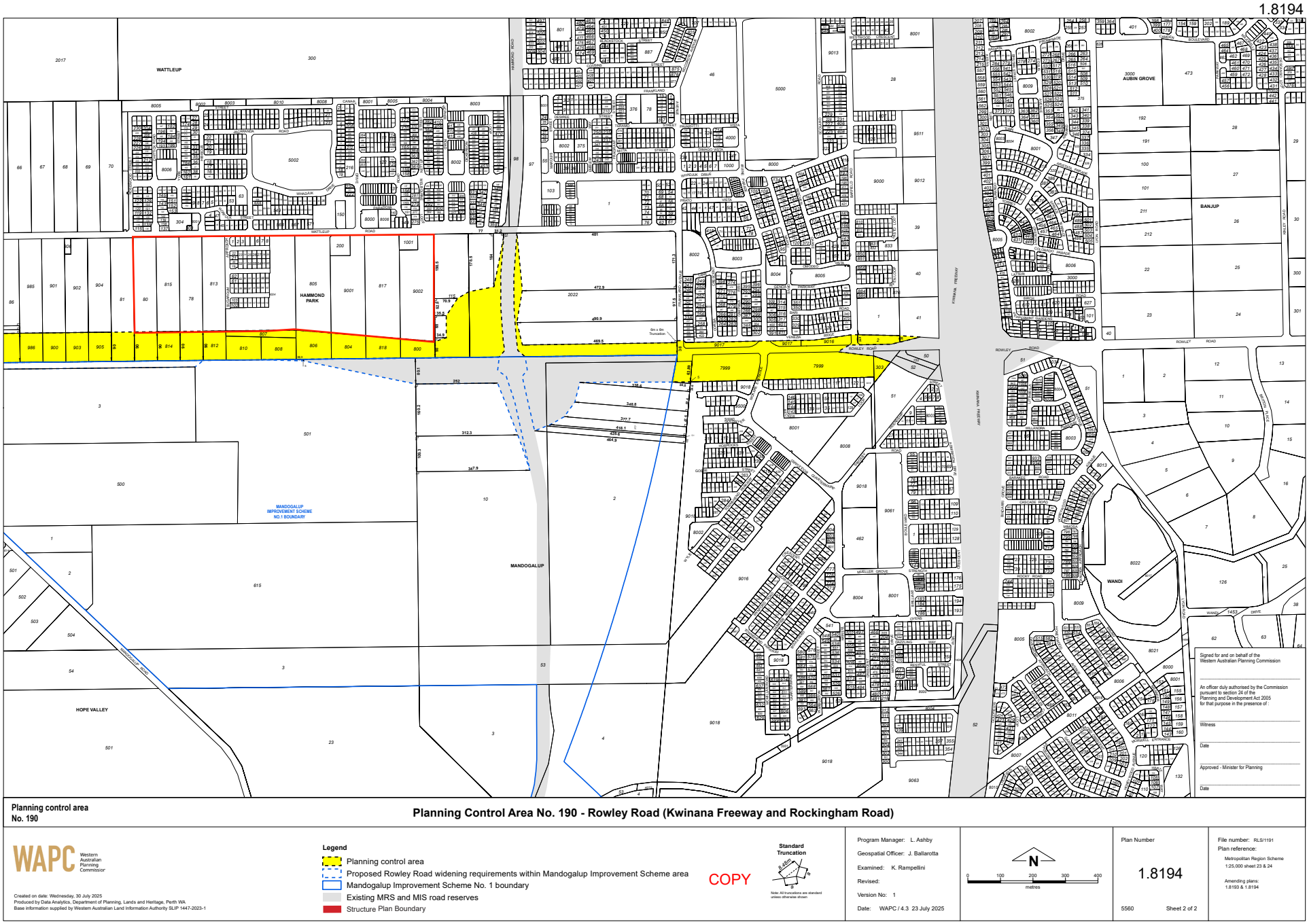


Figure 2 - Planning Control Area 190 Map

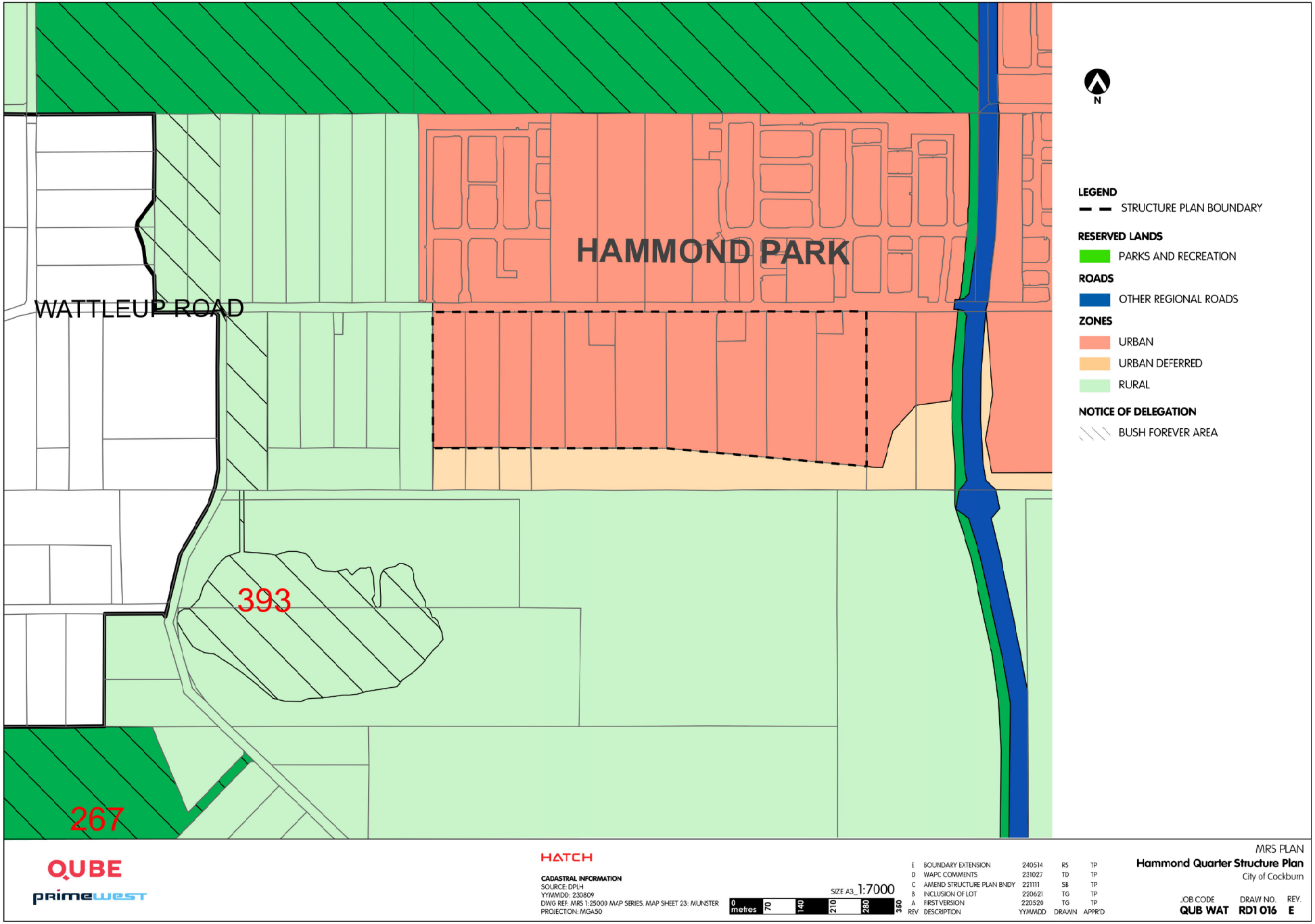


Figure 3 - Metropolitan Region Scheme Map

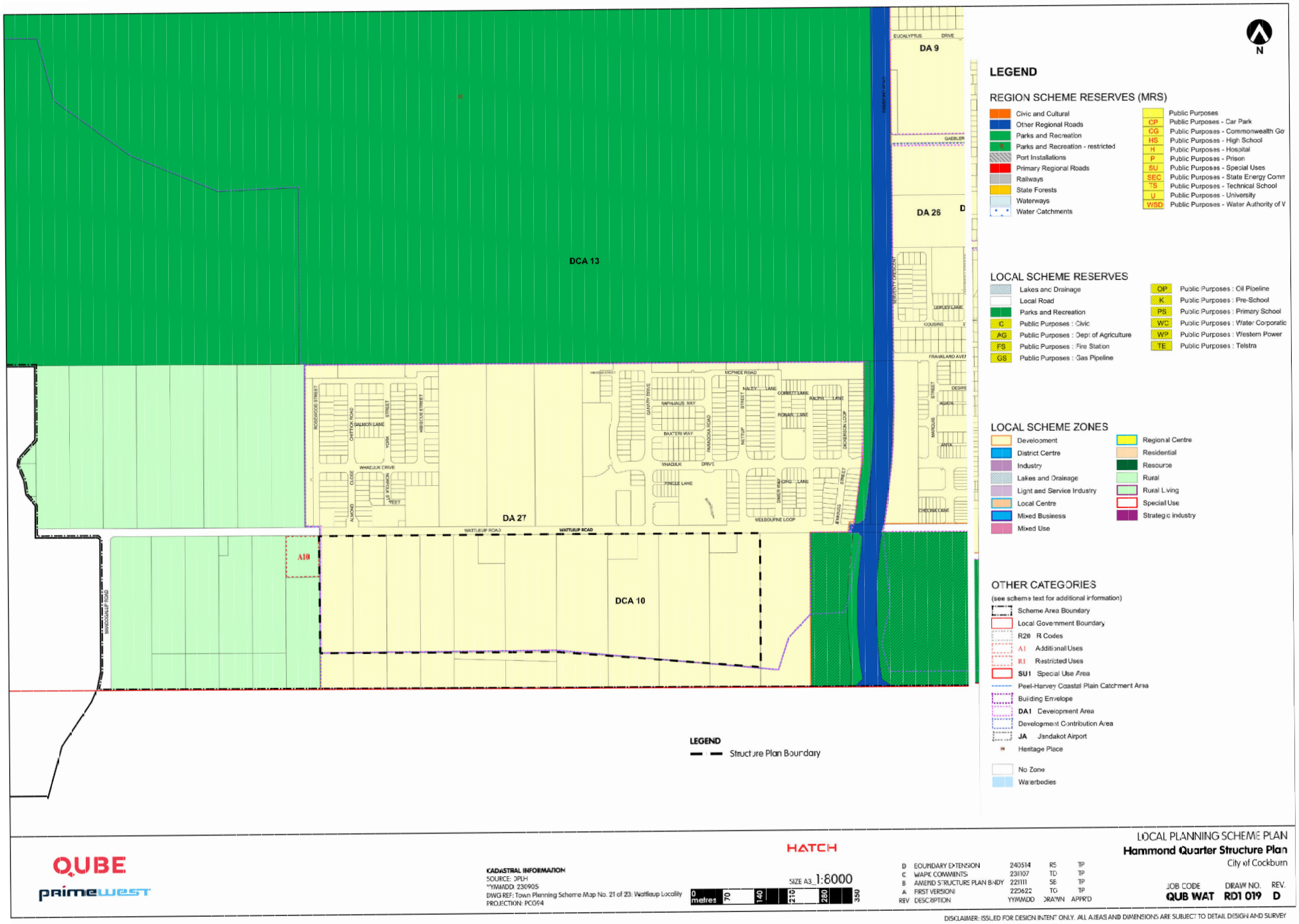


Figure 4 - City of Cockburn Town Planning Scheme No. 3 Map

1. FUTURE RESIDENTIAL DEVELOPMENT SHALL NOT DIRECTLY ABUT ROWLEY ROAD. FUTURE LOCAL STRUCTURE PLANNING IS TO DEMONSTRATE A SUITABLE INTERFACE TREATMENT (E.G. ENLARGED SERVICE ROAD DESIGN WITH FRONTING RESIDENTIAL DEVELOPMENT AS A MINIMUM) BEING PROVIDED TO THE FUTURE ROWLEY ROAD FREIGHT ACCESS ROUTE.

2. FUTURE ACCESS ROAD TO BE PROVIDED AS A FULL INTERSECTION UNTIL ROWLEY ROAD IS UPGRADED AND CONSTRUCTED TO A REGIONAL ROAD AT WHICH TIME THE INTERSECTION WILL BE CONVERTED AND MAINTAINED AS LEFT IN/LEFT OUT ACCESS ONLY. (SUBJECT TO MAIN ROADS WA APPROVAL).

3. AS PART OF THE UPGRADING OF ROWLEY ROAD, GRADE SEPARATED PEDESTRIAN AND VEHICULAR ACCESS IS TO BE PROVIDED AS A CONTINUATION OF BARFIELD ROAD, IN ORDER TO MAINTAIN CONNECTIVITY BETWEEN FUTURE DEVELOPMENT TO THE SOUTH OF ROWLEY ROAD.THIS MAY BE FURTHER RATIONALISED THROUGH SUBSEQUENT LOCAL STRUCTURE PLANNING TO DETERMINE HOW THIS SPECIFIC ACCESS IS CREATED.

4. FUTURE STRUCTURE PLANNING OF THE CELL SOUTH OF WATTLEUP ROAD MUST PROVIDE AN APPROPRIATE INTERFACE WITH RESIDENTIAL DEVELOPMENT NORTH OF WATTLEUP ROAD. THIS IS TO HAVE PARTICULAR REGARD TO THE POSITION OF THE WESTERN AUSTRALIAN PLANNING COMMISSION IN RESPECT OF ITS POSITION ON THE ACCEPTABILITY (OR OTHERWISE) OF RESIDENTIAL DEVELOPMENT SOUTH OF WATTLEUP ROAD, AND ALTERNATIVE (NON-RESIDENTIAL) LAND USES THAT MAY BE REQUIRED. ANY IMPACTS ASSOCIATED WITH THE FUTURE DEVELOPMENT OF NON-RESIDENTIAL LAND USES IN THE CELL SOUTH OF WATTLEUP ROAD MUST BE FULLY CONTAINED WITHIN THE CELL BOUNDARIES.

5. NEIGHBOURHOOD CENTRE-THE DESIGN AND FUNCTION OF THE PROPOSED NEIGHBOURHOOD CENTRE SHALL BE BASED ON 'MAIN STREET' PRINCIPLES AND RELEVANT PROVISIONS OF LIVEABLE NEIGHBOURHOODS. ANY ASSOCIATED LOCAL STRUCTURE PLAN MUST ADEQUATELY DEMONSTRATE THROUGH CONCEPT PLANS AND OR DETAILED AREA PLANS THE MANNER IN WHICH THE CENTRE ADDRESSES THE REQUIREMENTS OF THE RELEVANT SECTIONS OF THE SOUTHERN SUBURBS DISTRICT STRUCTURE PLAN - STAGE 3 REPORT, AND PARTICULARLY THE NEIGHBOURHOOD CENTRE CONCEPT PLAN PROVIDED WITHIN THE REPORT DOCUMENT.

6. NEIGHBOURHOOD NODES - THE DESIGN AND FUNCTIONALITY OF THE NEIGHBOUR- HOODNODES SHALL BE DISTINCTLY DIFFERENT TO THE PRIMACY OF THE NEIGHBOUR- HOOD CENTRE.THESE LOCATIONS ARE TO PROVIDE FOR ARANGE OF MORE LOCALLY FOCUSSED ACTIVITIES AND FUNCTIONS. WHERE RETAIL IS PROPOSED, THESE ARE TO NOT EXCEED A MAXIMUM RETAIL FUNCTION OF 300SQM, WITH SUCH FUNCTION BASED UPON A 'CONVENIENCE STORE' TYPE USE.

7. CENTRAL PRECINCT - A COMPREHENSIVE LOCAL STRUCTURE PLAN WILL BE REQUIRED FOR THE CENTRAL NEIGHBOURHOO DCENTRE AND ADJACENT DEVELOPMENT. THE CITY WILL NOT CONSIDER INDIVIDUAL STRUCTURE PLANS IN THIS LOCATION DUE TO THE NEED TO ENSURE THE SUITABLE INTEGRATION OF DEVELOPMENT.

GENERAL NOTES

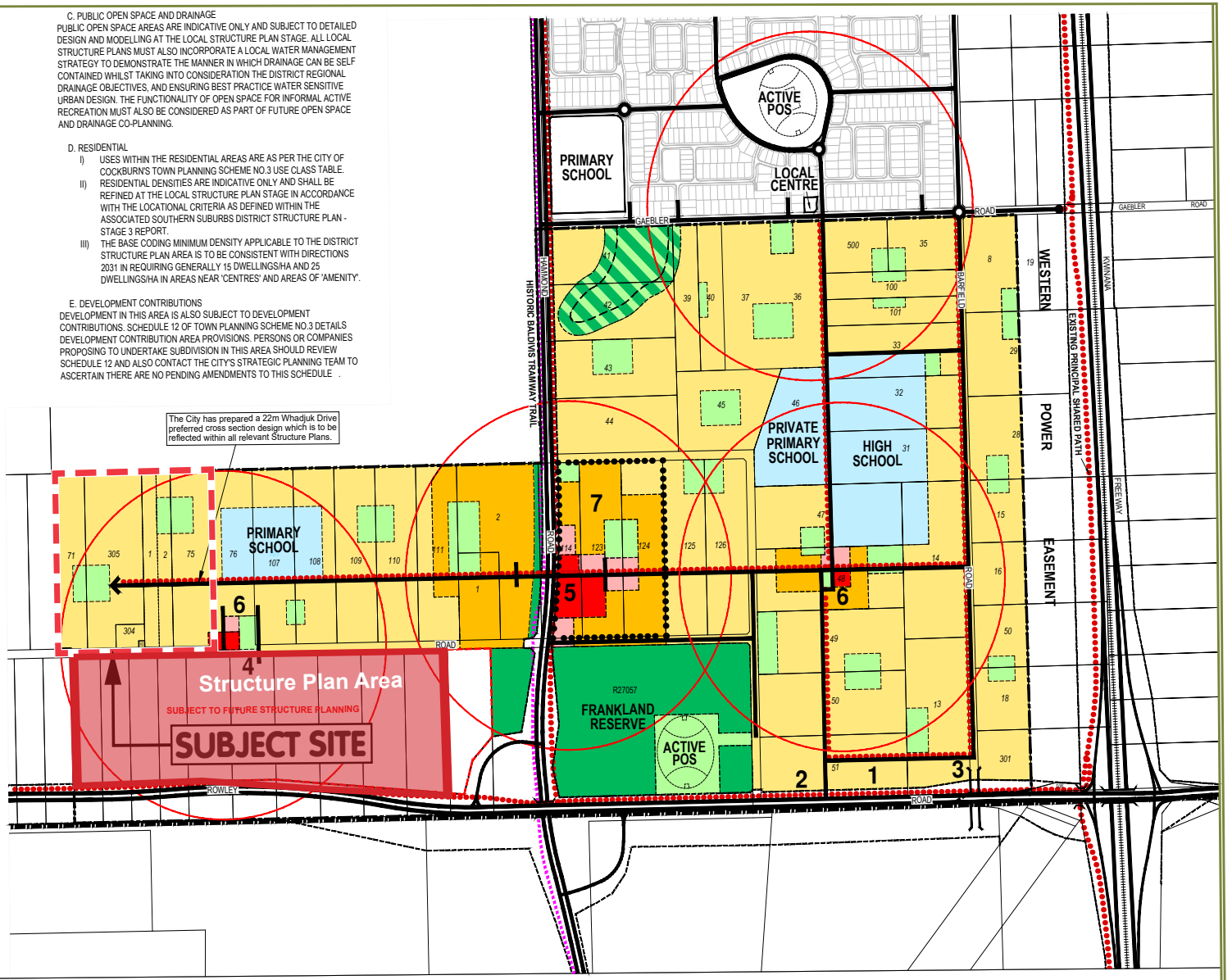
A. ALL LOCAL STRUCTURE PLANS MUST INCLUDE AND BE INFORMED BY:
- I) DETAILED LWMS BASED UPON REGIONAL DRAINAGE STUDY,
- II) DETAILED NOISE MANAGEMENT STRATEGY WHERE LSPAD JOINS ROWLEYROAD,
- III) FIRE MANAGEMENT PLAN WHERE LSP IS LOCATED NEAR ROS OR SIGNIFICANT POS,
- IV) FLORA AND FAUNA MANAGEMENT PLAN,
- V) TRAFFIC MANAGEMENT PLAN,
- VI) CONTAMINATED SITES & ACID SULPHATE SOILS MANAGEMENT PLAN WHERE REQUIRED,
- VII) HERITAGE STUDY WHERE LSP INCLUDES FORMER HISTORIC TRAMWAY,
- VIII) TRANSITION AND/OR INTERFACE STRATEGY IN RESPECT OF EXISTING RURAL USES.
- IX) NEIGHBOURHOOD CENTRE CONCEPT PLAN AND DETAILED AREA PLAN WHERE INCLUDED WITHIN LSP AREA,
- X) NEIGHBOURHOOD NODE CONCEPT PLAN AND DETAILED AREA PLAN.

B. LOCAL STRUCTURE PLANS
SUBDIVISION AND DEVELOPMENT OF THE SUBJECT AREA IS TO BE IN ACCORDANCE WITH AN ENDORSED APPLICABLE LOCAL STRUCTURE PLAN.

C. PUBLIC OPEN SPACE AND DRAINAGE
PUBLIC OPEN SPACE AREAS ARE INDICATIVE ONLY AND SUBJECT TO DETAILED DESIGN AND MODELLING AT THE LOCAL STRUCTURE PLAN STAGE. ALL LOCAL STRUCTURE PLANS MUST ALSO INCORPORATE A LOCAL WATER MANAGEMENT STRATEGY TO DEMONSTRATE THE MANNER IN WHICH DRAINAGE CAN BE SELF CONTAINED WHILST TAKING INTO CONSIDERATION THE DISTRICT REGIONAL DRAINAGE OBJECTIVES, AND ENSURING BEST PRACTICE WATER SENSITIVE URBAN DESIGN. THE FUNCTIONALITY OF OPEN SPACE FOR INFORMAL ACTIVE RECREATION MUST ALSO BE CONSIDERED AS PART OF FUTURE OPEN SPACE AND DRAINAGE CO-PLANNING.

D. RESIDENTIAL
- I) USES WITHIN THE RESIDENTIAL AREAS ARE AS PER THE CITY OF COCKBURN'S TOWN PLANNING SCHEME NO.3 USE CLASS TABLE.
- II) RESIDENTIAL DENSITIES ARE INDICATIVE ONLY AND SHALL BE REFINED AT THE LOCAL STRUCTURE PLAN STAGE IN ACCORDANCE WITH THE LOCATIONAL CRITERIA AS DEFINED WITHIN THE ASSOCIATED SOUTHERN SUBURBS DISTRICT STRUCTURE PLAN - STAGE 3 REPORT.
- III) THE BASE CODING MINIMUM DENSITY APPLICABLE TO THE DISTRICT STRUCTURE PLAN AREA IS TO BE CONSISTENT WITH DIRECTIONS 2031 IN REQUIRING GENERALLY 15 DWELLINGS/HA AND 25 DWELLINGS/HA IN AREAS NEAR 'CENTRES' AND AREAS OF 'AMENITY'.

E. DEVELOPMENT CONTRIBUTIONS
DEVELOPMENT IN THIS AREA IS ALSO SUBJECT TO DEVELOPMENT CONTRIBUTIONS. SCHEDULE 12 OF TOWN PLANNING SCHEME NO.3 DETAILS DEVELOPMENT CONTRIBUTION AREA PROVISIONS. PERSONS OR COMPANIES PROPOSING TO UNDERTAKE SUBDIVISION IN THIS AREA SHOULD REVIEW SCHEDULE 12 AND ALSO CONTACT THE CITY'S STRATEGIC PLANNING TEAM TO ASCERTAIN THERE ARE NO PENDING AMENDMENTS TO THIS SCHEDULE .



City of Cockburn — wetlands to waves

GNA 11/2015

0 200m
Scale

Residential Density
- High
- Medium

- Local Centre (Pedestrian Based Retail)
- Mixed Business/Commercial/ Home Based Business
- Community Facilities/ Schools etc
- Conservation Category Wetland* *In accordance with DEC Geomorphic Wetlands Swan Coastal Plain dataset

Key Open Space Areas:
- Public Open Space
- Regional Open Space

- Key Road Structure (Existing and Proposed)
- Major Shared Path
- Historic Baldivis Tramway Trail
- 400m Walkable Catchment
- Central Precinct

SOUTHERN SUBURBS DISTRICT STRUCTURE PLAN
- STAGE 3, HAMMOND PARK / WATTLEUP

Figure 5 - Southern Suburbs District Structure Plan Stage 3 Map

1.4.4 Strategic Planning

1.4.4.1 Directions 2031

Directions 2031 and Beyond (Directions 2031) is a high-level spatial framework and strategic plan for metropolitan Perth and Peel regions, providing a framework for the detailed planning and delivery of housing, infrastructure and services necessary for a variety of growth scenarios.

Directions 2031 identifies growth scenarios for low, medium and high-density rates of infill and greenfield development. The 'Connected City' medium density scenario, identified as the preferred growth scenario, was modeled to determine the area of greenfield land required to provide for a city of 3.5 million people. Consistent with the outcomes of this approach, *Directions 2031* sets a target of 15 dwellings per gross urban zoned hectare land in development areas.

Directions 2031 is supported by a series of draft Sub-Regional Strategies, which provide information about the levels of expected population growth in individual local government areas and identify development opportunities and prospects for increased density within Greenfield areas.

The SP area is included within the South-West Sub-Region identified within the Outer Metropolitan Sub-Regional Strategy for Perth and Peel (OMPPSS). The South-West Sub Region is expected to supply 119,760 dwellings under the adopted 'Connected City' scenario. 18,280 of these dwellings are expected to come from greenfield sites within the City of Cockburn.

The OMPPSS identifies the Southern Suburbs District SP area as 'urban zoned undeveloped' with an expectation to provide '3000+' dwellings. In proposing approximately 435 dwellings the SP provides for approximately 14.5% of expected dwellings in this location.

1.4.4.2 Perth and Peel @ 3.5 Million and South Metropolitan Peel Sub-Regional Planning Framework

Perth and Peel @ 3.5 million is a suite of strategic land use planning documents that provide a framework for accommodating 3.5 million people by 2050. The framework seeks to build upon the direction set by *Directions 2031* in delivering a more liveable, prosperous, connected, sustainable and collaborative city.

To achieve this, the framework establishes 7 overarching objectives:

- Delivering consolidated built from to provide for more efficient use of urban land and infrastructure and preserve environmental attributes;
- Promoting employment opportunities within strategic metropolitan centres to increase the number of people who live and work within the sub-regions;
- Providing a wide range of community and social infrastructure to enhance community health and wellbeing;
- Providing an efficient and effective regional movement network for people and freight that is integrated with land uses;
- Ensuring the timely and efficient delivery of servicing to growth areas;
- Preserving and enhancing the existing environmental and landscape values of the region, and;
- Managing the availability and use of natural resources in balance with broader environmental outcomes.

The framework establishes the context for four sub-regional planning frameworks which build upon the principles of *Directions 2031*. The SP area is included within the South Metropolitan Peel Sub-Regional Planning Framework Area (SMPSPF), which identifies the subject site as 'Urban'. The SMPSPF predicts a significant increase in population within the surrounding region, estimating that population will increase significantly from 523,406 in 2011 to 1.26 million in 2050, necessitating the provision of an additional 302,177 dwellings over this period. It is expected that the number of dwellings in the City of Cockburn will almost double, from 35,651 today to 65,770 by 2050. The proposed SP provides approximately 435 dwellings, contributing to the required additional dwellings in the City of Cockburn.

Refer Figure 6 - South Metropolitan Peel Sub-Regional Planning Framework Plan.

1.4.4.3 Liveable Neighbourhoods

Liveable Neighbourhoods, Edition 3 (LN 3) is a Western Australian Planning Commission (WAPC) operational policy used to guide the design and assessment of SPs and subdivision and development applications in greenfield areas. Its aims include promoting the design of walkable neighbourhoods; places that support community and a sense of place; mixed uses and active streets; accessible and sustainable parks; energy efficient design, and; housing diversity.

The key initiatives of LN 3 are covered under eight design elements. The implementation of these elements and the overall principles of LN 3 will be fundamental to ensuring that development of the SP area and the wider metropolitan region occurs in an appropriate manner. Application of the LN 3 principles is therefore relevant to all levels of planning for the site from the proposed SP through to detailed lot and building design.

By providing for a diverse range of housing within a

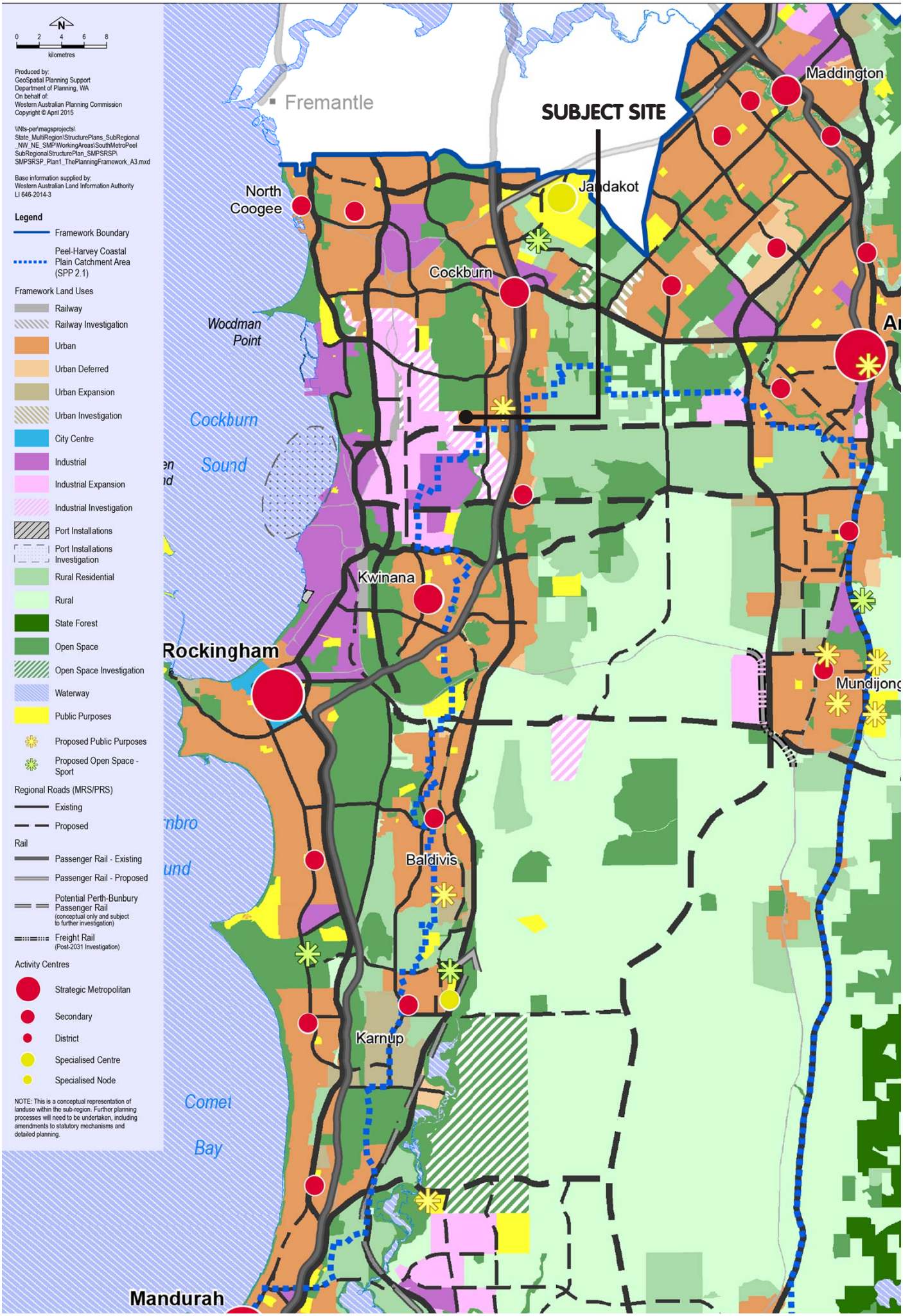


Figure 6 - South Metropolitan Peel Sub-Regional Planning Framework Plan

connected and walkable neighbourhood, structured around a sequence of high quality public open spaces, the SP reflects these requirements. A comprehensive justification of the design in relation to the principles outlined in LN 3 is provided in Section 3.0.

1.4.4.4 City of Cockburn Local Planning Strategy

The City of Cockburn Local Planning Strategy was endorsed by the WAPC on 28 October 2024.

The SP is consistent with the following core principles established in the City of Cockburn Local Planning Strategy (LPS):

- Ensure there is an appropriate housing and density mix to fulfill existing and potential demand from various groups;
- Promote medium and high density housing in and near regional and district centres and near public transport facilities;
- Provide a range of housing opportunities; and
- Promote mixed land uses in communities, especially through the location of housing in commercial centres.

The strategy notes that housing and population growth in the medium term will be strongly focused on greenfield areas (such as the SP area).

1.4.5 Planning Policies

1.4.5.1 State Planning Policy No. 1: State Planning Framework

State Planning Policy No.1: State Planning Framework (SPP1) unites existing state and regional policies, strategies and statements under a central framework to provide a context for decision-making on land use planning and development matters in Western Australia. The SP is consistent with the primary aim of this overarching policy, which can be summarised as "…to provide for the sustainable use and development of land." The WAPC and local government will refer to the relevant planning instruments referred to under SPP1 for all planning decisions, including those concerning the SP and subsequent planning proposals presented for the site.

1.4.5.2 State Planning Policy 3: Urban Growth and Settlement

State Planning Policy 3: Urban Growth and Settlement (SPP3) seeks to promote sustainable and well-planned settlement patterns that have regard to community needs and are responsive to environmental conditions. The objectives and principles of *Directions 2031* and Liveable Neighbourhoods are reflected in this Policy.

SPP3 recognises that a majority of greenfield development in the metropolitan region has been in the form of low-density suburban growth, to the detriment of land, water and raw material resource availability, infrastructure and servicing costs, transportation availability and efficiency and socioeconomic equality.

To promote sustainable, equitable and liveable urban growth, SPP3 encourages a more consolidated urban form. The SP area is generally consistent with the high level principles of SPP3 in facilitating a high quality, cohesive and walkable community with a diversity of housing and lot types.

1.4.5.3 State Planning Policy 7.3 – Volume 1 – Residential Design Codes

State Planning Policy 7.3 - Volume 1 - Residential Design Codes (R-Codes) is the basis for the control of residential development throughout Western Australia, providing a framework for controlling development intensity within residential zones through the application of R-Code densities on local planning scheme maps. The R-Code density primarily controls the allowable average and minimum lot size, with built form performance standards and 'deemed-to-comply' examples, specific to the stipulated density, outlined within Part 5 & 6 of the R-Codes.

1.4.5.4 State Planning Policy 3.7 Bushfire and associated Planning for Bushfire Guidelines

State Planning Policy 3.7 Bushfire directs how land use should address bushfire risk management in Western Australia. It establishes a framework to guide the implementation of effective risk-based land use planning and development to preserve life and reduce the impact of bushfire on property and infrastructure.

SPP3.7 applies to all land which has been designated as bushfire prone by the Department of Fire and Emergency Services (DFES) Commissioner, such as the SP area. It impacts upon all higher order strategic planning tools and parts of SPs, Subdivision and Development Applications.

The SP accords with the requirements of the SPP as detailed by the Bushfire Management Plan prepared for the SP area found in Appendix D of this report.

1.4.5.5 State Planning Policy 2.4 : Planning for Basic Raw Materials

State Planning Policy 2.4: Planning for Basic Raw Materials (SPP2.4) aims to ensure basic raw materials (BRM) and extractive industries matters are considered during planning and development decision-making, to facilitate the responsible extraction and use of the State's BRM resources.

Sand resources to the south are currently being extracted from landholdings within the IP47 area. The existing resource is nearing exhaustion, and extraction is moving in a southerly direction, away from the SP area. The approved subdivisions (and future subdivision within the SP area) have resulted in a separation distance of at least approximately 480 metres from current extraction areas, consistent with the requirements of SPP 2.4.

1.4.5.6 State Planning Policy 2.5 : Rural Planning

State Planning Policy 2.5: Rural Planning aims to protect and preserve rural land assets, and ensure broad compatibility between urban and rural land uses.

Land within the vicinity of the SP is zoned rural under the City's LPS, and areas of the SP have historically been used for rural pursuits.

1.4.5.7 State Planning Policy 3.6 : Infrastructure Contributions

State Planning Policy 3.6 : Infrastructure Contributions and associated guidelines coordinate and provide for contributions to community infrastructure required from new development.

The SP area is subject to the requirements of Development Contribution Area 10 and Development Contribution Area 13 (Community Infrastructure) as per Part One, Section 7.1.

1.4.5.8 State Planning Policy 4.1: Industrial Interface

Gazetted on 8 November 2024, the approved Mandoglup Improvement Scheme No.1 land use scenario discussed in section 2.6.2 of this report provides for an appropriate transition of land uses as advocated by *State Planning Policy 4.1: Industrial Interface*, by providing for low-intensity general industry land uses between Alcoa and the SP area and reasonable separation between the general industrial area and nearby residential land uses so far as practical and possible.

1.4.5.9 State Planning Policy 5.4: Road and Rail Noise

The SP area abuts land set aside for the future Rowley Road, which is intended to be a major freight route. As such, a Transport Noise Assessment (TNA) has been provided in Appendix G. This TNA has been prepared with consultation with Main Roads, the DPLH and City of Cockburn, and recommends measures to satisfy the requirements of SPP 5.4.

1.4.5.10 Government Sewerage Policy 2009

The Policy intent is for reticulated sewerage to be provided during the subdivision and development of land. The SP satisfies the Policy in proposing reticulated sewer servicing the site, as per the Engineering Report in Appendix B.

The Water Corporation has advised that the existing water reticulation system is able to service lots up to RL 38m AHD. This will dictate the highest lot levels across the development which will require lots along the eastern end of the development to be cut down substantially (up to 6 metres).

1.4.5.11 WAPC Development Control Policy 2.3: Public Open Space in Residential Areas

Development Control Policy 2.3: Public Open Space in Residential Areas aims to ensure residential development is provided with adequate and well-located areas of public open space to provide for the needs of local residents.

The SP satisfies the requirements and intent of DC Policy 2.3, and *Liveable Neighbourhoods* in providing for a minimum of 10% of the developable area as public open space. This compliments the surrounding network of district and local open space.

1.4.5.12 WAPC Operational Policy 2.4: Planning for School Sites

The Policy establishes a methodology for contributions for government primary schools which is transparent and equitable, and clearly articulates where subdividers/ landowners are required to cede land (free of cost), or payment of a pro-rata contribution, or both.

Feedback has been sought from the Department of Education who have confirmed the SP area, including Amendment 1, is included in the catchment of the primary school located in the Hammond West SP area to the north of Wattleup Road (Jilbup Primary School). As per Part One, Section 7.1 of this report, the landowner is required to provide pro-rata contributions to the primary school.

1.4.6 Local Planning Policies

The City of Cockburn's Local Planning Policies are, where relevant, to be addressed and considered through the subdivision and detailed design stages.

1.4.7 Other approvals and decisions

Several Council endorsed and proposed SPs are in place across the Hammond Park locality, which outline the direction of future urban development surrounding the SP area, in line with the objectives of SSDSP3. The SP area is located on the southern side of Wattleup Road, opposite land subject to the Quenda SP over Lots 107, 150 and 9150 Wattleup Road, the Hammond Park West SP over Lots 71, 74-75, and 303-305 Wattleup Road lots 109 & 110 Wattleup Road, Hammond Park and a Structure Pan over Lots 1, 111 & 810 Wattleup Road.

As stated in the SSDSP3, the proposed SP has considered the interface to residential development on these sites through the location of key intersections and consideration of connections over Wattleup Road.

1.4.8 Pre-Lodgement Consultation

A summary of pre-lodgement consultation is provided in Table 2 below.

Table 2 - Pre-Lodgement Consultation

Agency	Date of Consultation	Method of Consultation	Outcome
Department of Planning, Lands and Heritage	November 2020 to May 2021. May 2024.	Correspondence and Meetings	Agreement on the Concept Plan and WAPC approval of the Plan of Subdivision and Density Site Plan in accordance with the terms of the Ministerial Appeal determination. Feedback on LSP layout requirements for westerly extension, including POS network and interface requirements.
City of Cockburn (Planning)	November 2020 to current - various and ongoing (including May 2024)	Correspondence and Meetings	Agreement on POS concept design and LSP Concept Plan. Pre-lodgement briefing in relation to DPLH requirements and landowner intentions for westerly extension.
City of Cockburn (Engineering)	November 2020 to current - various and ongoing	Correspondence and Meetings	Agreement on Earthworks and drainage concept.
City of Cockburn (Parks)	November 2020 to current - various and ongoing	Correspondence and Meetings	Agreement on POS Concept Design & Draft LSP Design.
Main Roads WA	May 2021 to current – various and ongoing	Correspondence and Meetings	Interface with Rowley Road extension.
Department of Education	2021	Correspondence	Confirmation of Jilbup Primary School catchment can accomodate additional lots proposed in Amendment 1.

2.0 Site conditions and constraints

2.1 Biodiversity and natural area assets

Amendment 1 (July 2024): Environmental reporting has been updated to incorporate additional lots 78, 80, 813 and 815 (Emerge Associates, 2024).

All lots within the subject site, apart from Lot 803 and 805, have been cleared of native vegetation, consistent with the site's development for semi-rural and agricultural uses.

Lot 805 contains a number of trees. These are unable to be retained through the development process due to the significant changes in topography across the site, required to deliver a reticulated potable water supply to residential lots within the SP area.

Lot 803 was previously identified as containing native vegetation. Approval has been granted by the Commonwealth Department of Climate Change, Energy, Water and Environment under the EPBC Act for the clearing of 3.03 hectares of land on Lot 803 Wattleup Road.

Approval to clear the land was subseqently granted under the State *Environmental Protection Act 1986*. Approval was granted by the Department of Water, Agriculture and the Environment in accordance with the Preliminary Documentation Report prepared by Emerge Associates. This is found in Appendix E.

2.2 Topography, landform and soils

Amendment 1 (July 2024): Site landform assessment had been extended to incorporate additional lots 78, 80, 813 and 815 and confirm that site development is compatible with agreed local area earthworking strategy (refer Appendix B, Cossil & Webley, 2024).

The Geological Survey of Western Australia Perth Metropolitan Region soils maps for Fremantle (part 2033I & 2033IV) indicates that the majority of the site is generally characterised by Sand derived from Tamala Limestone. These soil types are well suited to urban development, with very good permeability anticipated.

Based on experience in Qube landholdings that surround the SP area, it is anticipated that a Site Classification A will be provided in accordance with Australian Standard AS2870: "Residential Slabs and Footings".

The Site is steeply graded, with levels ranging from approximately RL 44.0mAHD at the eastern boundary to RL 19.0mAHD at the south west corner. Additionally, extensive earthworks will be required to create level lots which are terraced between retaining walls.

The Water Corporation has advised that the existing water reticulation system is able to service lots up to RL 38m AHD. This will dictate the highest lot levels across the development which will require lots along the eastern end of the development to be cut down substantially (up to 6 metres).

These constraints on earthworks will prevent the retention of existing topography within the lot areas, resulting in the requirement for earthworks within lots abutting Wattleup Road. A preliminary earthworks plan has been prepared for the site and can be found in Appendix B - Engineering Report and Engineering Report Addendum (Cossill & Webley, 2024).

The preliminary earthworks plan demonstrates that significant earthworks are required within lots abutting Wattleup Road to enable the construction of dwellings across the site, the provision of public open space and servicing of the structure plan area.

2.3 Hydrology

Amendment 1 (July 2024): Hydrological modelling has been reviewed consistent with the agreed urban water management strategies and drainage catchments are suitably provided for (refer Appendix A, Addendum, Environnivate and Hyd2o Hydrology, 2024).

The Annual Average Maximum Groundwater Levels (AAMGL) vary from approximately RL15.5m AHD on the western boundary to RL18.5m AHD in the north-east corner of the Site. It is anticipated that preliminary earthworks levels will provide at least 4 metres clearance to groundwater, thus groundwater is not expected to restrict or influence the development of the Site.

2.4 Bushfire hazard

Amendment 1 (July 2024): Bushfire reporting and hazard assessment has been updated to incorporate Lots 78, 80, 813 and 815 and confirm that bushfire risk is able to be suitably mitigated to allow for development (refer Appendix D, Addendum, MBS Environmental, 2024).

Portions of the site are identified on the Department of Fire and Emergency Services' Map of Bushfire Prone Areas. On this basis, *State Planning Policy 3.7 Bushfire* requires the preparation of a Bushfire Management Plan. Additionally, the Ministerial subdivision Approvals require the preparation of a Bushfire Management Plan which meets the requirements of SPP 3.7.

In accordance with the requirements of SPP 3.7, a BMP has been prepared for the entirety of the SP area which has been accepted by the City of Cockburn.

The BMP provides a preliminary BAL assessment which

indicates that no lots within the SP area are exposed to unacceptable level of bushfire risk, based on the proposed development of the site.

A Bushfire Management Plan will be required to support all future subdivisions of the SP area, where land is located within a designated Bushfire Prone Area.

For further detail, refer to Appendix D - Bushfire Management Plan.

2.5 Heritage

An online search for relevant aboriginal heritage information was undertaken using the Department of Planning, Lands and Heritage (Aboriginal Heritage) Aboriginal Heritage Inquiry System (AHIS). This search found no registered Aboriginal heritage sites or other heritage places within the site, with the closest registered Aboriginal site 500 metres west of the site.

An online search for non-indigenous heritage information was also conducted in order to determine the presence of potential or actual non-aboriginal heritage features of significance within the site. This review did not identify any areas of non-indigenous heritage significance.

For further detail, refer to Appendix E – Environmental Assessment and Management Strategy (Emerge, 2024).

2.6 Land Use Buffers

Figure 7 depicts the constraints and buffers from surrounding land uses that are discussed in Section 2.6.

2.6.1 Planning Control Area 190

PCA 190 abuts the southern boundary of the SP area and protects land required for the planned future upgrade and western extension of Rowley Road, identified as a regional road (a primary distributor) in the South Metropolitan Peel Sub-regional Planning Framework.

The ultimate levels and acoustic fencing requirements within the SP and associated technical appendices have been determined through consultation with MRWA, the DPLH and the City. A noise wall is proposed along the northern boundary of the future Rowley Road to provide noise attenuation, while ultimate earthwork levels provide noise attenuation within the eastern portion of the SP area. This is outlined within the Transport Noise Assessment in Appendix G.

2.6.2 Mandogalup Improvement Scheme No.1-Mandogalup

The SP area is located 50 to 90 metres north of Improvement Plan 47 (IP47), which took effect in April 2019. This gives the WAPC the authority to plan for and facilitate the implementation of an improvement scheme on behalf of the Western Australian State Government. Where an improvement scheme is in effect, the improvement scheme prevails over the applicable regional and local planning schemes.

The IP47 area is identified as an Industrial Investigation area in the South Metropolitan Peel Subregional Planning Framework, requiring further detailed planning and investigations to be undertaken prior to consideration for rezoning. The work undertaken to prepare IP47 and the associated Improvement Scheme currently under preparation represent these further investigations.

On 23 November 2022, the WAPC endorsed a preferred land use scenario and a list of drafting instructions for implementation during drafting of a draft improvement scheme. The endorsed land use scenario seeks to:

- *reconcile long standing contention around air quality matters;*
- *affirm the policy position for appropriate transition between heavy industrial and sensitive land;*
- *uses as per State Planning Policy 4.1: Industrial interface;*
- *support the delivery of Westport and the Global Advanced Industries Hub;*
- *ensure the Kwinana Industrial Area is afforded an appropriate level of protection and primacy into the future;*
- *have regard to Alcoa's ability to use its (entire) landholdings for its operations out to at least 2045, as per the State Agreement; and*
- *provide land use certainty and a reasonable uplift (from rural) for the majority of landowners within IP47.*

The preferred land use scenario provides for an appropriate transition of land uses as advocated by *State Planning Policy 4.1: Industrial Interface*, by providing for low-intensity general industry land uses between Alcoa and the SP area and reasonable separation between the general industrial area and nearby residential land uses so far as practical and possible.

The key elements of the preferred land use scenario, including land use transitions and separation from residential areas, were formalised through the gazettal of Mandogalup Improvement Scheme No. 1 on the 8th November 2024.

Adequate separation distances are achieved through a combination of an 11.5m wide local road reserve, 30m wide public open space along the southern boundary of the SP, and the regional road corridor for Rowley Road which is approximately 100m wide.

It is anticipated that individual proposals to develop land within the improvement scheme area will be assessed against State Planning Policy 4.1 - Industrial Interface and Environmental Protection Authority Guidance Statement No. 3: Separation distances between industrial and sensitive land uses, to ensure land use compatibility.

2.6.3 Kwinana Industrial (Including Air Quality) Buffer (2010)

The south-eastern portion of the subject site is intersected by the Kwinana Industrial (Including Air Quality) Buffer (2010) which aims to minimise the potential for land use conflict between urban development and activities of a more industrial nature, such as Alcoa's residue storage areas. However, additional scientific information and analysis which has become available in recent years raises questions regarding the observance of the non-residential transition area and whether this practice should continue in a contemporary land use planning context.

A number of planning approvals provide for residential development within the 500m buffer area, including the Hammond West Structure Plan and associated subdivisions; as well as the two subdivision applications approved by the Minister in 2020.

The SP includes an approximately 30m wide linear public open space reserve, and an 11.5m wide road reserve along the southern boundary of the SP area. This further increases the separation distance between residential and industrial land uses.

As per Part 1 of this SP, a notification on titles is required for all lots located within 500 metres of the Kwinana Industrial Area (including air quality buffer).

That approximately 332 lots are located within the revised 500m wide non-residential transition zone of the Kwinana Industrial (including Air Quality) buffer, and that approximately 200 square metres is located within the buffer area at the south-western corner of the structure plan as identified on Plan 1, which is comprised of public open space and road reserve.

2.6.4 Market Gardens

Market garden uses occur immediately to west of the SP area.

State Planning Policy 2.5 - Rural Planning, and the minimum 300m buffer distance requirements from a market garden under the Environmental Protection Authority Guidance for the Assessment of Environmental Factors - Separation Distances between Industrial and Sensitive Land Uses.

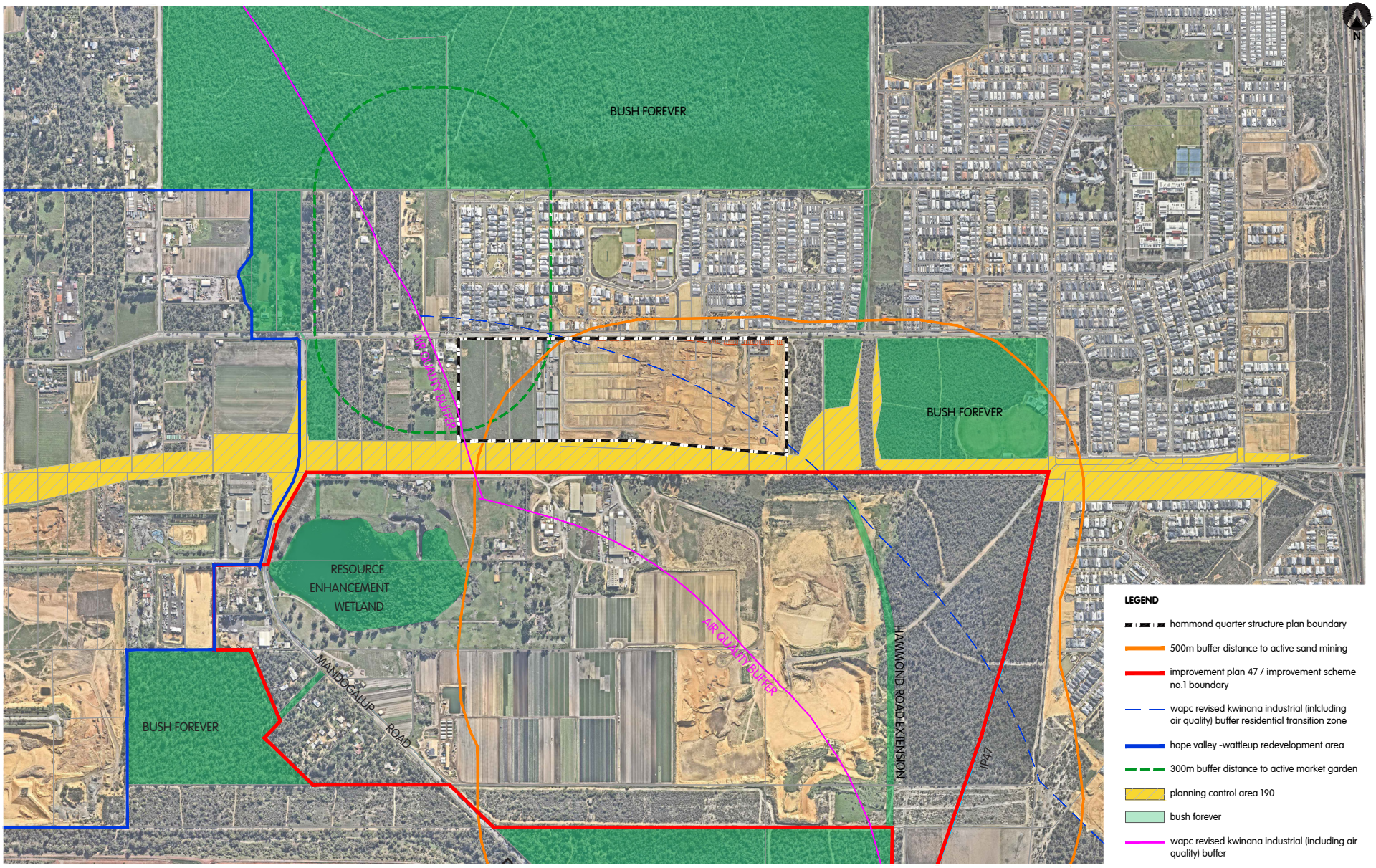
The SP is generally in accordance with the recommended separation distances. In accordance with SPP 2.5, a notification on title, pursuant to Section 165 of the *Planning and Development Act 2005* be placed on certificates of title of lots proposed within 300m of an operating market garden advising of the presence of a market garden and the associated hazards.

2.6.5 Sand Mining

State Planning Policy 2.4 - Planning for Basic Raw Materials, and the EPA Guidance Statement 3 recommends between 300m and 500m minimum buffer distance between sand quarries and residential land uses.

Sand mining is occurring approximately 480m from proposed residential development; however, the resource is nearing exhaustion and mining activities are progressively moving south, away from the structure plan area.

Notwithstanding, a notification on title regarding existing non-residential development and land uses is required in accordance with Part One, Section 4.2.



QUBE
primewest

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DWG REF: LGATE-001
PROJECTION: PCG94

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C	AMENDMENTS	251114	RS	DW
	STRUCTURE PLAN BOUNDARY			
B	AMENDMENT	241004	RS	TP
A	FIRST ISSUE	231130	TG	TP

CONSTRAINTS PLAN
Hammond Quarter Structure Plan
City of Cockburn

JOB CODE **QUB WAT** DRAW NO. **RD1 027** REV. **D**

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Figure 7 - Constraints Plan

LEGEND

Structure Plan Boundary

QUBE
PRIMEWEST

CADASTRAL INFORMATION
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YYMMDD: 250625
DWG REF: LGATE-001
PROJECTION: PCG94

HATCH

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REV	DESCRIPTION	YYMMDD	DRAWN	APPRD
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F	UPDATE CONCEPT	240708	SB	TP
E	BOUNDARY EXTENSION	240514	RS	TP
D	WAPC COMMENTS	231107	TD	TP
C	AMEND STRUCTURE PLAN BNDY	221111	SB	TP
B	INCLUSION OF LOT	220621	TG	TP
A	FIRST VERSION	220520	TG	TP

SITE PLAN
Hammond Quarter Structure Plan
City of Cockburn

JOB CODE	DRAW NO.	REV.
QUB WAT	**RD1 017**	**G**

Figure 8 - Site Plan

3.0 Land use and subdivision requirements

The layout of this SP has been predetermined by the Ministerial Appeal decision, mandatory Concept Plan elements and the ultimate Concept Plan layout endorsed by the WAPC. The design of the SP area has in turn set the design of the area subject to Amendment 1 (2024).

The Appeal decision required the following fixed elements to the Concept Plan as follows:

- Three fixed entry points to Wattleup Road;
- 30m linear POS space along the southern edge of the precinct; and
- Fixed road reserve width and landowner apportioning requirements.

In order to meet the Ministerial requirements, address the integration with the wider Hammond Park neighbourhood, respect Council endorsed SP's north of Wattleup Road and address engineering delivery requirements a number of key changes to the existing SP's were made through the preparation of a wider Neigbourhood Plan over the whole of Hammond Park (refer Figure 9). This illustrates the key design responses of the approved Concept Plan and proposed SP as follows:

- The mandated linear POS was supplemented with local pocket parks as common local focal points, providing a range of POS typologies;
- The three Wattleup Road access points all connected directly to the southern linear open space to create active walking loops through the precinct and north of Wattleup Road through to the network of similar linear and pocket park spaces, including the Beeliar Parkland frontage and neighbourhood retail to the east;
- The central pocket park in particular was aligned to the central access point to Wattleup Road to enable direct walkable access north to the Hammond Park Primary School (opening in 2025);
- The local street network was re-orientated to an east – west alignment to enable all local streets to focus back to the central open space, with subtle pivots in the street alignment and landscaped slow points to maintain low vehicle speeds;
- Lowering of the elevated land in the east portion of the site (which is currently above the serviceable ground level for potable water supply) and a reduction in the height of retaining walls by running streets east – west with the large residual downwards slope to the west; and
- Remove all direct access to Wattleup Road including integration of the homestead lots into the design with alternate internal street access and ultimate ground level integration that reflects water servicing and retaining limitations.

In affect the approved Concept Plan has dictated the design layout of the SP. This layout has also impacted the design of the area subject to Amendment 1, particularly:

- the continuation of the linear POS along the southern boundary, which dictates the quantum of open space outside of this area; and
- maintaining three access points onto Wattleup Road.

Figure 9 shows a concept plan for the development of the Hammond Park locality. The neighbourhood concept shows how land east of the structure plan area might be developed and no approval to subdivide or develop this land has been granted. Planning for these areas is indicative only and subject to change.

The network of open spaces includes neighbourhood pocket parks, district open space, and bush forever. This is discussed in detail in Section 3.2. Open space is connected through a network of linear open space reserves, providing valuable connection through the locality.

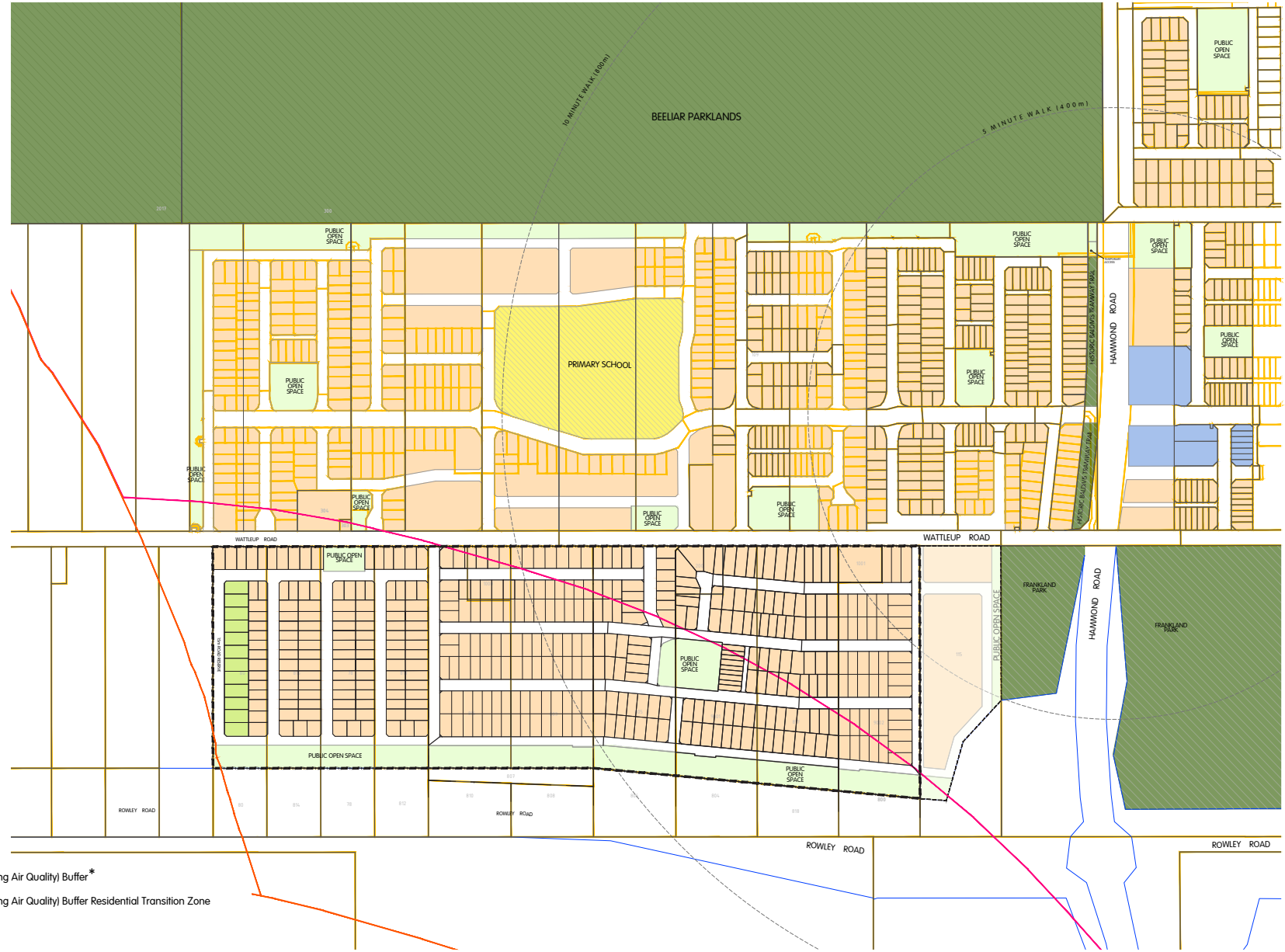
The Concept Plan also shows the three proposed connections to Wattleup Road from the Structure Plan Area, discussed in detail in Section 3.4.

3.1 Land use

Consistent with Liveable Neighbourhoods, the design objectives for the SP include the following:

- To respond to the topography and site conditions of the land, particularly the water servicing constraints, earthworks and retaining considerations;
- To provide a walkable, interconnected street network that is integrated with adjoining Hammond Park retail, community and open space infrastructure to the north;
- To integrate the drainage with POS for the aesthetic and recreational value of future residents;
- To ensure a balanced mix of lot sizes and dwelling types appropriate to the locality that contribute to affordable housing options; and
- To maximise the solar orientation of residential lots.

The SP incorporates a subdivision layout based on a traditional grid pattern with interconnected roads, adjusted where necessary to respond to the topography, which integrates with the lot design and road network of surrounding and approved development.



LEGEND

- HAMMOND QUARTER STRUCTURE PLAN AREA POS/DRAINAGE 13% ACHIEVED
- RESIDENTIAL
- COMMERCIAL
- PUBLIC OPEN SPACE
- TRANSITIONAL RESIDENTIAL
- REGIONAL OPEN SPACE /BUSH FOREVER
- PRIMARY SCHOOL

- WAPC revised Kwinana Industrial (Including Air Quality) Buffer*
- WAPC revised Kwinana Industrial (Including Air Quality) Buffer Residential Transition Zone

QUBE

* The Policy defines three areas (Areas A, B and C), where: Area A is the area of land on which heavy industry is located; Area B is a buffer area surrounding industry; Area C is beyond Areas A and B, predominantly rural and residential.

CADASTRAL INFORMATION
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DWG REF: LGATE-001
PROJECTION: PCG94

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P.1	LABEL UPDATE	250715	RS	DW
P	BOUNDARY UPDATES	250714	RS	DW
N	RELOCATE POS - TO SUIT DRAINAGE	240423	SB	TP
M	REMOVE TEMP ROAD NOTATION	240313	SB	TP
L	COLOUR TEMP CONNECTION AS RESI	240214	SB	TP

CONCEPT PLAN - WATTLEUP NEIGHBOURHOOD

Hammond Quarter Structure Plan
City of Cockburn

JOB CODE	DRAW NO.	REV.
QUB WAT	**RD1 010**	**P.1**

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Figure 9 - Neighbourhood Concept

3.2 Open space

WAPC's *Liveable Neighbourhoods* and *Development Control Policy 2.3 - Public Open Space in Residential Areas* require a minimum 10 percent of the gross subdivisional area be provided as public open space.

Condition 3(d) of the Ministerial approvals requires the concept plan (and thus the SP) identifies an area(s) of land equal to (at least) 10 per cent of the site's gross subdivisible area as public open space. Additionally Condition 3(a) required that the concept plan separates residential lots from land affected by Planning Control Area 190 and required for the planned western extension of Rowley Road by a public open space area at least 30 metres in width.

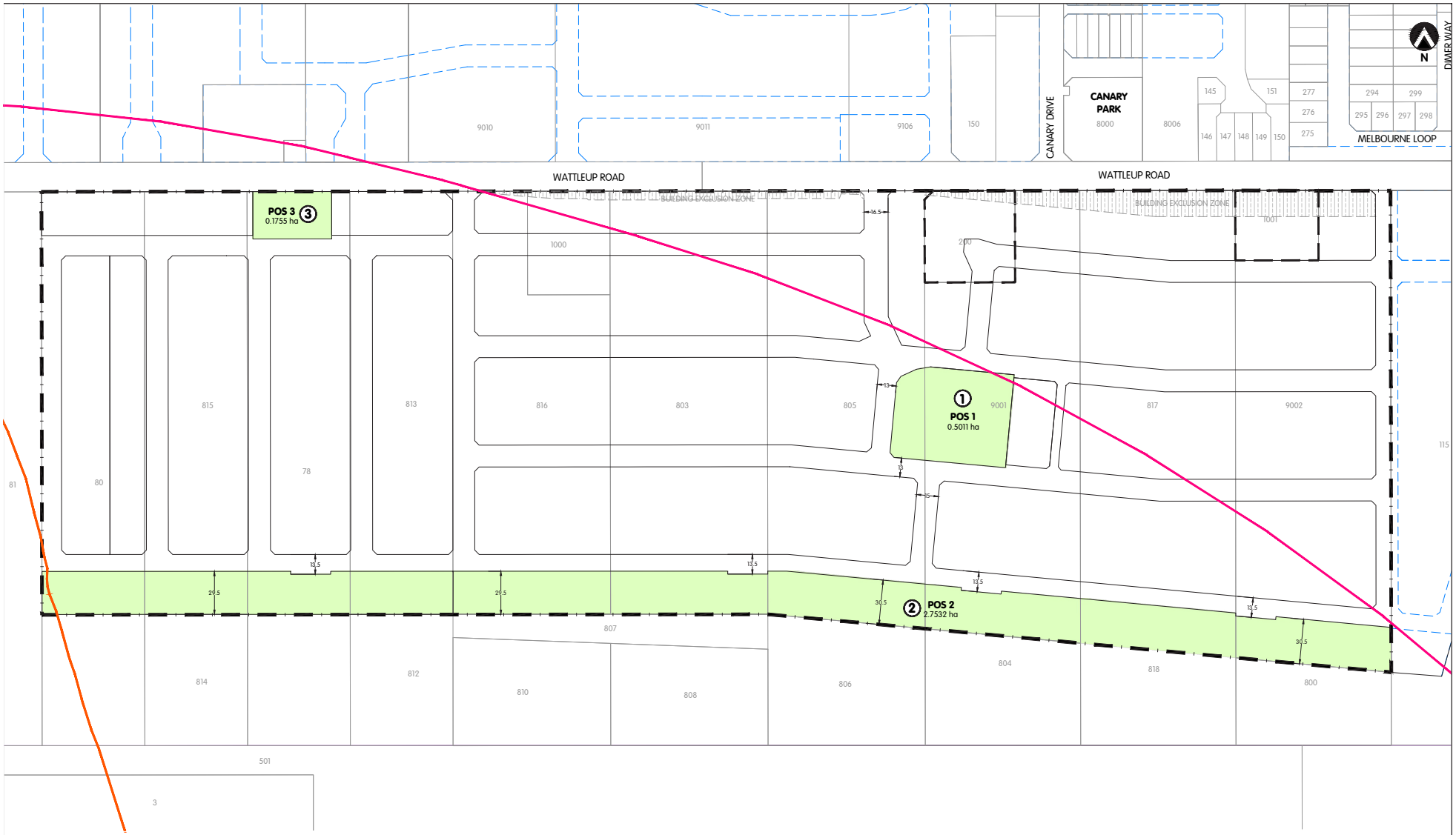
The open space network is defined by three discrete public open space reserves, totalling 3.4298 ha and representing 12.66% of the gross subdivisible area, and providing 10.5% creditable open space. These areas are:

1. A 0.5011 ha central open space area including passive grassed areas, shaded structure with barbecue and seating arrangements and playspace (POS 1);
2. A 2.7532 ha linear POS area abutting the Rowley Road extension incorporating a series of functional amenity spaces throughout the wider open space area (POS 2).
3. A 0.1755 ha open space area including passive grassed areas, screened trees/planting along boundary and seating node (POS 3).

The POS network is resultant of considerable consultation with the City of Cockburn, with three main considerations:

- Providing an amount of POS in a location consistent with the Ministerial Approval and following consultation with the City of Cockburn;
- Ensure a variety of recreational needs and POS amenity within a walkable catchment of all residential lots and integrated with the wider Hammond Park open space network; and
- Balance between the unique servicing, drainage and earthworks requirements and ensuring the provision of useable POS amenity.

Proposed Public Open Space Schedule				
Site Area (Lots 816, 1000, 803, 805, 200, 9001, 817, 1001, 9002, 78, 80, 813 and 815)				27.6786
Deductions				
Dedicated drainage reserve not included in POS (1:1 year event)			0.1642	
Restricted POS over 20%			0.4205	
Gross subdivisible area				27.0938
Public open space @ 10 percent				2.7094
May comprise:				
- minimum 80% unrestricted POS			2.1675	
- maximum 20% restricted POS			0.5419	
Public Open Space Contribution	Open Space Area (gross)	Unrestricted	Restricted (Battered area with slope greater than 1:6, and 1:1 - 1:5 year event)	Dedicated Drainage (1:1 year event)
POS 1 (Central)	0.5011	0.3015	0.1574	0.0422
POS 2 (Linear)	2.7532	1.8900	0.7661	0.0971
POS 3 (North)	0.1755	0.1117	0.0389	0.0249
Sub-Total	3.4298	2.3032	0.9624	0.1642
- maximum 20% restricted POS			0.5419	
Total (Unrestricted & maximum 20% restricted POS)		2.8451 (10.5%)		



LEGEND

- Structure Plan Boundary
- Indicative Boundary

Local Scheme Reserves

- Local Road Reserve
- Public Open Space

POS BREAKDOWN

1	0.5011 ha
2	2.7532 ha
3	0.1755 ha
POS TOTAL	**3.4298 ha**

- WAPC revised Kwinana Industrial (Including Air Quality) Buffer
- WAPC revised Kwinana Industrial (Including Air Quality) Buffer Residential Transition Zone

QUBE
primewest

CADASTRAL INFORMATION
SOURCE: LANDGATE
YYMMDD: 201125
DWG REF: 201125-cad.DWG
PROJECTION: PCG94

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G	ROAD WIDENING	241004	RS	TP
F	BOUNDARY EXTENSION	240708	SB	TP
E	BOUNDARY EXTENSION	240514	RS	TP
D	WAPC COMMENTS	231109	TD	TP
C	AMEND STRUCTURE PLAN BNDY	221111	SB	TP

PUBLIC OPEN SPACE
Hammond Quarter Structure Plan
City of Cockburn

JOB CODE	DRAW NO.	REV.
QUB WAT	**RD1 014**	**H**

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Plan 2 - Public Open Space Plan

A preliminary POS design was presented to the City of Cockburn prior to lodgement. The design presented in this SP has been refined to increase the useable area of the central POS and has resulted in a greater proportion of useable turf area, whilst maintaining drainage requirements.

The Landscape Masterplan found in Appendix C also details the trees that are able and suitable for retention following a review of the suitable trees and earthworks.

It also details the area of unrestricted, restricted open space, and credited drainage within each of the POS reserves.

3.3 Residential

The SP, as amended (July 2024), proposes approximately 435 residential lots within a residential density of R20, R30 and R40. The subdivision configuration proposed by the SP adopts the principles of traditional neighbourhood design, with a wide variety of lot typologies suited to a range of income groups and household types.

Further, the proposed placement of lots achieves a highly desirable solar orientation outcome, with the majority of lots aligned on an east-west or north-south axis, as recommended by Liveable Neighbourhoods.

The SP proposes a residential density of 24.58 dwellings per residential gross site hectare. This is a minor variation to the target of 26 dwellings per residential site hectare. South Metropolitan Peel Sub-regional Planning Framework. The minor variation is generally a result of the following:

- The pattern of development (and the resulting lot yield) has been largely determined by the Minister's approval to subdivide land in the structure plan area;
- The structure plan identifies public open space areas greater than the 10 per cent required under WAPC policy; and
- The SP proposes larger lots abutting Wattleup Road, to accommodate battering for Wattleup Road, which affects an area of approximately 0.427 hectares.

3.4 Movement network

Amendment 1 (July 2024): Transport impact analysis has been updated to incorporate Lots 78, 80, 813 and 815 confirming that overall trip generation and access arrangements remain within acceptable parameters.

The internal street network proposed for the SP area establishes a hierarchy of laneways and access streets, facilitating vehicular, pedestrian and cyclist connections between neighbouring landholdings to the east and north. Slow points along the 15m wide Access Street D will be generally in accordance with the Engineering and Servicing Report.

Access shall be provided generally in accordance with the access points shown on the SP, and Plan 3 - Movement Network. The Plans show three access points from the LSP to Wattleup Road:

- Access Road 1 – Full movement access at Wattleup Road
- Access Road 2 – Full movement access at Wattleup Road
- Access Road 3 – left-in left out access at Wattleup Road

A Transport Impact Assessment has been prepared in support of the SP and is found in Appendix F. The TIA assesses traffic access, volumes and safety. The report documents likely traffic generation associated with the proposed development, its impact on the internal and external road network, and public transport, walking and cycling requirements. The assessment confirms that the impact of predicted traffic volumes associated with development of the SP area will have an acceptable impact on roads in the vicinity.

Wattleup Road is proposed to be upgraded to an urban standard to support residential development on both northern and southern sides of the road.

The area subject to Amendment 1 is accessed at two points: a four-way intersection with Access Road 1, and a three-way intersection in the southern area of the SP, adjacent to the POS. The proposed four-way intersection with Access Road 1 facilitates access to both the amendment area as well as the Hammond Quarter Structure Plan area to the east.

SIDRA analysis undertaken found that the Future North-South Road/Wattleup Road intersection would operate at an acceptable level of service under the 2034 assessment scenario. This is discussed in Sections 8.4 and 9 of the Transport Impact Assessment prepared by PTG Consulting to support the amendment.

3.5 Water management

Amendment 1 (July 2024): LWMS reporting has been revised consistent with the addition of Lots 78, 80, 813 and 815 to confirm that agreed urban water management strategies and drainage catchments are suitably provided for (refer Appendix A, Addendum).

Consistent with condition 9 of the Subdivision Approvals, an urban water management plan has been prepared and is attached in Appendix A. The Department of Water and Environmental Regulation (DWER) has accepted an urban water management plan (typically prepared in support of a subdivision application), in lieu of a local water management strategy.

DWER have also provided the same support for the additional area proposed in Amendment 1.

Adequate water resources have been acquired for the irrigation of public open space, specifically a 9950kl (GWL161689, 7 May 2024) water license. These areas will use waterwise planting and 5-Star WELS rated water efficient devices to reduce ongoing water requirements.

The stormwater drainage system is designed to manage a range of rainfall events up to the 1% Annual Exceedance Probability (AEP), and this is achieved by adopting the small storm, minor and major stormwater management system design approach outlined in ARR 2016 (Ball et al., 2016) and the Decision process for stormwater management in WA (DWER, 2017).

The SP area is divided into five (5) stormwater drainage catchments. The stormwater catchments also pick up the southern carriageway of Wattleup Rd for the length of the subdivision frontage.

Key design elements of the minor and major storm event drainage system are as follows:

- Stormwater runoff from lots will be partially retained by soak wells, with excess stormwater conveyed to the street drainage system via overland flow.
- Stormwater runoff from internal roads will be conveyed by the pit and pipe drainage system. For rainfall events exceeding the capacity of the pipe system (nominally >20% AEP) excess stormwater will be conveyed by overland flow, with roads graded to the detention basin at the catchment low point.
- Internal roads will discharge to the infiltration basin located in Lots 9003, 809, 9001 and 78 Public Open Spaces (Plan 2). Details of the storage are presented in Table 5.
- The external road catchment (Wattleup Rd) will drain via the pipe drainage system and discharge to the infiltration basin located in Lots 9003, 809, 9001 and 78 Public Open Spaces.
- The infiltration basin has been sized using a soil hydraulic conductivity of 8 m/day, for the area outside of the bio retention basin.

3.6 Infrastructure coordination, servicing, & staging

An Engineering Services Report was prepared by Cossill & Webley Consulting Engineers in January 2022 (and addendum relating to Lots 78, 80, 813 and 815). The report outlines the infrastructure likely to be required to develop the site and confirms it can be fully serviced with electrical, water, sewer, gas, stormwater drainage and communications infrastructure.

The Site forms part of the Water Corporation's Thompson's Lake Waste Water Reticulation System and sewer infrastructure will be provided by connection the reticulation sewer that runs along the Wattleup Road north of the Site. This new line grades to a Type 40 Waste Water Pumping Station (WWPS) "Thomsons Lake Pump Station G", located at the natural low point within Lot 74 to the north of Wattleup Road. There are no impediments to the provision of sewerage infrastructure to service the Site.

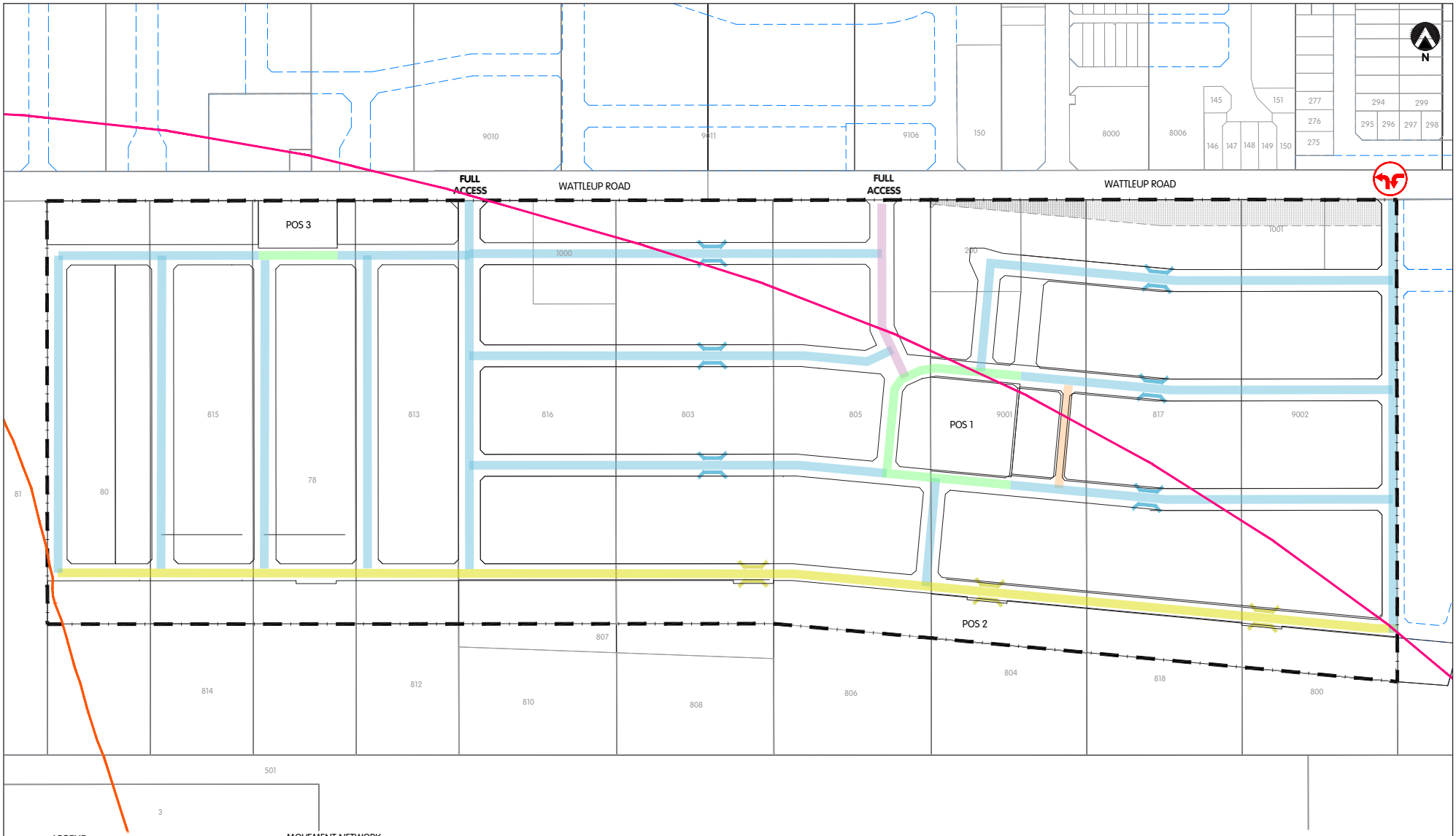
Water supply will be provided via an extension of the existing pipe infrastructure in Wattleup Road. Electrical supply can be provided by extension of the existing infrastructure on Wattleup Road.

Telecommunications and gas are available via extensions from the existing network in Wattleup Road to the development. There is capacity in the existing network to service the proposed development.

Telecommunications carriers Telstra and Optus have both confirmed that no additional infrastructure upgrades are likely to be required as a result of the subdivision development (inclusive of the area subject to Amendment 1). Optus has advised further coverage and capacity improvements will follow once Optus new P0955 Wandi North is built (forecast March 2024). It is important to note that TPG were contacted, however no response has been received.

Staging will generally be from west to east consistent with availability of services. POS areas will be delivery concurrently with the adjacent residential development. Secondary temporary access to Wattleup Road will be maintained at all times to provide safe access in the event of bushfire. Indicative staging is shown in Plan 5 -Staging Plan.

Refer to Appendix B – Engineering Report



LEGEND

- Structure Plan Boundary
- Indicative Boundary
- Left-in/Left-out Only

MOVEMENT NETWORK

- Access Street D (16.5m)
- Access Street D (15.0m)
- Access Street D (12.5m - 13.0m)
- Access Street D (11.5m)
- Laneway (6m)
- Landscaped Vehicular Slow Point
- WAPC revised Kwinana Industrial (Including Air Quality) Buffer
- WAPC revised Kwinana Industrial (Including Air Quality) Buffer Residential Transition Zone

QUBE
primewest

CADASTRAL INFORMATION
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DWG REF: 201125-cad.DWG
PROJECTION: PCG94

HATCH

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G	ROAD WIDENING	241004	RS	TP
F	UPDATE CONCEPT	240708	SB	TP
E	BOUNDARY EXTENSION	240514	RS	TP
D	WAPC COMMENTS	231109	TD	TP
C	AMEND STRUCTURE PLAN BNDY	221111	SB	TP

MOVEMENT NETWORK
Hammond Quarter Structure Plan
City of Cockburn

JOB CODE	DRAW NO.	REV.
QUB WAT	RD1 015	H

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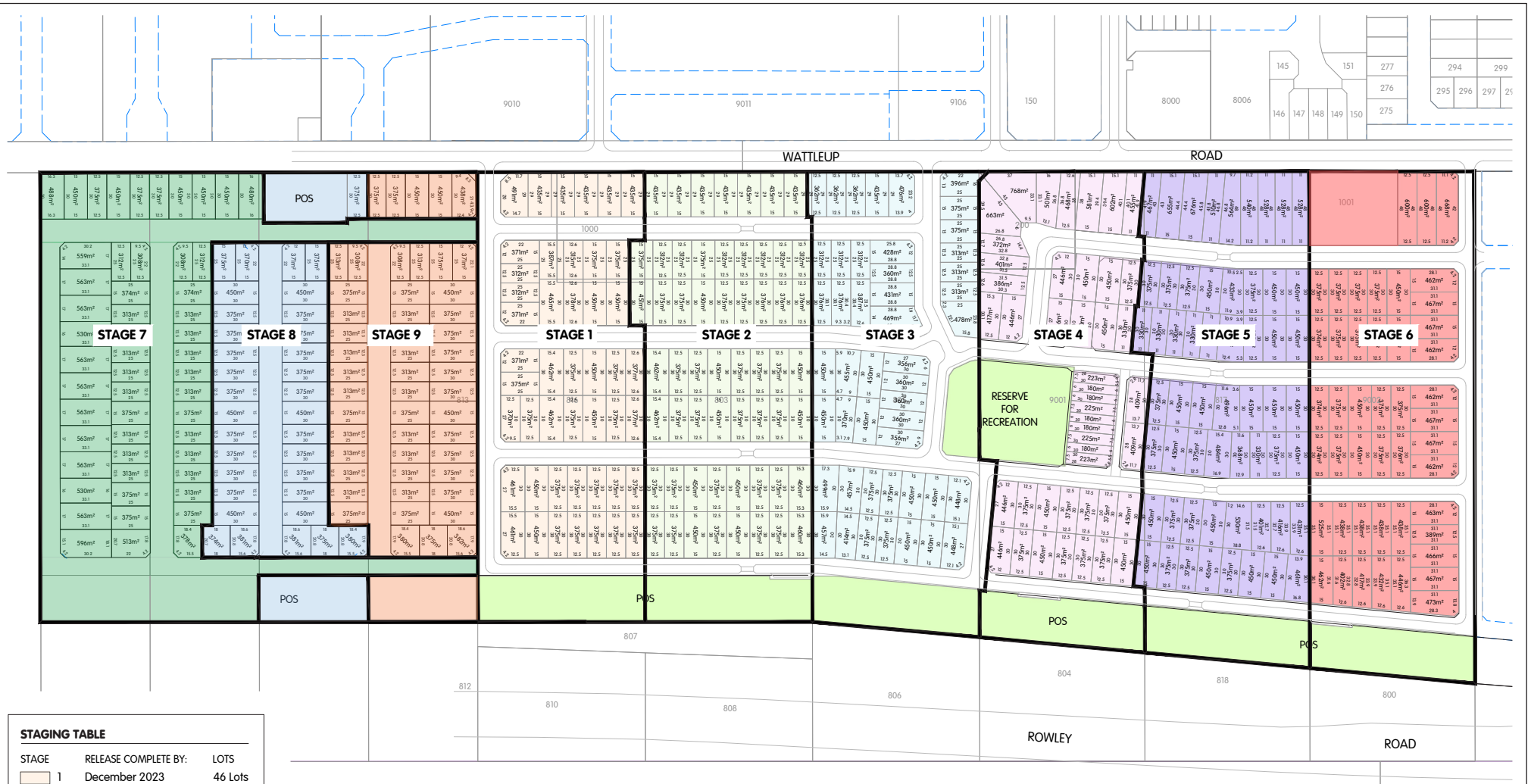
Plan 3 - Movement Network



STAGING TABLE

STAGE	RELEASE COMPLETE BY:	LOTS
1	December 2023	46 Lots
2	December 2023	57 Lots
3	December 2024	47 Lots
4	December 2024	45 Lots
5	December 2025	57 Lots
6	December 2025	47 Lots
7	2026	52 Lots
8	2026/2027	34 Lots
9	2027	50 Lots
TOTAL		**435 Lots**

LEGEND

- STAGING BOUNDARY
- 804 EXISTING LOT NUMBERS
- INDICATIVE FUTURE LOT BOUNDARIES

N

QUBE
primewest

CADASTRAL INFORMATION
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YYMMDD: 201125
DWG REF: 201125-cad.DWG
PROJECTION: PCG94

HATCH | RobertsDay

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B	WAPC COMMENTS	231109	TD	TP
A	FIRST ISSUE	221117	SB	TP

STAGING PLAN
Hammond Quarter Structure Plan
City of Cockburn

JOB CODE **QUB WAT** DRAW NO. **RD1 021** REV. **C**

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Plan 4 - Staging Plan

4.0 Conclusion

The Hammond Quarter SP will facilitate the consolidation and update of historic SP's 27A and 27B in accordance with the approval of subdivision applications by the Minister for Planning in November 2020 and associated detailed planning endorsed by WAPC in May 2021.

This planning ensured there was careful consideration of higher order strategic planning objectives outlined by the Southern Suburbs District SP - Stage 3 for the wider Hammond Park neighbourhood. This included particular attention to walkable access to the eastern Neighbourhood Centre retail facilities, the Hammond Park Primary School (opening 2025) and the wider network of central pocket parks and perimeter linear open spaces.

The approval of this SP will allow for the allocation for a singular planning framework for the SP area. This will ensure a cohesive application of SP standards for further subdivision and development including overall agreed subdivision layout, allocation of density codes and a network of quality public open space.

It is expected that the SP will accommodate 435 dwellings, primarily consisting of single residential dwellings on freehold lots, facilitating a total population of approximately 1,044 people. This provides a density of 24.58 dwellings per residential site hectare, which represents a minor variation of 23.33 dwellings per site hectare of residential land.

Appendix A

Urban Water Management Plan

5 July, 2024

Your Ref:
Our Ref: H24019Av1

QUBE Property Group
437 Roberts Rd
Subiaco, WA 6008
Attention: Stephen Carter

Dear Stephen,

HAMMOND QUARTER STRUCTURE PLAN - URBAN WATER MANAGEMENT PLAN ADDENDUM

This urban water management plan (UWMP) addendum has been prepared by Hyd2o on behalf of QUBE Property Group in support of the proposed Hammond Quarter Structure Plan Amendment in Wattleup Rd, Hammond Park. The Amendment to the existing structure plan is shown in Figure 1 and Attachment A and proposes for the inclusion of several adjacent lots to the existing structure plan area.

This UWMP Addendum seeks only to provide the details of additional site investigations and stormwater management modelling undertaken for the additional lots. This report does not intend to reproduce all elements of the previously approved UWMP (Environnivate, 2022), and is intended to be read in conjunction with the previous document and only detail relevant information to this addendum. Key principles and objectives of the previously approved UWMP remain current and valid for implementation.

The report has been prepared consistent with the previously approved UWMP (Environnivate, 2022) and Better Urban Water Management (WAPC, 2008) guidelines.

1. SITE CHARACTERISTICS

The site is described as having the following pre-development characteristics:

- The site is generally cleared with a few residential buildings, in addition to a steel storage warehouse area situated along the eastern part of the site (Figure 1).
- The topography ranges from 18 mAHD in the north to 24 mAHD in the south (Figure 1).
- A geotechnical investigation was undertaken by Galt Geotechnics in 2023, which included 20 test pits across the site. Generally, the site was characterised as being dominated by fine to medium natural sands. Permeability testing at twelve locations was undertaken with a minimum rate of 5 m/day recorded at one site and 10 of the twelve sites recording permeabilities in excess of 15 m/day. Galt concluded the site as suitable for on site stormwater management and disposal. A copy of the geotechnical report has been included as Attachment B.
- Further permeability testing was conducted by Hyd2o in proximity to the area of the proposed main stormwater storage area for the site on 15 April 2024. Testing at 1.5m below natural surface at this location recorded a rate of 3.4 m/day. Soils in the area however were found to be increasingly coarse with depth and considerably higher permeability rates in this area are expected at depth in line with Galt (2023) nearby results with excavation of surface soils.

- Groundwater mapping for the site is shown in Figure 2. DWER's online Perth Groundwater Map (DWER, 2024) was recently updated to provide Gnangara Jandakot 2019 maximum water table elevation contours, with previous groundwater contour mapping removed. Advice from DWER indicates these revised 2019 contours account for the declines and rises in water tables in recent decades and the impacts of current climate trends and are therefore considered more appropriate for use than previous mapping. This mapping shows site groundwater levels ranging from approximately 11 mAHD to 13 mAHD with flow to the west. Depth to groundwater from natural surface is therefore estimated to range from approximately 5m to 11 m.
- There are no defined waterways, watercourses, or drains within the site. All surface water runoff currently infiltrates through the subsurface profile.
- There are no wetlands or water dependant ecosystems within the site.
- The site has no known risk of Acid Sulphate Soils (ASS).

2. STORMWATER MODELLING

Stormwater modelling for storage areas was performed using XP Storm. The design rainfall storms modelled in XP-Storm were based on methodology in Australian Rainfall and Runoff (AR&R) (Ball et al, Australia, 2016). All design rainfall and temporal patterns where imported into the model using the ARR Data Hub. Rainfall was assumed to be spatially uniform across the catchment. Storm durations modelled ranged from 30 minutes to 72 hours and all ensembles were run for each storm to determine critical design events.

Water quality management is proposed for the site through the retention and infiltration of the first 15mm of rainfall on lots, with road runoff managed in biofiltration areas, consistent with the Environnivate (2022) UWMP. Flood storage for major events is then managed via infiltration in adjacent POS areas. The site has been delineated into three catchments to enable distributed infiltration of stormwater, consistent with engineering advice (Attachment D). Note that Wattelup Rd runoff is assumed to be managed to the north of the site consistent with previous water management planning and design.

Consistent with biofiltration basin designs in the UWMP (Environnivate, 2022), the modelled storage designs have been configured with 1:6 side slopes with a maximum water level providing to an overall depth of 0.5m. The total required bioretention volume of 138 m^3 has been modelled based on an infiltration rate of 2.5 m/day.

Stormwater modelling outcomes are detailed in Table 1 and Figure 2. Areas shown on Figure 2 are shown to scale to demonstrate the likely areas of inundation for various events within POS. Detailed stormwater modelling outputs are shown in Appendix E.

For the 20% and 1% Annual Exceedance Probability (AEP) events, the required volumes are estimated to be 170 m^3 and 1084 m^3 respectively (ex biofilter). Storage design is consistent with the UWMP (Environnivate, 2022) sized for 1:6 side slopes and 1.2 metres depth. An infiltration rate of 5 m/day was used for major event design in accordance with the geotechnical report (Galt Geotechnics, 2023). Top of water level surface area calculated is consistent with the available POS area, requiring a total of 0.17 ha (ex biofilter).

Landscape plans consistent with stormwater requirements are presented in Attachment F.

Table 1: Stormwater Management XP-Storm Modelling Results

Catchment Details	Catchment C	Catchment D	Catchment E
Residential Lots Standard (ha) (15mm On-Site; Continuing Loss 8 mm/hr)	3.18	0.36	0.53
Residential Lots Transitional (ha) (15mm On-Site; Continuing Loss 8 mm/hr)	-	0.67	-
Public Open Space (10% RO) (ha)	0.18	0.41	0.45
Road & Road Reserve (80% RO) (ha)	1.10	0.52	0.31
Total Contributing Area (ha)	4.46	1.96	1.29
Bioretention Storage Design Parameters			
Base Area (m^2)	85	32	15
Side Slopes (Average) (v:h)	6	6	6
AAMGL (mAHD)	14.0	14.0	15.0
Invert (mAHD)	17.5	22.5	19.5
Design Hydraulic Conductivity (m/day)	2.5	2.5	2.5
First 15mm : Bioretention Area			
Flood Rise (m)	0.49	0.49	0.48
Volume (m^3)	77	38	23
TWL Surface Area (m^2)	249	137	94
TWL (mAHD)	17.99	22.99	19.98
Stormwater Retention Area Design Parameters			
Base Area (m^2)	250	55	8
Side Slopes (Average) (v:h)	6	6	6
Invert (mAHD)	16.8	21.8	18.8
Design Hydraulic Conductivity (m/day)	5	5	5
20% AEP Event			
Flood Rise (m)	0.30	0.48	0.57
Volume (m^3)	93	52	25
TWL Surface Area (m^2)	389	180	96
TWL (mAHD)	17.1	22.28	19.37
Critical Storm (hours)	3	3	3
1% AEP Event			
Flood Rise (m)	1.2	1.17	1.17
Volume (m^3)	679	270	135
TWL Surface Area (m^2)	961	477	289
TWL (mAHD)	18.0	22.97	19.97
Critical Storm (hours)	6	3	3

3. REFERENCES

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Western Australian Planning Commission (2008). Better Urban Water Management, October 2008

Should you have any queries regarding this report, please do not hesitate to contact Sasha Martens or Brian Lau of this office.

Yours sincerely,

Brian Lau

Environmental Hydrologist

Figures

Figure 1. Location Plan

Figure 2. Stormwater Management Plan

Attachments

Attachment A: Structure Plan

Attachment B: Geotechnical Report (Galt Geotechnics, 2023)

Attachment C: Hyd2o Permeability Testing

Attachment D:Engineering Drawings

Attachment E: Stormwater Modelling Outputs

Attachment F: Landscape Plans

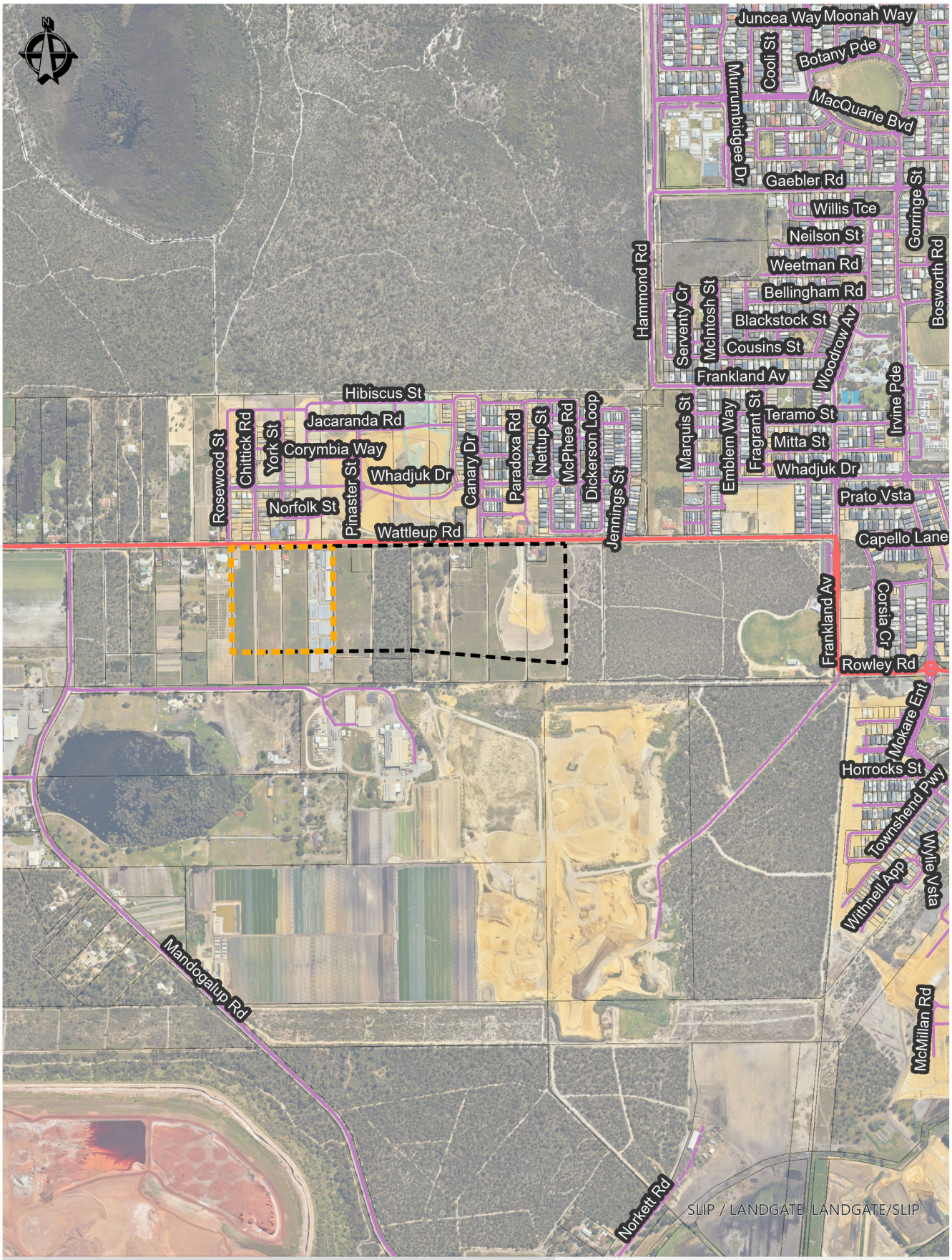
This document is published in accordance with and subject to an agreement between Hyd2o and the Client for whom it has been prepared, and is restricted to those issues that have been raised by the Client in its engagement of Hyd2o. It has been prepared using the skill and care ordinarily exercised by hydrologists in the preparation of such documents.

Hyd2o recognise site conditions change and contain varying degrees of non-uniformity that cannot be fully defined by field investigation. Measurements and values obtained from sampling and testing in this document are indicative within a limited timeframe, and unless otherwise specified, should not be accepted as conditions on site beyond that timeframe.

Any person or organisation that relies on or uses the document for purposes or reasons other than those agreed by Hyd2o and the Client does so entirely at their own risk. Hyd2o denies all liability in tort, contract or otherwise for any loss, damage or injury of any kind whatsoever (whether in negligence or otherwise) that may be suffered as a consequence of relying on this document for any purpose other than that agreed with the Client.

FIGURES

Date: 2/07/2024 Job No. H24019



Amendment Area

Structure Plan Boundary

0 100 200 300 400 500 Meters

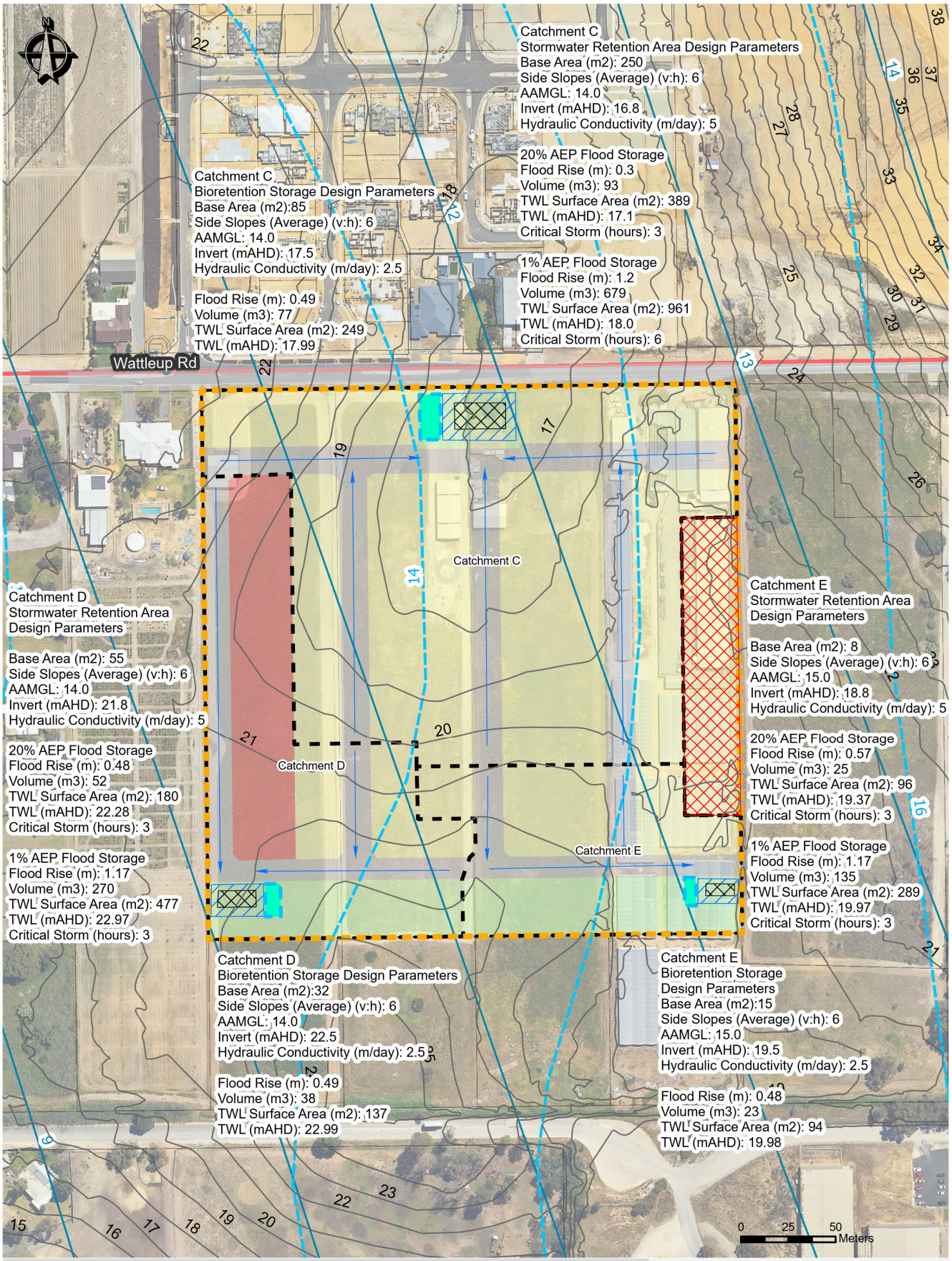
hyd2o

Hammond Quarter
UWMP Addendum

Location Plan

Figure 1

Date: 05/07/2024 Job No. H24019



Amendment Area	1% AEP Flood Storage	DWER GW Historical Maximum
POS	20% AEP Flood Storage	DWER GW 2019 Maximum
Lots Standard	15mm Biofiltration	Flow Direction
Lots Transition	Catchment Boundary	To External Catchment
Roads	DWER Lidar 1m Contours	

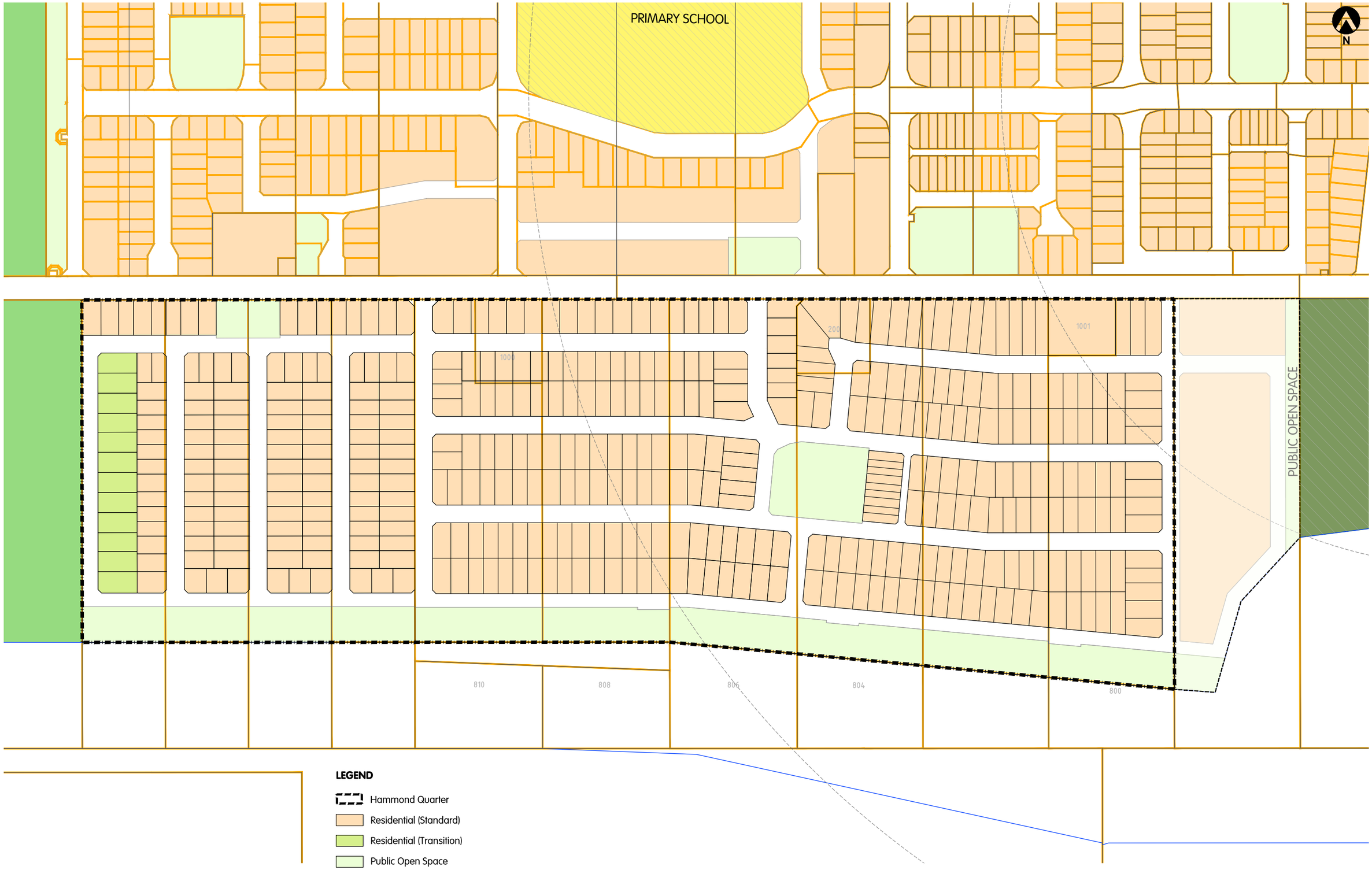
hyd2o

Hammond Quarter
UWMP Addendum

Stormwater Management Plan

Figure 2

ATTACHMENT A
Structure Plan



QUBE

HATCH

CADASTRAL INFORMATION
SOURCE: LANDGATE SLIP
YYMMDD: 230619
DWG REF: LGATE-001
PROJECTION: PCG94

SIZE A3_1:2500

0 metres 20 40 60 80 100

REV	DESCRIPTION	YYMMDD	DRAWN	APPR'D
M	REMOVE TEMP ROAD NOTATION	240313	SB	TP
L	COLOUR TEMP CONNECTION AS RESI	240214	SB	TP
K	REVISE STRUCTURE PLAN DESIGN	240214	SB	TP
J	WAPC COMMENTS	231107	TD	TP

CONCEPT PLAN - WATTLEUP NEIGHBOURHOOD

Hammond Quarter Structure Plan

City of Cockburn

JOB CODE	DRAW NO.	REV.
QUB WAT	**RD1 010**	**M**

DISCLAIMER: ISSUED FOR DESIGN INTENT ONLY. ALL AREAS AND DIMENSIONS ARE SUBJECT TO DETAIL DESIGN AND SURVEY

LEGEND

- Area of Modification
- Residential (Standard)
- Residential (Transition)
- Public Open Space

YIELD TABLE

Existing Lots	4
Proposed Lots	
Residential (Standard)	125
Residential (Transition)	11
TOTAL	**136**
Public Open Space	2

Note: Totals include proposed lots used for temporary road access.

QUBE

HATCH

CADASTRAL INFORMATION
SOURCE: LANDGATE SLIP
YYMMDD: 230619
DWG REF: LGATE-001
PROJECTION: PCG94

SIZE A3_1:2000

0 metres 20 40 60 80 100

REV	DESCRIPTION	YYMMDD	DRAWN	APPR'D
M	REMOVE TEMP ROAD NOTATION	240313	SB	TP
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K	REVISE STRUCTURE PLAN DESIGN	240214	SB	TP
J	WAPC COMMENTS	231107	TD	TP

CONCEPT PLAN - WATTLEUP NEIGHBOURHOOD
City of Cockburn

JOB CODE	DRAW NO.	REV.
QUB WAT	**RD1 010**	**M**

DISCLAIMER: ISSUED FOR DESIGN INTENT ONLY. ALL AREAS AND DIMENSIONS ARE SUBJECT TO DETAIL DESIGN AND SURVEY

ATTACHMENT B

Geotechnical Report (Galt Geotechnics, 2023)

Report on

ENVIRONMENTAL AND GEOTECHNICAL DUE DILIGENCE ASSESSMENT 343-361 WATTLEUP ROAD WATTLEUP

Submitted to:
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WAE230106-01 001 R Rev0

07 December 2023

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FIGURE 2: Geology Mapping

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APPENDIX B: TEST PIT REPORTS

APPENDIX C: PERTH SAND PENETROMETER TEST RESULTS

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APPENDIX K: GROUNDWATER LABORATORY RESULTS

APPENDIX L: UNDERSTANDING YOUR REPORT

1. INTRODUCTION

This report presents the findings of Galt Environmental's (Galt's) environmental and geotechnical due diligence assessment for the proposed residential development located at Lots 343-361 at Wattleup Road, Wattleup (the site).

The site location relative to the surrounding area is shown on Figure 1.

2. SITE DESCRIPTION AND PROPOSED DEVELOPMENT

The site is relatively rectangular and consists of 3 lots with a total area of approximately 7.38 ha. Publicly available topographical data shows that the surface slopes from RL 24 m AHD along the southern boundary to RL 18 m AHD along Wattleup Road.

Historical aerial imagery shows that the lots have all been previously used for market gardening since the early 1970s. The site contains 2 large tin sheds with evidence of some earthworking and soil stockpiling. We understand the site is likely to be a residential sub-division.

Site photographs taken during fieldwork are presented in Appendix A.

Historical aerial imagery of the site is presented in Figures 4A-4R.

3. OBJECTIVES

The objectives of the study were as follows:

- Assess the potential for contamination to be present based on an assessment of past and present land uses;
- Assess the potential pathways for contains (if any) to migrate from sources to sensitive receptors;
- Assess sensitive reception that may be impacted by contaminants (if any);
- Assess the nature and extent of soil and groundwater contamination (if any) at the site; and
- Determine if site contamination (if any) represents a risk to human health or the environment.

4. SITE CONDITIONS

4.1 Geology

The Fremantle sheet of the 1:50,000 series Environmental Geology series map indicates that the site is underlain by Sand derived from the weathering of Tamala Limestone.

The findings of our investigation are broadly in accordance with geological mapping. In addition, we encountered limestone below 1.5m in the southern portion of the site.

Geology mapping is presented on Figure 2.

4.2 Groundwater

The Perth Groundwater Atlas (1997) maps the historical maximum groundwater level at the site as ranging from RL 13 m AHD in the west to RL 15 m AHD in the east. Groundwater was encountered at depths ranging from 3.3 m to 9.5 m across the site with the shallowest groundwater in the eastern portion of the site.

Groundwater contours are presented on Figure 3C.

4.3 Contaminated Sites

The DWER contaminated sites database was searched for known contaminated sites. This database contains information of sites classified as either 'contaminated - restricted use', 'contaminated – remediation required' or 'remediated for restricted use only'.

This site is not classified as a contaminated site. The nearest contaminated site is approximately 1 km to the southwest. This is classified as 'contaminated – remediation required'.

Contaminated sites mapping is presented in Figure 3A.

4.4 Historical Aerial Imagery

Historical aerial imagery was reviewed to develop an understanding of previous land uses since 1953. The imagery shows the site was undeveloped with natural vegetation until 1970 when Lot 343 was cleared and a small dwelling constructed. At this time, Lot 357 appears to be under cultivation and Lot 361 appears to be partially cleared.

Sometime during 1974 a dwelling was constructed on Lot 361 and all 3 Lots were cleared by 1977. Further sheds were constructed on Lot 357 in 1989 and on Lot 361 sometime in 1995.

All 3 lots remained cleared and appear to be used as market gardens throughout the years until summer of 2013 when the centre Lot 357 appears to be cleared with some earth working and stockpiling present.

Historical aerial imagery is presented in Figures 4A-4R.

4.5 Detailed Site Investigation

A detailed site investigation and walk over was conducted by an environmental scientist from Galt. At the time of investigation, we noticed some fly-tipping in the southern portion of Lot 361. This included building rubble, mostly metal, old furniture and general fill. This material was loosely stockpiled and spread between test pits TP59 and TP60 (see Figure 1).

No asbestos containing material was noted during the site walkover and no fill material was encountered in the excavated test pit materials.

5. FIELDWORK

Fieldwork was carried out between 1 and 15 November 2023 and consisted of:

- Excavation of test pits at 20 locations per lot (60 total) to depths ranging from 1.8 m to 2.5m;
- Collection of soil samples at 0.5 m intervals until the termination of each test pit;
- Installation of 3 groundwater monitoring wells to depths ranging from 5.0 m to 10.6 m;
- Collection of groundwater samples from the newly installed wells;
- Testing with a PSP adjacent to each test pit to a depth of 2.1 m in each instance and;
- Permeability testing at 12 locations (4 per lot) at depths ranging from 0.45 m to 0.7 m.

General

An engineering geologist and environmental scientist from Galt selected and positioned the test locations, conducted a walkover survey, observed the test pitting, logged the materials encountered in the test pits and performed the penetrometer and infiltration testing.

The fieldwork was conducted in general accordance with AS 1726-2017.

Photographs of the site taken during our study are presented in Appendix A.

The approximate test locations are shown on Figure 1, Site and Location Plan.

Test Pits

The test pits were excavated using a JCB 3CX backhoe supplied and operated by ANH Contracting. The materials encountered were logged and sampled for laboratory testing.

The test pit reports along with a list of notes and abbreviation and the method of soil description used on the reports is presented in Appendix B.

Perth Sand Penetrometer Tests

Perth sand penetrometer (PSP) tests were carried out adjacent to each borehole to a depth of 2.1 m. The testing was carried out in accordance with AS1289.6.3.3. The results of the testing are presented in Appendix C.

Infiltration Tests

Infiltration tests were carried out using the 'inverse auger hole' method described by Cocks[1]. The results of the infiltration testing are presented in Appendix D and are summarised in Table 1.

Table 1: Summary of Infiltration Test Results

Test Location	Pipe Embedment (m)	Minimum Unsaturated Hydraulic Conductivity, k (m/day)
IT01	0.70	>15
IT02	0.65	>15
IT03	0.63	>15
IT04	0.57	9.3
IT05	0.45	>15
IT06	0.55	>15
IT07	0.52	5.4
IT08	0.65	>15
IT09	0.50	>15
IT10	0.52	>15
IT11	0.53	>15
IT12	0.55	>15

Notes: 1. Values >15m/day not reported due to inaccuracy of the test in highly permeable material

[1] Cocks, G (2007), "Disposal of Stormwater Runoff by Soakage in Perth Western Australia", Journal and News of the Australian Geomechanics Society, Volume 42 No. 3, pp 101-114.

Groundwater Monitoring Well Installation

Groundwater monitoring wells (GMW) were positioned by an environmental scientist from Galt. The 3 GWMs were installed in boreholes drilled using a track-mounted AMS Power probe operated by Galt. The samples were collected, logged and sampled.

The wells consisted of 50 mm PVC pipe extending to depths ranging from 2.0 m to 7.6 m with a 3.0 m slotted section at the base. A gravel pack was placed over the slotted section of the well in the annulus between the borehole wall and PVC pipe, followed by a bentonite seal (typically 0.3m thick). The remainder of the borehole was filled using leftover sand and finished with cap and lockable monument cover.

The borehole reports along with a list of notes and abbreviation and the method of soil description use on the reports is presented in Appendix E. The GWM well construction reports are presented in Appendix F.

Groundwater Sampling

The groundwater wells were sampled in accordance with the following Australian Standards:

- AS/NZS 5667.1:1998 *Water Quality Sampling. Part I – Guidance on the Design of Sampling Programs, Sampling Techniques and the Preservation and Handling of Samples*; and
- AS/NZS 5667.11:1998 *Water Quality Sampling. Part II – Guidance on the Sampling of Groundwater*.

Groundwater samples were recovered using low-flow methods. The pump was set at the centre of the screened interval and drawdown measured concurrently whilst pumping to ensure the pump flow rates were less than the recharge capacity of the well. An initial flow rate in the order of 0.5-1.0 L/min was used and adjusted to ensure minimal drawdown (<0.1m) during purging. New nitrile disposable gloves were used at each monitoring well location.

Representative samples were collected after stabilisation of groundwater physio-chemical parameters was achieved. Measurements of these parameters, including temperature, pH, electrical conductivity, redox potential and dissolved oxygen, were taken every one minute using calibrated YSI.

Stabilisation of groundwater parameters is considered to be achieved when there is less than 10% variation in physiochemical parameters between three successive readings. The groundwater physio-chemical parameters were recorded on a groundwater field data sheet. The field data sheet also includes physical observations such as colour and turbidity of the purged water, any indications of the presence of contamination, including odour and sheen, the presence of any foreign material or objects, any quality assurance/quality control (QA/QC) sampling and the unique sample identifier.

Groundwater samples were collected directly from the low-flow pump into preserved and labelled, laboratory supplied bottles and filled to zero headspace. Samples that required field filtering were collected using an in-line, single-use, 0.45 µm filter.

All samples were stored on ice within an esky during fieldwork and were couriered to the laboratory at the conclusion of the field work, with adequate packing and ice to ensure that they arrived intact and at the appropriate temperature to ensure sample preservation.

The YSI certificate of calibration is presented in Appendix G.

6. REGULATORY ASSESSMENT CRITERIA

Regulatory assessment criteria for soil and groundwater analysis were selected taking into account the previous land use, proposed use as residential development, applicable soil and groundwater beneficial uses and consistency with relevant published guidelines including the following:

- Department of Environmental Regulation (DER) (2015) *Identification and Investigation of Acid Sulfate Soils and Acidic Landscapes*;
- National Environment Protection (2013) *National Environmental Protection (Assessment of Site Contamination) Measure (NEPM);*
- Department of Health (2014). *Assessment and management of contaminated sites – Contaminated sites guidelines*;
- DER (2014) *Assessment and Management of Contaminated Sites*;
- Australian and New Zealand Environment and Conservation Council (ANZECC) (2000) *Australian and New Zealand Guidelines for Fresh and Marine Water Quality; and*
- Australian and New Zealand Governments (2018) *Australian and New Zealand Guidelines for Fresh and Marine Water Quality; and*

The soil samples were assessed against the following:

- HSL – Health screening levels (RES A);
- EILs – Generic residential and public open space guidelines (1A); and
- HILs – Residential soil guidelines (RES A)

The groundwater samples were assessed against the following:

- GILs – Drinking water guidelines (1C); and
- DoH – Non-potable use of groundwater

We note drinking water is not considered to be a beneficial use of groundwater at the site. However, the assessment criteria have been used for comparative purposes.

7. QUALITY ASSURANCE AND QUALITY CONTROL

Quality assurance/quality control (QA/QC) measures were adopted in accordance with NEPM (2013) *National Environmental Protection (Assessment of Site Contamination) Measures* and are necessary to ensure the precision, accuracy, representativeness, comparability and completeness of the data. The following QA/QC measures were implemented during this assessment:

- collection of field quality control samples including field and inter laboratory duplicate samples at the recommended rate of 1 per 20 primary samples;
- assessment of relative percentage difference (RPD) calculated for field and inter laboratory duplicate samples;
- collection of rinsate samples from equipment used during sampling;
- inclusion of trip blank samples during each sampling event and transportation to the laboratory; and
- all samples were submitted to NATA-accredited laboratories for selected analysis.

The QA/QC program also considered internal laboratory QA/QC results. These include laboratory duplicate and blank sample results, method blanks, surrogates and matrix spikes.

7.1 Field Sampling QA/QC

The purpose of taking field QA/QC samples is to ensure quality and reproducibility of all testing methods used. These samples provide information which eliminates any errors due to sources of cross-contamination, inconsistencies in sampling methods and checks on analytical techniques used.

The following measures were implemented during the sampling program at the site:

- all samples were collected using new disposable nitrile gloves;
- sampling equipment was decontaminated between sampling locations; and
- all samples collected for laboratory analysis were stored in laboratory-supplied containers.

Field duplicate samples were taken in order to identify the variation in analyte concentration between samples collected from the same sampling point, and inter-laboratory duplicate samples were taken for the purpose of repeatability of laboratory analysis. Field duplicate samples were sent along with the primary sample to the primary testing laboratory Eurofins and inter-laboratory duplicate samples were sent to the secondary laboratory MPL Envirolab for analysis.

Rinsate samples were collected and tested to demonstrate samples were free from contamination that could have been introduced to samples through contact with sampling equipment or the sampler, and that decontamination measures undertaken between successive sampling locations were adequate.

Trip (or transport) blank samples were prepared using laboratory supplied de-ionised water and sample containers prior to sampling. These samples were used to demonstrate the presence or absence of cross-contamination of samples during transport and storage.

7.2 Laboratory QA/QC

Laboratory analysis was undertaken by a NATA-accredited laboratory (Eurofins) using NATA-accredited methods of analysis. Galt requires that laboratories have a QA/QC program that is endorsed by NATA to monitor and control every aspect of the laboratory process, including:

- laboratory control samples,
- method blanks,
- matrix spikes,
- laboratory duplicates; and
- surrogates

All internal laboratory QA/QC samples were undertaken at frequencies at or above those detailed in the NEPM guidelines.

7.3 Chain of Custody Documentation

All samples were transported under Galt's internal chain of custody (CoC) procedures. This process details the links in the transfer of samples between the time of collection and arrival at the laboratory including:

- the name of the person transferring the samples;
- the name of the person receiving laboratory samples;
- the time and date the samples were collected;
- time and date samples were received at the laboratory;
- name and contact details of the client;
- scope of analysis applicable to each sample;

- details of the sample matrix; and
- any other specific instructions in the handling of the samples during the analysis.

Chain of custody documentation is provided in Appendix H.

8. ENVIRONMENTAL ASSESSMENT

Laboratory testing was undertaken on groundwater samples and selected soil samples for a range of analysis and potential contaminants relevant to the historical land use at the site. This analysis included:

- Nutrients;
- Heavy metals including leachate; and;
- Organochlorine, organophosphorus and carbamate derived pesticides.

Laboratory testing was undertaken by Eurofins|ARL using NATA accredited laboratory methods of analysis.

Laboratory certificates of analysis are presented in Appendix I.

8.1 Soil

A summary of soil testing results is shown in Table 2 below. The laboratory test results, including relevant assessment criteria, are provided in Appendix J.

Table 2: Summary of Soil Test Results

Analyte	Results Range	Exceedances
Arsenic	< LOR[1] - 4.1 mg/kg	None
Cadmium	< LOR	None
Chromium (III+VI)	1.0 - 12 mg/kg	None
Copper	< LOR – 440 mg/kg	None
Lead	1.0 – 2.9 mg/kg	None
Mercury	0.02 mg/kg	None
Nickel	< LOR – 1.7 mg/kg	None
Zinc	< LOR – 27 mg/L	None
Organochlorine Pesticides	< LOR	None
Organophosphorus Pesticides	< LOR	None
Carbamate Pesticides	< LOR	None

Notes 1. < LOR indicates results were below the laboratory limits of reporting.

8.2 Groundwater

A summary of groundwater results is presented in Table 3 below. The laboratory test results, including relevant assessment criteria, are presented in Appendix K.

Table 3: Summary of Groundwater Results

Analyte	Results Range	Exceedances
Field Parameters		
pH	5.39 – 5.65	None
Electrical Conductivity	174 - 208 µS/cm	None
Redox Potential	27.5 – 112 mV	None
Dissolved Oxygen	0.92 – 5.04 mg/L	None
Laboratory Analysis		
Arsenic	< LOR[1] – 0.04 mg/L	None
Cadmium	< LOR – 0.0003	None
Chromium (III+VI)	< LOR – 0.28 mg/L	None
Copper	0.001 – 0.19 mg/L	None
Lead	< LOR – 0.047 mg/L	3[2]
Mercury	0.0001 mg/L	None
Nickel	< LOR – 0.091 mg/L	1[2]
Zinc	< LOR – 0.24 mg/L	None
Organochlorine Pesticides	< LOR	None
Organophosphorus Pesticides	< LOR	None
Carbamate Pesticides	< LOR	None

Notes
1. < LOR indicates results were below the laboratory limits of reporting
2. All samples exceeded the NEPM drinking water guidelines for lead (0.001 mg/L). Sample MW01 exceeded the NEPM drinking water guidelines for Nickel (0.02 mg/L). NEMP drinking water guidelines are for comparative purposes only.

8.3 Conclusion

Based on the results of the study, we consider it unlikely that soil or groundwater at the site presents a risk to human health or the environment in terms of the proposed land use as a residential development.

We note the exceedances of lead and nickel in groundwater against the drinking water guidelines, however, it is noted that this is for comparative purposes only and drinking water at the site will be scheme supplied.

We consider that the site is suitable for the proposed use as a residential sub-division. We consider that the data collected during this study is an adequate characterisation baseline for the soil and groundwater conditions at the site.

9. GEOTECHNICAL ASSESSMENT

9.1 Site Classification

We consider the site is geotechnically capable of supporting the proposed residential sub-division. We have assessed the site in accordance with AS 2870 (2011) "Residential Slabs and Footings". We consider that a site classification equivalent to "Class A" is appropriate for the site.

The site preparation procedures outlined in Section 9.2 must be completed.

9.2 Site Preparation

The site preparation measures outlined below are required prior to construction of the structure including on-ground slabs, shallow footings (including retaining wall footings) and pavement subgrades.

- Clear and remove all vegetation including grubbing out of tree roots.
- Remove all debris and other deleterious material from site (as encountered).
- Excavate to the required levels. Stockpile suitable excavated material for potential re-use as approved fill (see Section 9.4).
- Compact the exposed sandy surface to achieve the density specified in Section 9.3 to a minimum depth of 0.9 m.
- Any areas of loose sand or unsuitable material must be removed and replaced with approved fill as outlined in Section 9.4.
- Where fill is required to build up levels, use approved fill (see Section 9.4), placed and compacted in layers of no greater than 300 mm loose thickness in accordance with Section 9.3.

9.3 Compaction

Approved granular fill and the *in situ* sand must be compacted using suitable compaction equipment to achieve a dry density ratio of at least 95% MMDD (maximum modified dry density) as determined in accordance with AS 1289.5.2.1 at a moisture content within 2% of optimum moisture content (OMC).

Granular fill must be placed in horizontal layers of not greater than 300 mm loose thickness. Each layer must be compacted by suitable compaction equipment, and carefully controlled to ensure even compaction over the full area and depth of each layer.

Where clean sand (<5% gravel, <5% fines, including *in situ* sand) is used as fill and the Perth sand penetrometer (PSP) is used for compaction control, the following PSP blow counts may be assumed to correlate to the required dry density ratio of 95% MMDD:

- Depth range 0.0 m to 0.15 m: SET
- Depth range 0.15 m to 0.45 m: 8 blows
- Depth range 0.45 m to 0.75 m: 10 blows
- Depth range 0.75 m to 1.05 m: 12 blows

If difficulties are experienced recording the required blow counts, a site-specific PSP correlation should be carried out to determine the PSP blow count correlating to a DDR of 95% MMDD. The correlation must:

- be done on site;
- use the nuclear density gauge (NDG) to determine density at a minimum of 5 points with varying density to a depth of 300 mm below surface;

- at least one point must be at a density greater than 95% MMDD;
- use a calibrated PSP to determine the PSP blow count from 150 mm to 450 mm at each of the NDG test points; and
- be plotted on a chart of PSP blow count vs DDR.

Any other fill (i.e., with >5% gravel or >5% fines) must be tested using a nuclear density gauge in accordance with AS1289.5.8.1.

Over-excavation and replacement of loose materials must be done where the minimum dry density ratio cannot be achieved.

Fill must be placed in horizontal layers of not greater than 300 mm loose thickness. Each layer must be compacted by suitable compaction equipment, and carefully controlled to ensure even compaction over the full area and depth of each layer.

Testing Frequency

After compaction, verify that the required density has been achieved by testing at the base of excavation and through the full depth of any fill and to a minimum depth of 0.9 m. The frequency of testing should be as follows:

- on each lift of fill at the rate of 1 test per 500 m^3 or at least 2 tests per layer (4 tests per layer below the building footprint), whichever is greater;
- at each spread footing location;
- at 10 m centres along gravity retaining wall footings and strip footings (where present); and
- at 20 m centres below on-ground slabs and pavements.

Vibrations

Care will need to be taken when compacting in the vicinity of existing structures, such as adjacent properties. This is particularly important if vibratory compaction is being carried out. Tynan (1973)[2] provides guidance on the selection of compaction equipment for use adjacent to structures.

Large compaction equipment (self-propelled vibrating rollers, etc.) must not be used within 2 m behind retaining walls. Hand compaction plant (e.g. plate compactors) must be used.

9.4 Approved Fill

Imported granular fill must comply with the material requirements as stated in AS 3798-2007, "Guidelines on Earthworks for Commercial and Residential Developments". Sand fill must comprise clean sand that is free of organic or deleterious matter and have a fines content of less than 5%.

Generally, we consider the sand material present at the site is suitable for re-use as inert structural fill. Any other structural fill must meet the following requirements:

- must not contain any putrescible deleterious inclusions or rubbish.
- organic content must be less than 2% by weight.
- must not contain any particles greater than 100 mm in size.
- have a fines content of less than 5%.

Where doubt exists, a geotechnical engineer must be engaged to inspect and approve the use of potential fill materials.

[2] Tynan (1973) Ground Vibration and Damage Effects on Buildings, Australia Road Research Board, Special Report No. 11.

9.5 Excavation and Batters

The subsurface conditions on site comprise sand, overlying inferred iron cemented sand, overlying sand, to the maximum depth of our investigation (8.2 m below current ground levels). We consider that excavation will be readily achieved to a depth of at least 2.5 m using conventional earthmoving equipment (i.e., with a 15 tonne or larger excavator with a toothed bucket).

Excavations in sand are prone to instability unless support is provided. Care must be exercised in such excavations and appropriate safety measures adopted where necessary (refer to the Code of Practice Excavation (2005) published by the commission for occupational safety and health).

Excavations at least 1 m above the groundwater level must be battered at slopes no steeper than 1V:2H for temporary slopes and 1V:3H for permanent slopes where no external restraint is provided to the slope (suitable for slope heights up to 2 m with no surcharge at the crest of the slope). Even at these slope angles erosion and rilling may occur. Where steeper slopes are required, temporary or permanent slope retention must be employed.

Where open batters cannot be accommodated, temporary/permanent retaining structures must be installed prior to excavation. The stability of open excavations must be carefully assessed by the contractor during construction.

A geotechnical engineer must be consulted where there is any doubt regarding the stability or safety of unsupported excavations.

9.6 Footings

Footings and on-ground slabs for single / double storey houses may be designed for a Class A site in accordance with AS2870-2011.

All foundation excavations must be assessed by a competent person prior to blinding.

9.7 Retaining Structures

Retaining structures may be designed in accordance with AS 4678-2002 “Earth-Retaining Structures”. Design soil parameters for granular soils are provided in Table 6.

Table 4: Design Parameters for Retaining Structures

Soil Type	Bulk Density (kN/m^3)	Angle of Internal Friction (deg.)	Wall Friction = 0°		Wall Friction = 0.5Φ	
			Coefficient of Active Earth Pressure, K_a	Coefficient of Passive Earth Pressure, K_p	Coefficient of Active Earth Pressure, K_a	Coefficient of Passive Earth Pressure, K_p
Compacted *in situ* sand or sand fill	18	34	0.28	3.5	0.25	5.7

Notes:
1. Earth pressure coefficients are provided in this table for conditions of zero friction between the wall and the soil and with wall friction of 0.5Φ’.
2. A horizontal ground surface behind the wall has been assumed.
3. The retaining wall designer should make an independent assessment of the parameters appropriate to the construction method to be used, including alternative values of wall friction.

Compaction plant can augment the lateral earth pressure acting on retaining walls. Hand operated compaction equipment is recommended within 2 m of any retaining walls to minimise compaction pressures.

It is important to note that some ground movement will occur behind any soil retaining system, including gravity retaining walls.

Retaining walls can move and rotate under imposed soil loading resulting in settlement behind the wall. This must be considered in the design and during construction of the retaining walls in order that adjacent properties are not adversely affected. Particular care should be exercised when forming excavations so as not to affect neighbouring properties. Account must be taken of the effect of both temporary and permanent works on neighbouring properties. Anchoring or strutting of retaining walls may be required.

Detailed design of retaining structures should be undertaken using methods appropriate to the proposed retention system. We can provide further advice / design if required.

9.8 Stormwater Disposal

We consider that the sands at the site are suitable for the disposal of stormwater by infiltration by means of soak wells provided that the bases are at least 0.5 m above the historical maximum groundwater elevation.

Notwithstanding the results of the permeability testing, we recommend a design value of permeability (k) not greater than 5 m/day for the *in situ* sand to allow for the variability in materials and reduced permeability as a consequence of:

- densification of sand during site preparation works;
- natural variation in sands; and
- clogging of the sand around soak wells and soakage basins over time with fines.

Soak wells should be placed outside a line of 1V:2H extending below the edge of the nearest footing, subject to local council regulations. Discharge from soak wells has been known to promote densification of loose sandy soils, leading to settlements of footings and slabs. Soak wells should be carefully wrapped with geotextile to prevent migration of sand and fines into the soak well.

9.9 Pavement Design

A subgrade California bearing ratio, CBR of 12% may be assumed for pavement design where the site preparation detailed in Section 9.2 has been completed.

10. LIMITATIONS

We draw your attention to Appendix L of this report, "Understanding Your Report". The information provided within is intended to inform you as to what your realistic expectations of this report should be. This information is provided not to reduce the level of responsibility accepted by Galt, but to ensure that all parties who rely on this report are aware of the responsibilities each assumes in so doing so.

GALT ENVIRONMENTAL

Brad Palmer	Sarah Carter
Environmental Scientist	Environmental Scientist

https://galtgeo.sharepoint.com/sites/WAE230106/Shared Documents/01 Qube SI Wattleup Rd/03 Correspondence/WAE230106-01 001 R Rev0.docx

Figures

www.galtenv.com.au
50 Edward Street OSBORNE PARK WA 6017
ABN: 96 520 810 622

Legend

- Site Boundary
- Groundwater Monitoring Well
- Infiltration Test
- Test Pit

N

0 20 40 60 80 100
Meters

NOTES
Aerial Imagery and Cadastre sourced from Landgate/SLIP

SCALE	1:1,500	(A3)
DRAWN	CED	
DATE DRAWN	7/12/2023	
CHECKED	–	
DATE CHECKED	–	
PROJECTION	GDA 1994 MGA Zone 50	

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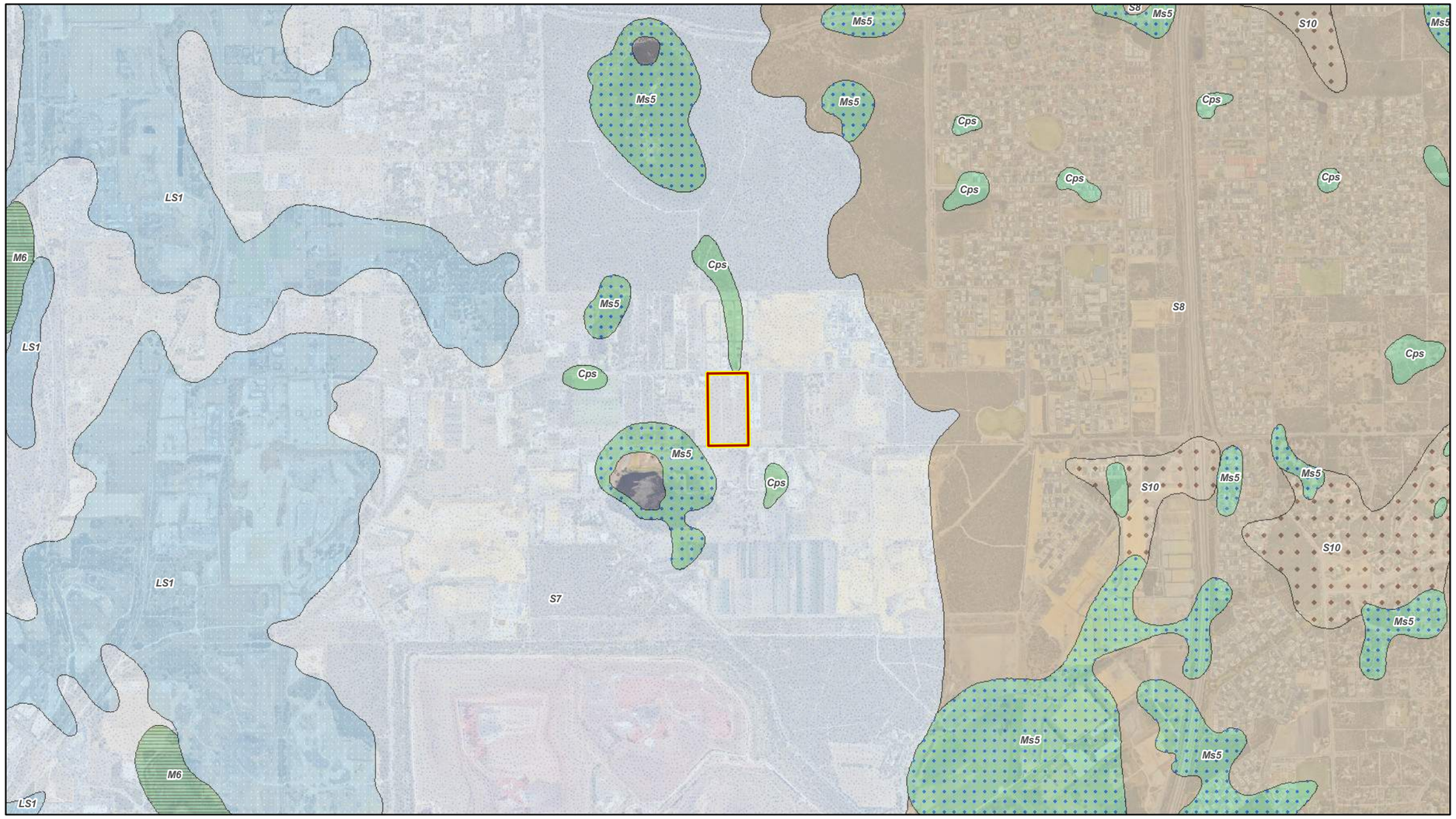
CLIENT	**QUBE PROPERTY**
PROJECT	ENVIRONMENTAL AND GEOTECHNICAL DD
LOCATION	343, 357 AND 361 WATTLEUP ROAD HAMMOND PARK
TITLE	SITE & LOCATION PLAN
Job No	WAE230106-01
Fig No	FIGURE 1
Rev	**A**



GEOLOGY MAP

FREMANTLE:20334	CODE, NARRATIVE
Cps	Cps: PEATY CLAY - dark grey and black, soft, variable organic content, some quartz sand in places, of lacustrine origin
LS1	LS1: LIMESTONE - pale yellowish brown, fine to coarse-grained, sub-angular to well rounded, quartz, trace of feldspar, shell debris, variably lithified, surface kankar, of eolian origin
M6	M6: SILT - brownish grey, calcareous in part, soft, some fine sand content in places, of lacustrine origin
Ms5	Ms5: SANDY SILT - dark brownish grey silt, with disseminated fine-grained quartz sand, firm, variable clay content, of lacustrine origin
S10	S10: SAND - as S8 as relatively thin veneer over strong, blocky, brown silts and clays
S7	S7: SAND - pale yellowish brown, medium to coarse-grained sub-angular quartz, trace of feldspar, moderately sorted, of residual origin
S8	S8: SAND - very light grey at surface, yellow at depth, fine to medium-grained, sub-rounded quartz, moderately well sorted, of eolian origin

GEOLOGY MAP LEGEND

Geology sourced from the GSWA 1:50 000 mapsheet FREMANTLE (ENVIRONMENTAL GEOLOGY)

Legend

Site Boundary

100K DIGITAL GEOLOGY

NOT AVAILABLE

FREMANTLE(2033)

250K DIGITAL GEOLOGY

NOT AVAILABLE

PINJARRA(SI 50-2)

N

0 400 800 1200 1600 2000

Meters

NOTES

Aerial Imagery and Cadastre sourced from Landgate/SLIP

SCALE	1:25,000	(A3)
DRAWN	CED	
DATE DRAWN	17/10/2023	
CHECKED	–	
DATE CHECKED	–	
PROJECTION	GDA 1994 MGA Zone 50	

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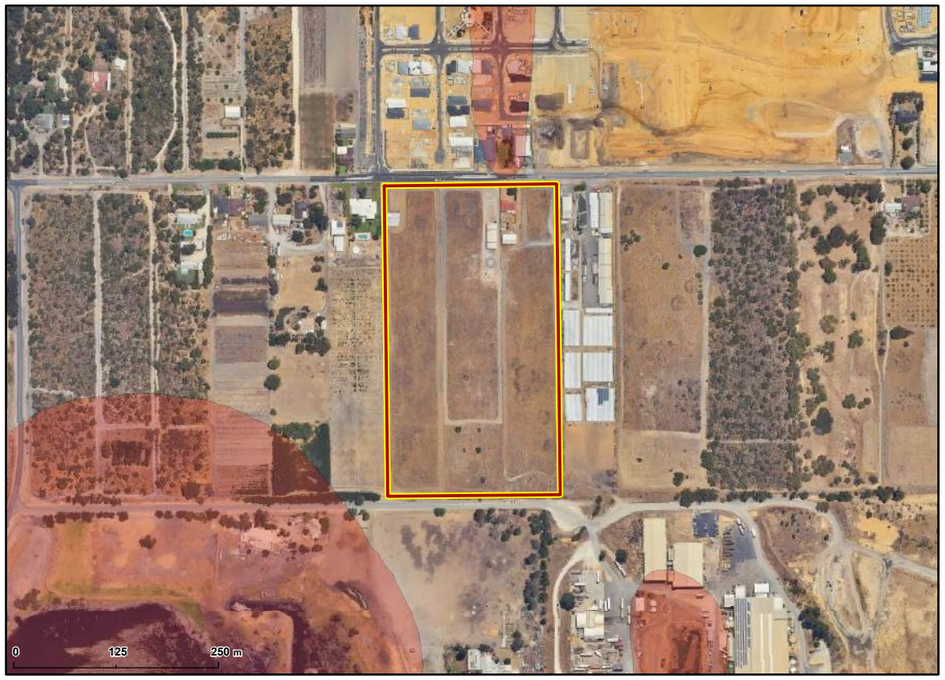
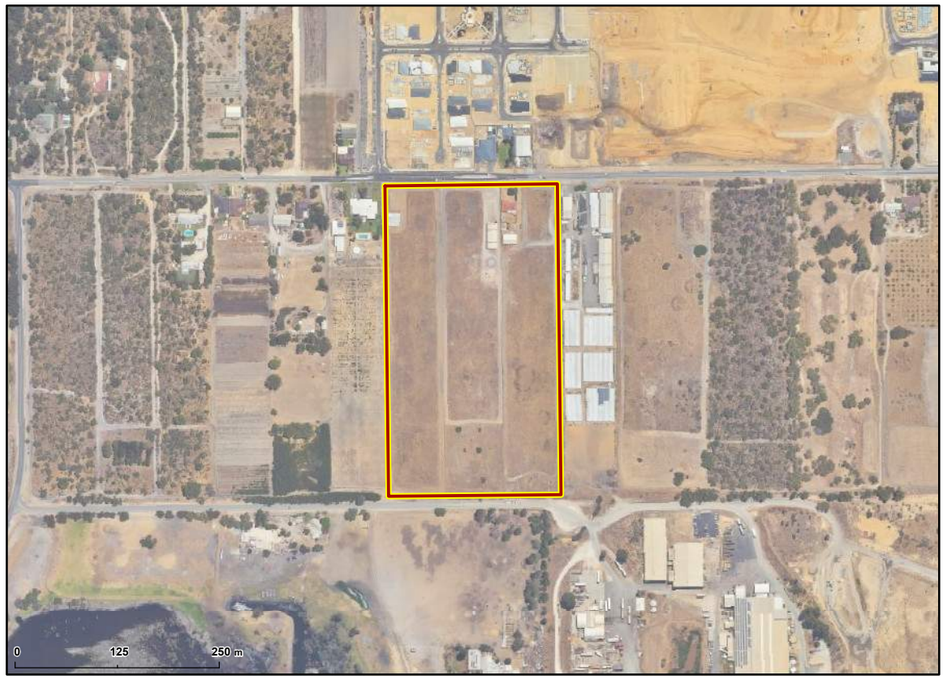
SITE	WATTLEUP RD HAMMOND PARK
LOCATION	343, 357 AND 361 WATTLEUP ROAD HAMMOND PARK
TITLE	GEOLOGY
Job No	WAE230106
Fig No	FIGURE 2
Rev	A



ACID SULFATE SOIL RISK MAPPING

- High to moderate risk
- Moderate to low risk
- High Risk of ASS (CSIRO NatASS_1902103)
- Low Risk of ASS (CSIRO NatASS_1902103)

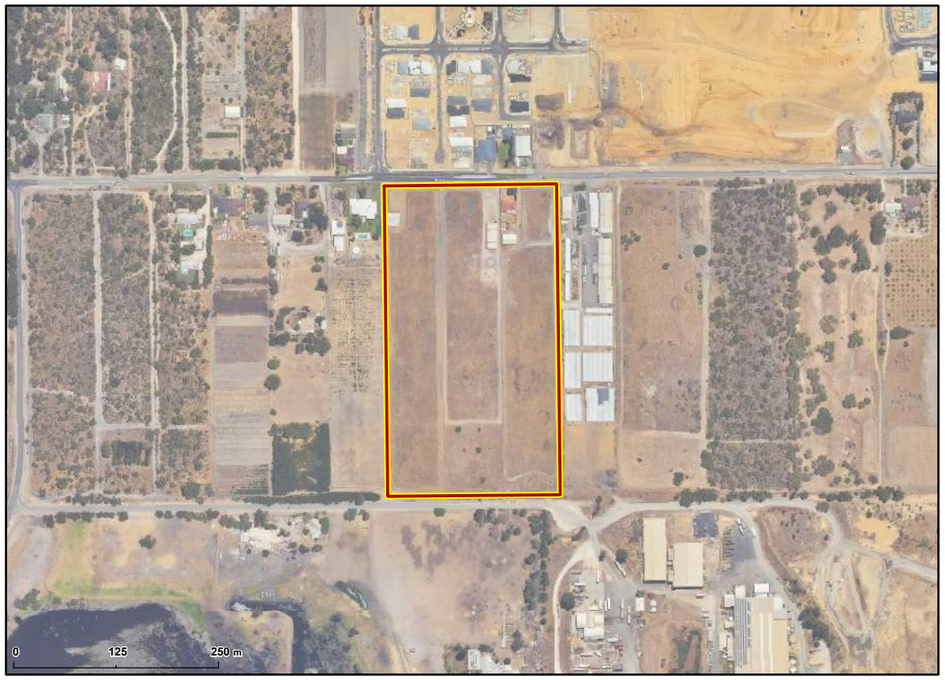
ACID SULFATE SOIL RISK MAPPING information sourced from DER datasets DER-003, DER-004, DER-008, DER-009, DER-010, DER-011. The information shows the risk of Acid Sulfate Soil (ASS) materials being disturbed by land development activities based on the likelihood of ASS materials occurring within soil profiles. This data was developed to assist planners in assessing whether development applications require additional conditions for sites where there is a risk disturbing ASS. The NatASS_1902103 was sourced from the CSIRO and covers the areas not subject to mapping by DER.



CONTAMINATED SITES

- Contaminated - remediation required
- Contaminated - restricted use
- Remediated for restricted use
- Contaminated - remediation required
- Contaminated - restricted use
- Remediated for restricted use

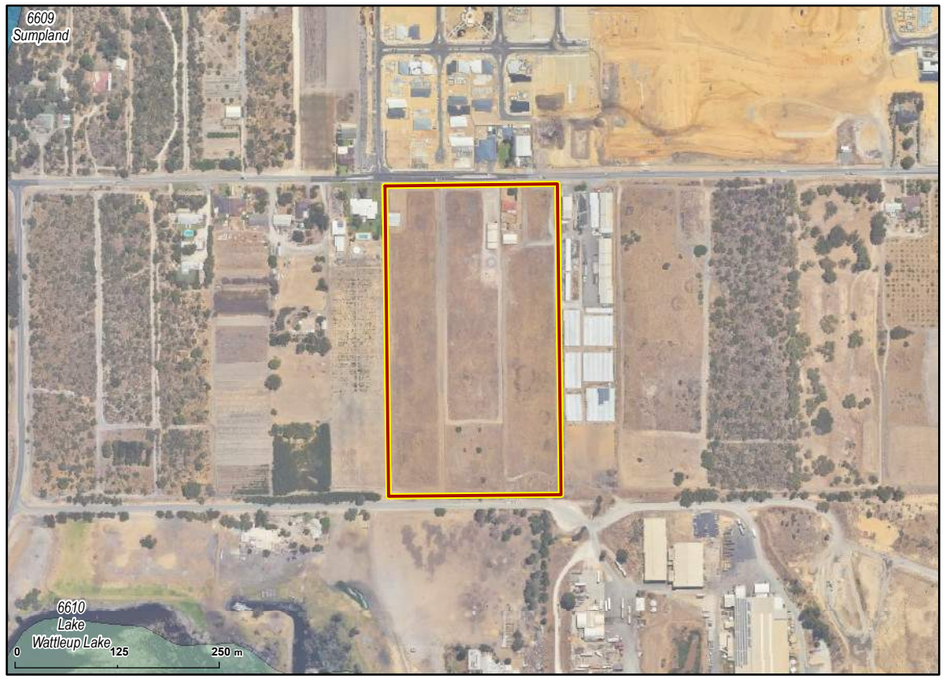
CONTAMINATED SITES information sourced from Contaminated - Reported Sites (DER-015) dataset.
The Contaminated Sites Database holds information on confirmed contaminated sites (those classified 'contaminated-remediation required', 'contaminated-restricted use' and remediated for restricted use').
Information on all other reported sites is recorded on the Reported Sites Register



RAMSAR SITES

- RAMSAR site
- Directory of Important Wetlands

This RAMSAR SITES dataset describes the official boundaries of the nine wetland areas initially proposed in February 1990 by the Government of Western Australia for listing as Wetlands of International Importance under the Convention on Wetlands of Importance especially as Waterfowl Habitat, otherwise known as the Ramsar Convention. These nine sites were added to the Ramsar Convention official List of Wetlands of International Importance in June 1990.
The Directory of Important Wetlands is a polygon coverage representing the Western Australian wetlands cited in the "A Directory of Important Wetlands in Australia" Third Edition (EA, 2001), plus various additions for wetlands listed after 2001. The full dataset is collated by the Australian Government Department of the Environment from various datasets supplied by the relevant State agencies. A subset of the WA Important Wetlands are listed as RAMSAR wetlands.



GEOMORPHIC WETLANDS

- Multiple Use
- Resource Enhancement
- Conservation
- Not Applicable
- Not Assessed

GEOMORPHIC WETLANDS information sourced from datasets DBCA-013, - DBCA-019, DBCA-040, DBCA-43 & DBCA-44. Refer to https://catalogue.data.wa.gov.au/organization/department-of-biodiversity-conservation-and-attractions for additional information.

Legend

- Site Boundary

N

0 120 240 360 480 600
Meters

NOTES
Aerial Imagery sourced from Landgate / SLIP

SCALE	1:7,500	(A3)
DRAWN	CED	
DATE DRAWN	17/10/2023	
CHECKED	–	
DATE CHECKED	–	
PROJECTION	GDA 1994 MGA Zone 50	

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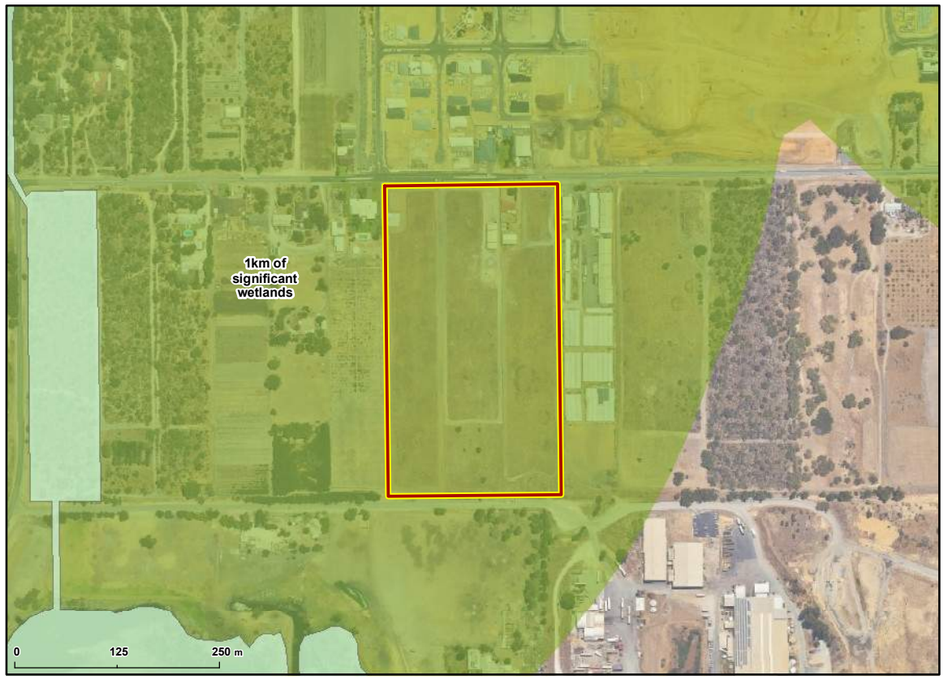
SITE	WATTLEUP RD HAMMOND PARK
LOCATION	343, 357 AND 361 WATTLEUP ROAD HAMMOND PARK
TITLE	INDICATIVE ENVIRONMENTAL ASPECTS (1 OF 4)
Job No	WAE230106
Fig No	FIGURE 3A
Rev	A



CLEARING REGULATIONS - ENVIRONMENTALLY SENSITIVE AREAS & GOVERNMENT SEWERAGE POLICY

Environmentally Sensitive Areas

Government Sewerage Policy

a) Estuary catchments on the Swan and Scott Coastal Plains

b) The Brockman River catchment

c) Within 2km of selected estuaries and inlets

d) Within 2km of the estuarine areas of selected rivers

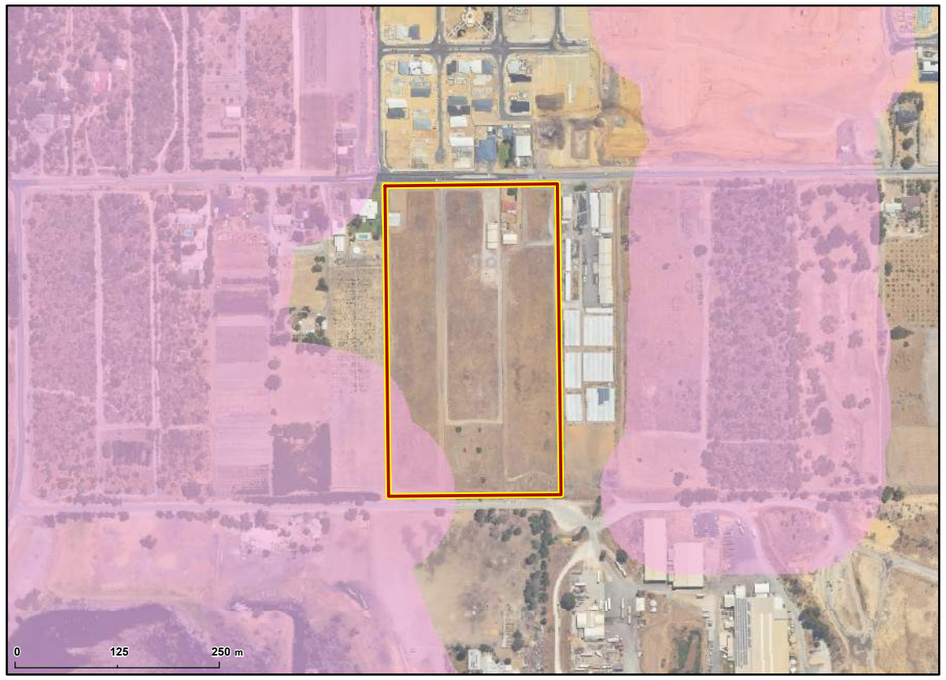
e) 2km of coastal embayments

f) 1km of significant wetlands

g) Habitats of specially protected water-dependent fauna, and within 1km of groundwater dependent threatened and priority ecological communities

h) Wild rivers catchment

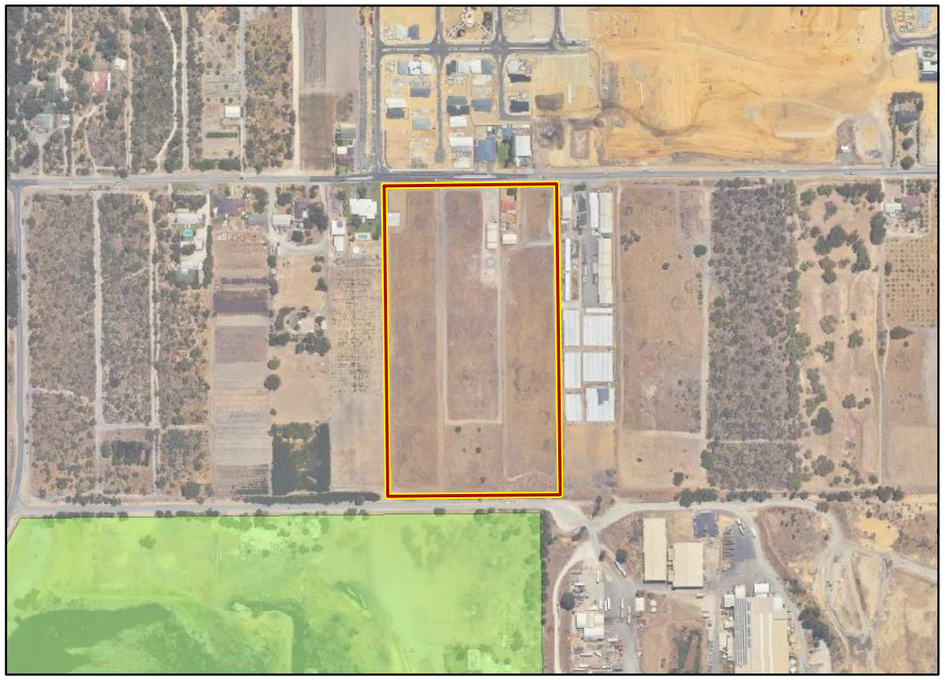
CLEARING REGULATIONS - ENVIRONMENTALLY SENSITIVE AREAS & GOVERNMENT SEWERAGE POLICY information sourced from Clearing Regulations - Environmentally Sensitive Areas (DER-016). Environmentally Sensitive Areas as declared in Environmental Protection (Environmentally Sensitive Areas) Notice 2005, Government Gazette No. 55. This dataset is provided to assist landowners and managers in determining the location of environmentally sensitive areas under the Environmental Protection Act 1986. It is not a substitute for any requirement of the legislation.



BUSH FIRE PRONE AREAS

Bush Fire Prone Areas 2021 (OBRM-019)

BUSH FIRE PRONE AREAS information sourced from Bush Fire Prone Areas 2019 dataset (OBRM-015) and identifies bush fire prone areas of Western Australia as designated by the Fire and Emergency Services (FES) Commissioner on 31 July 2019. Bush fire prone areas are subject to, or likely to be subject to, bush fire attack. A bush fire prone area is identified by the presence of and proximity to bush fire prone vegetation, and includes both the area containing the bush fire prone vegetaion and a 100 metre buffer zone immediately surrounding it.



EUROPEAN HERITAGE

European Heritage (Heritage Council WA)

Protection Order (DPLH_004)

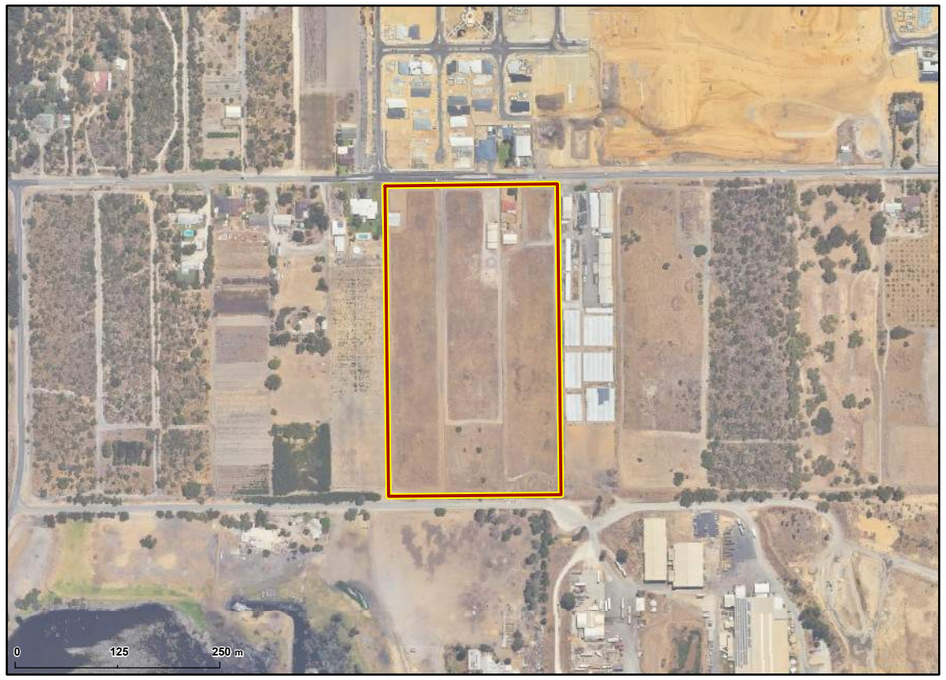
Heritage Agreements (DPLH_005)

State Register (DPLH_006)

Assessment Program (DPLH_007)

Local Heritage Survey (DPLH_008)

EUROPEAN HERITAGE datasets Protection Order (DPLH_004) protect places of cultural heritage significance to Western Australia from damage. Heritage Agreements (DPLH_005) are entered into between a property owner and the Heritage Council or another public authority on behalf of the State in return for planning approval or other concessions granted to the owner. The State Register of Heritage Places (DPLH_006) recognises a place's value and importance to Western Australia. It includes buildings, structures, gardens, cemeteries, landscapes and archaeological sites and has more than 1,300 places listed in it. The State Register is managed by the Heritage Council and provides a place with statutory protection to ensure that any proposed demolition, relocation, subdivision, amalgamation, alteration, addition or new development is in harmony with its cultural heritage values. When a place is on the Heritage Council's Assessment Program (DPLH-007), it means that the Heritage Council has an interest in the place and it will be assessed and considered for inclusion on the State Register of Heritage Places. The Local Heritage Survey (DPLH_008)[Previously called Municipal Inventory] is a list of places within a local district which are, or may become, of cultural heritage significance. For further information about Local Heritage Surveys, contact the relevant Local Government.



ABORIGINAL HERITAGE

Contact DAA

Lodged

Registered Site

Stored Data / Not a Site

ABORIGINAL HERITAGE sourced from Aboriginal Heritage Places (DPLH-001) contains places within Western Australia that have been reported to the Registrar of Aboriginal Sites as possible Aboriginal sites within the meaning of the Aboriginal Heritage Act 1972 (AHA).This includes: Registered Sites – being places assessed by the Aboriginal Cultural Material Committee (ACMC) as meeting the criteria for section 5 of the AHA. Lodged Places - being places that are yet to be formally assessed by the ACMC against the criteria of section 5 stored Data – being places the ACMC has assessed to which section 5 of the AHA does not apply.

Legend

Site Boundary

N

0 120 240 360 480 600

Meters

NOTES

Aerial Imagery sourced from Landgate / SLIP

SCALE	1:7,500	(A3)
DRAWN	CED	
DATE DRAWN	17/10/2023	
CHECKED	–	
DATE CHECKED	–	
PROJECTION	GDA 1994 MGA Zone 50	

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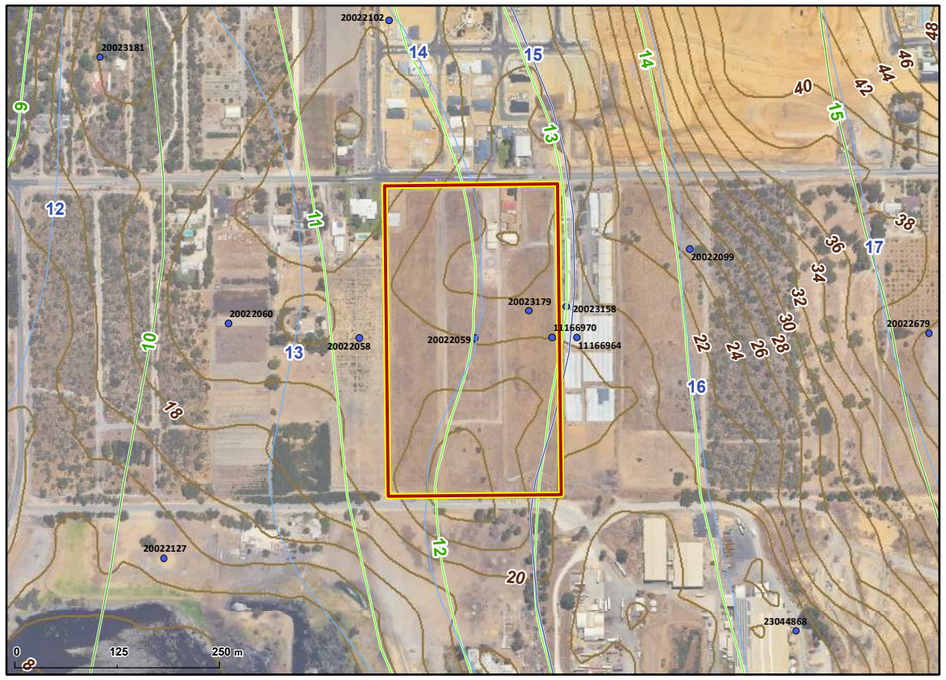
SITE	WATTLEUP RD HAMMOND PARK
LOCATION	343, 357 AND 361 WATTLEUP ROAD HAMMOND PARK
TITLE	INDICATIVE ENVIRONMENTAL ASPECTS (2 OF 4)

Job No	Fig No	Rev
WAE230106	FIGURE 3B	A



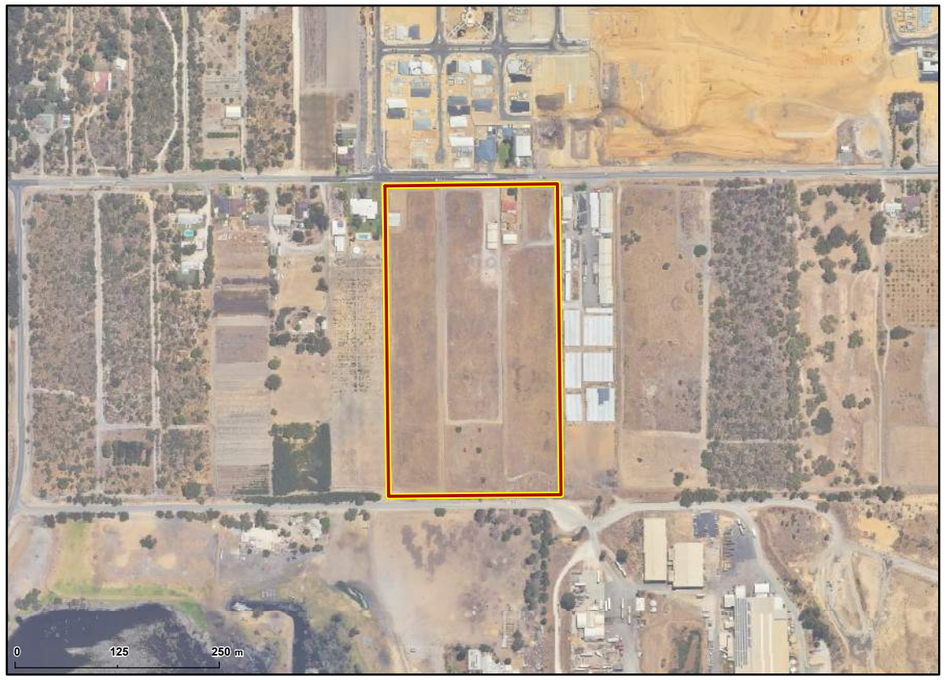
GROUNDWATER CONTOURS & WIN SITES

Historical Maximum (1997)
- 5m
- 1m

End of Summer (2003)
- 5m
- 1m

WIN Sites
- Ground, Borehole or Well
- Other

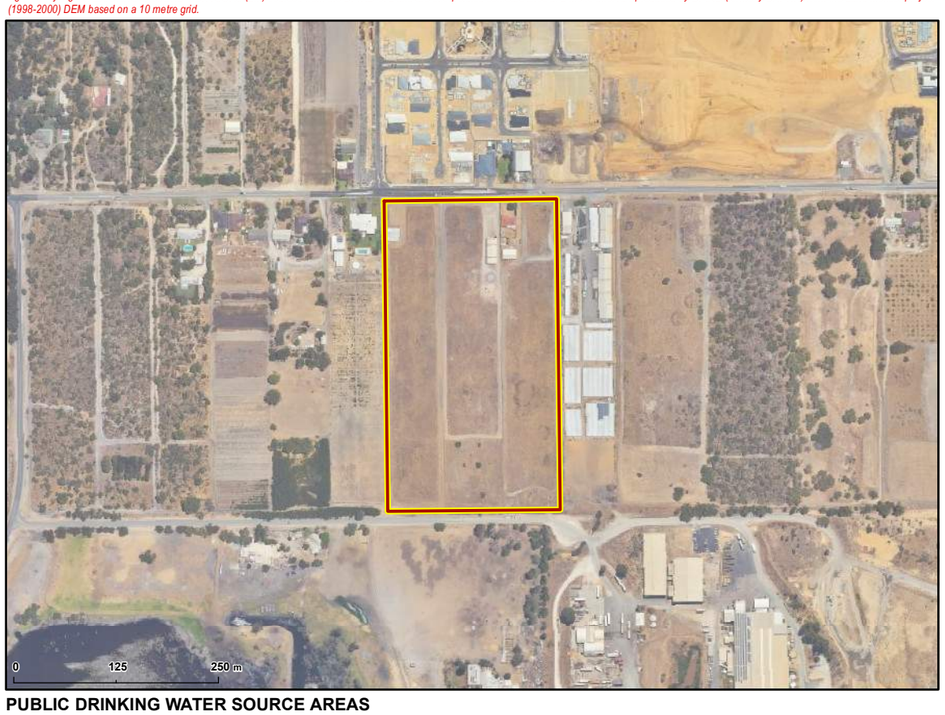
GROUNDWATER CONTOURS & WIN SITES information sourced from the Department of Water. The Perth Groundwater Atlas (1997) shows the historical maximum groundwater level. The Perth Groundwater Atlas (2004) shows the May 2003 (late summer) groundwater level. We note that the 2004 atlas typically reflects the seasonal minimum groundwater levels and the historical maximum groundwater level is likely to be significantly higher. EXISTING GROUND CONTOURS (2m) sourced from the DPIRD-072 and are Interpolated contours lines at 2 metre intervals produced by DPIRD (formerly DAFWA) from the Land Monitor project (1998-2000) DEM based on a 10 metre grid.



FLOODPLAIN MAPPING

- Floodplain Development Control Area
- Not a Floodplain Development Control Area
- Flood Fringe
- Floodway
- FPM 1 in 100 (1%) AEP Flood Fringe Line
- 1 in 10 (10%) AEP floodplain
- 1 in 20 (5%) AEP floodplain
- 1 in 25 (4%) AEP floodplain
- 1 in 50 (2%) AEP floodplain
- 1 in 100 (1%) AEP floodplain
- 1 in 200 (0.5%) AEP floodplain
- 1 in 500 (0.2%) AEP floodplain
- Designated flood event floodplain
- Maximum Channel Capacity
- Probable maximum flood

FLOODPLAIN MAPPING information sourced from Department of Water datasets (DOW-032), (DOW-041), (DOW-043), (DOW-054). The Dept of Water produces 100 year ARI floodplain mapping of rivers and major watercourses. The 100 year ARI flood level is expected to occur, on average, once every 100 years. Floods higher than this level will occur but will be less frequent. Floodplain development strategies are then developed to ensure that proposed floodplain development has adequate flood protection and does not impact on the existing flood regime of the area.



PUBLIC DRINKING WATER SOURCE AREAS

- P1 AREA
- P2 AREA
- P3 AREA
- P3* AREA
- PRIORITY NA

PUBLIC DRINKING WATER SOURCE AREAS information sourced from datasets Public Drinking Water Source Areas (DWER-033) Public drinking water source areas (PDWSAs) are surface water catchments and groundwater areas that provide drinking water to cities, towns and communities throughout the state. PDWSAs are proclaimed under the Metropolitan Water Supply, Sewerage, and Drainage Act 1909 or the Country Areas Water Supply Act 1947. Groundwater sources are normally referred to as underground water pollution control areas or water reserves. Surface water sources are generally referred to as catchment areas. In response to the 2010-11 dry season, the Department of Water updated the areas suitable/unsuitable for additional garden bores in the Perth region.

GARDEN BORE SUITABILITY

- Suitable
- Unsuitable

GARDEN BORE SUITABILITY information sourced from datasets Garden Bore Suitability (DWER-025). In response to the 2010-11 dry season, the Department of Water updated the areas suitable/unsuitable for additional garden bores in the Perth region. Areas designated unsuitable for additional garden bores have included the following factors: - salinity levels likely to be 1500 mg/L TDS or greater (in some instances >1000 mg/L TDS) because of proximity to river or ocean; - proximity to conservation wetlands (EPP 2004, Conservation, and Resource Enhancement); - potential for unreliable supply to clay soils (Guildford Clay); areas of thin superficial formations underlain by Rockingham Sand and/or Leederville Formation; and - potential for development of acid sulphate soils. - current Gnangara Mound groundwater abstraction risk map plus buffers around wetlands recommended for protection in the Gnangara Sustainability Strategy.

Legend

- Site Boundary

N

0 120 240 360 480 600
Meters

NOTES
Aerial Imagery sourced from Landgate / SLIP

SCALE	1:7,500	(A3)
DRAWN	CED	
DATE DRAWN	17/10/2023	
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DATE CHECKED	–	
PROJECTION	GDA 1994 MGA Zone 50	

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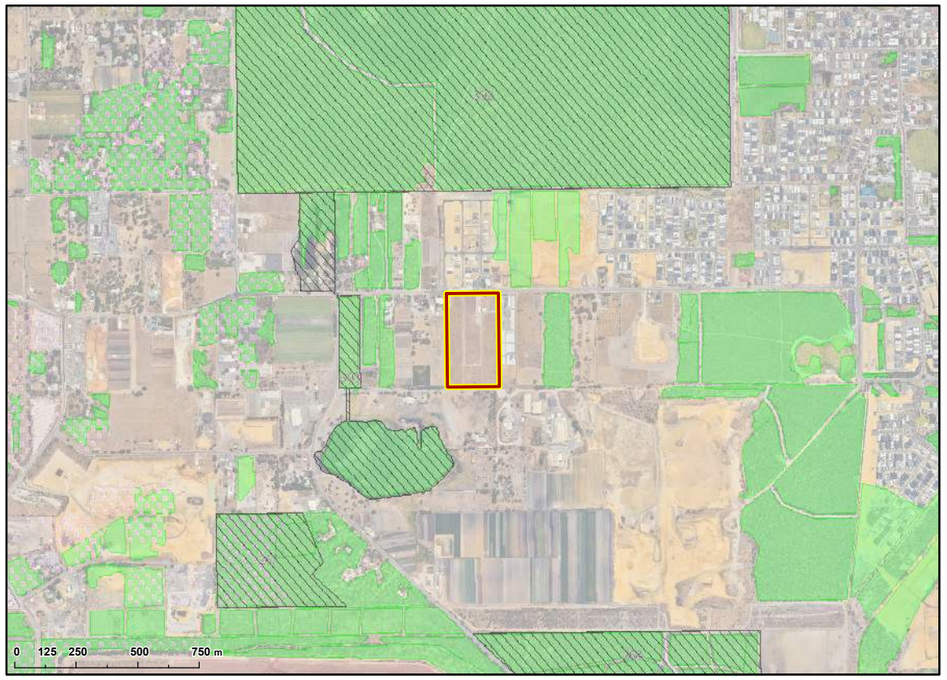
SITE	WATTLEUP RD HAMMOND PARK
LOCATION	343, 357 AND 361 WATTLEUP ROAD HAMMOND PARK
TITLE	INDICATIVE ENVIRONMENTAL ASPECTS (3 OF 4)

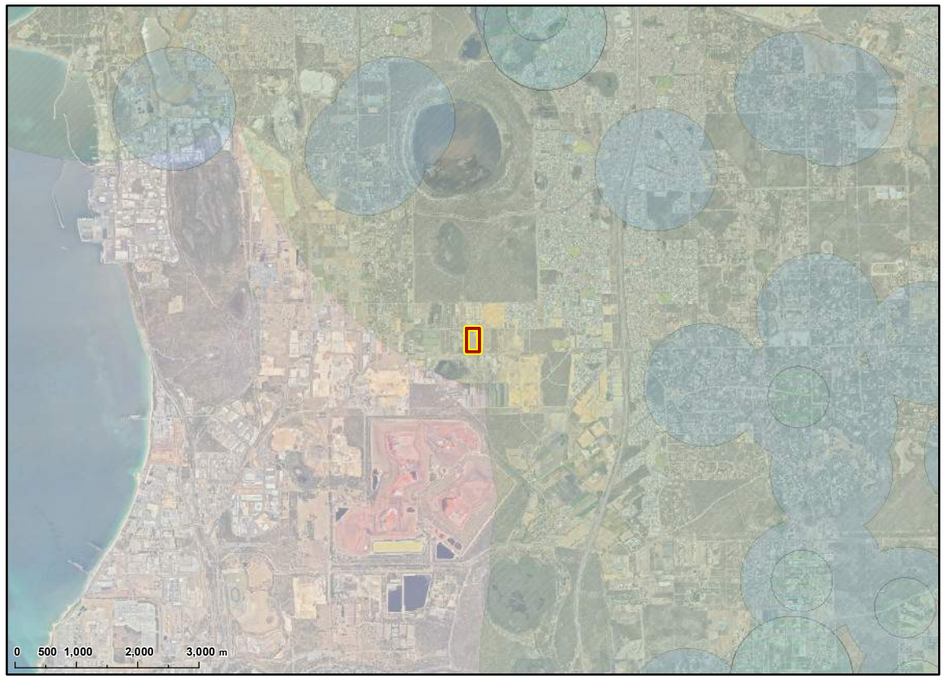
Job No	Fig No	Rev
WAE230106	FIGURE 3C	A



SIGNIFICANT VEGETATION

- Bush Forever Areas 2000 (DOP-071)
- Forest Disease Risk Areas (DBCA-024)
- Native Vegetation Extent (DPIRD-005)
- Tuart Woodlands (DBCA-048)

The Bush Forever layer (DOP-071) is the original Bush Forever Areas in 2000 sourced from Department of Planning.The Forest Disease Risk Areas (DBCA-024) is from the official statutory plans from the DEC GIS Branch. The Department of Biodiversity, Conservation and Attractions (DBCA) maintains this dataset. The Native Vegetation Extent (DPIRD-005) data set contains the vegetation extent from the mapping of remnant vegetation in Western Australia and is maintained by Department of Primary Industries and Regional Development. Tuart Woodlands (DBCA-048) shows the areas of conservation, management due to the serious decline in the condition of tuart woodlands in the past few years.



SIGNIFICANT FAUNA

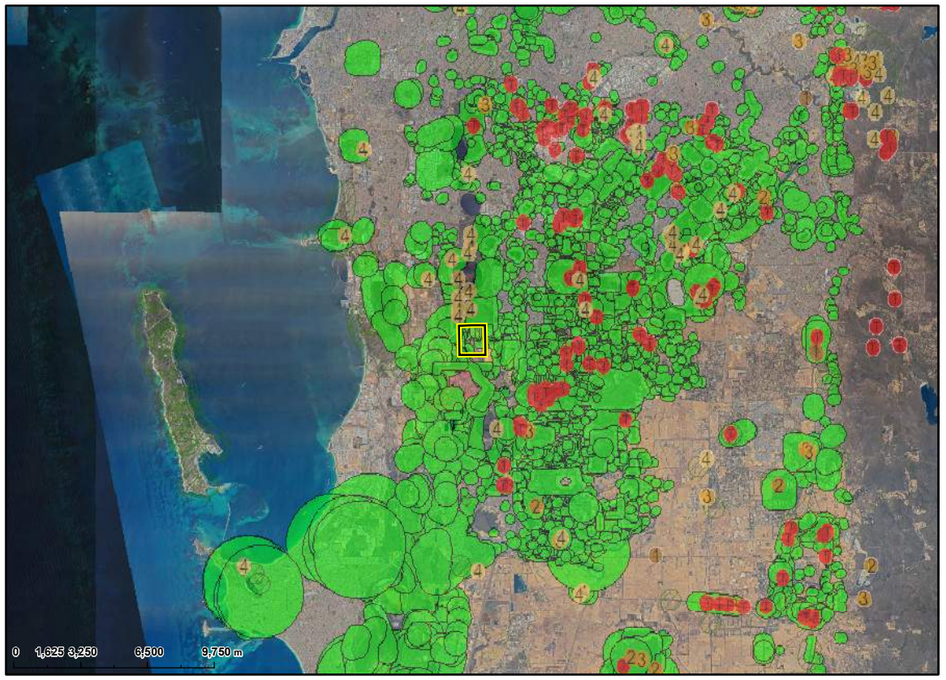
Western Ringtail Possum Habitat Suitability
- Very High
- High
- Medium
- Low
- Very Low
- Unsuitable

Carnabys Cockatoo
- Breeding Area - Confirmed Roost Sites
- Unconfirmed Roost Sites
- Confirmed Roost Sites Buffered 6km

Black Cockatoo
- Roosting Sites Buffered
- Breeding Sites Buffered

Western Swamp Tortoise
- EPP2003 Western Swamp TortoisePolicy Boundary
- Western Swamp Tortoise Habitat

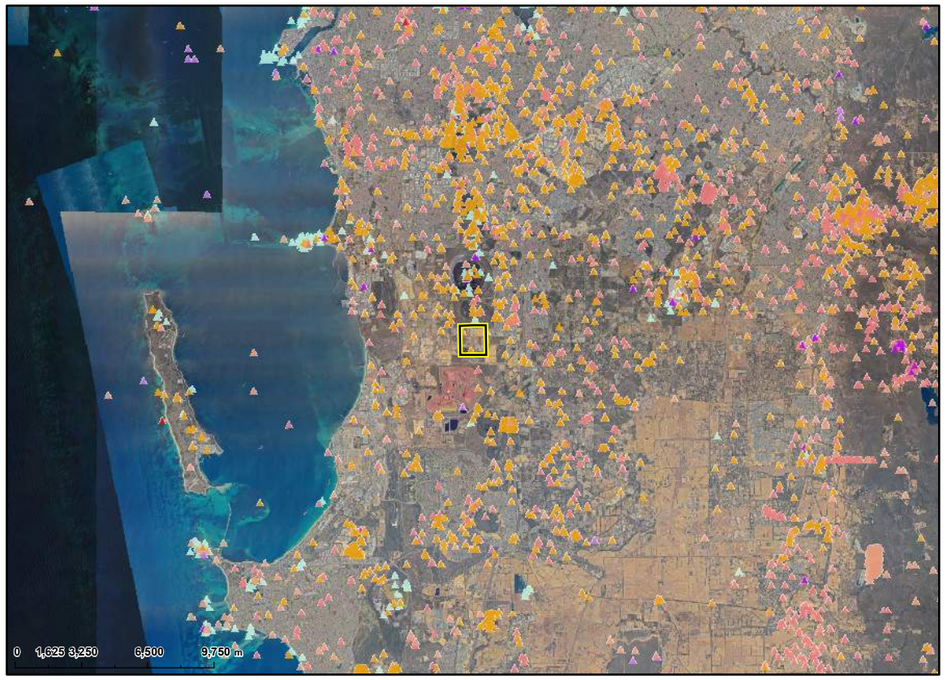
(DBCA-050) describes the currently known and confirmed night roost areas for Carnaby's Black Cockatoo in the South - West of Western Australia. A confirmed site is a site where CBC were recorded roosting as part of a formal roost survey (using the Great Cocky Count method in which birds are recorded as they settle, 30 minutes either side of sunset), as described by Berry (2006). (DBCA-052) is a 6km buffer around a confirmed site.Buffering was done to cover roost movement and recording accuracy. Roosts were buffered to 6km to indicate the likely feeding area of the roost. (DBCA-054) Shows the confirmed breeding areas of the Carnaby's Black Cockatoo (CBC) within the Swan Coastal Plain and the Jarrah Forest IBRA regions. Confirmed sites are identified where chicks or eggs of CBC have been observed.



THREATENED AND PRIORITY FLORA & ECOLOGICAL COMMUNITIES

- 1 Priority 1
- 2 Priority 2
- 3 Priority 3
- 4 Priority 4
- T Threatened
- X Extinct
- Priority
- Threatened

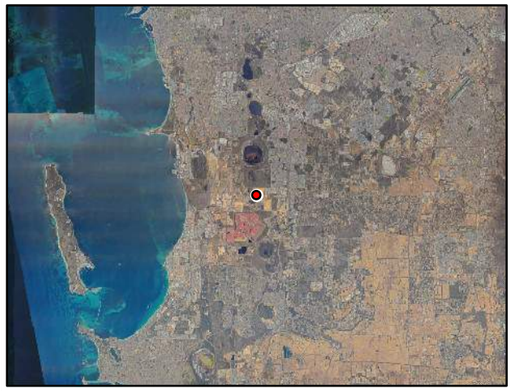
Threatened and Priority Flora (DBCA-036) describes threatened (declared rare) and priority flora populations for all land tenures, within the State of Western Australia. Threatened Ecological Communities (DBCA-038) describes Threatened Ecological Community (TEC) and Priority Ecological Community (PEC) Sites (Buffered) in WA. Threatened Ecological Communities (TEC) have been endorsed by the minister as threatened while Priority Ecological Communities (PEC) are those which have not yet been endorsed. Threatened Ecological Communities are described as either: "Presumed Totally Destroyed", "Critically Endangered", "Endangered" and "Vulnerable" while Priority Ecological Communities are described as being "Priority 1-5". Other Ecological Communities can be described as being: "Lower Risk" or "Not evaluated". Communities are based on various life-forms including plants, invertebrates and micro-organisms.



THREATENED AND PRIORITY FAUNA

- Threatened - Critically Endangered
- Threatened - Endangered
- Threatened - Vulnerable
- Presumed Extinct
- Specially Protected - Migratory Birds
- Specially Protected - Conservation Dependent
- Specially Protected - Other Specially Protected
- Priority Fauna

Threatened and Priority Fauna (DBCA-037) data set has been derived from the following two databases: 1. The WA Threatened and Priority Fauna Database which contains records of observations of any fauna listed as threatened under the Wildlife Conservation Act 1950 or listed on the Dept. of Biodiversity, Conservation and Attractions (DBCA) Priority Fauna List. This data is maintained by DBCA. 2. The DBCA Fauna Survey Database which contains records of Western Australian fauna from sources including historical reports, DBCA staff, survey data from major projects, consultants, and the general public that are licence holders. This data is managed by DBCA. The information is used to assist the Department with the management of fauna populations especially in relation to proposed land developments or activities likely to impact on fauna and fauna habitat. Data and/or information from the database can be accessed by written request to the Principle Zoologist, Species and Communities Branch. Detailed location information for individual species is generally kept confidential unless direct conservation benefits to the species can be demonstrated.



Legend

- Site Boundary

N

0 400 800 1200 1600 2000
Meters

NOTES
Aerial Imagery sourced from Landgate / SLIP

SCALE	1:25,000	(A3)
DRAWN	CED	
DATE DRAWN	17/10/2023	
CHECKED	–	
DATE CHECKED	–	
PROJECTION	GDA 1994 MGA Zone 50	

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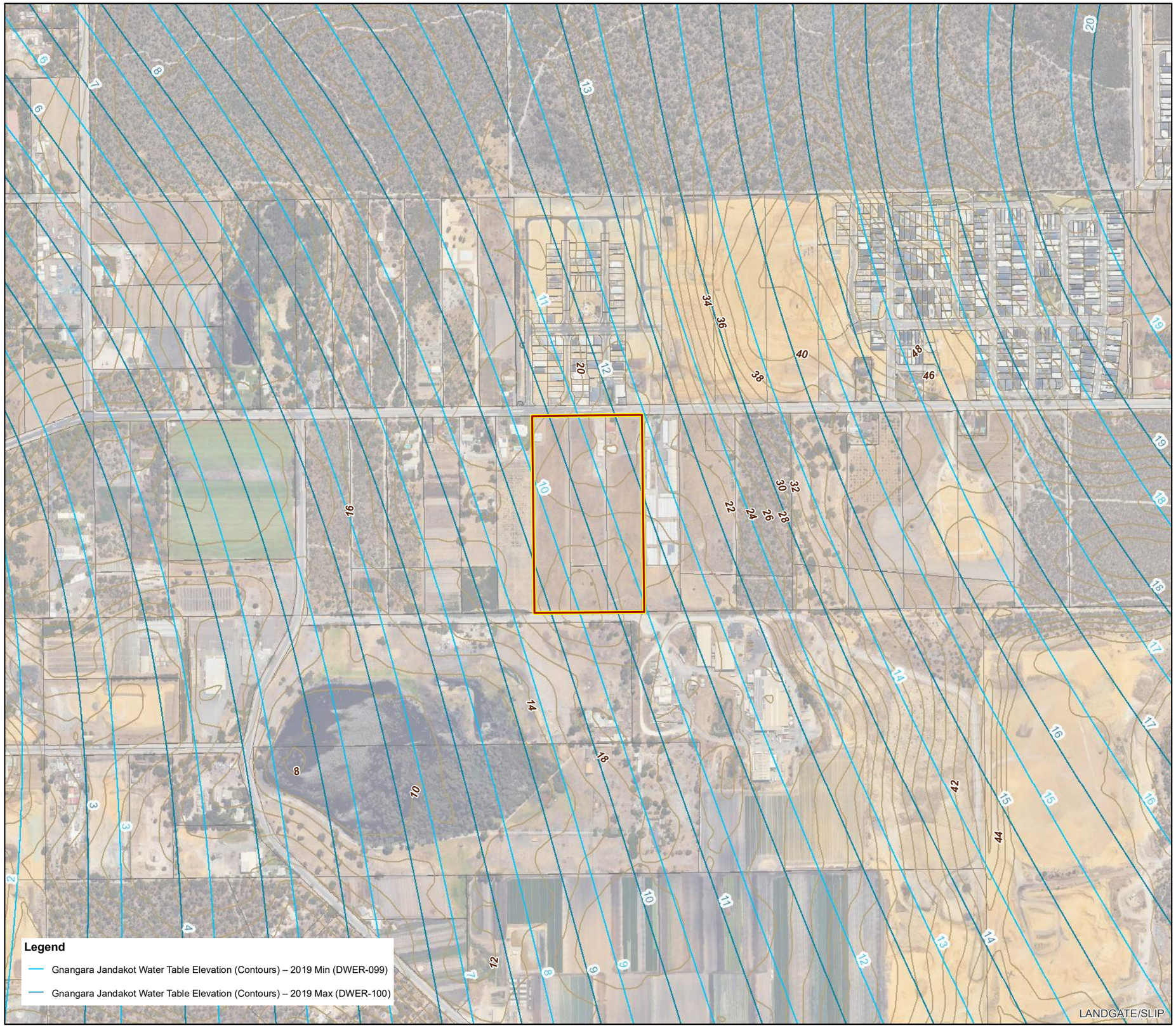
SITE	WATTLEUP RD HAMMOND PARK
LOCATION	343, 357 AND 361 WATTLEUP ROAD HAMMOND PARK
TITLE	INDICATIVE ENVIRONMENTAL ASPECTS (4 OF 4)
Job No	WAE230106
Fig No	FIGURE 3D
Rev	A



N

0 110 220 330 440 550
Meters

NOTES
Aerial Imagery sourced from Landgate / SLIP

SCALE	1:7,500	(A3)
DRAWN	CED	
DATE DRAWN	17/10/2023	
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DATE CHECKED	_	
PROJECTION	GDA 1994 MGA Zone 50	

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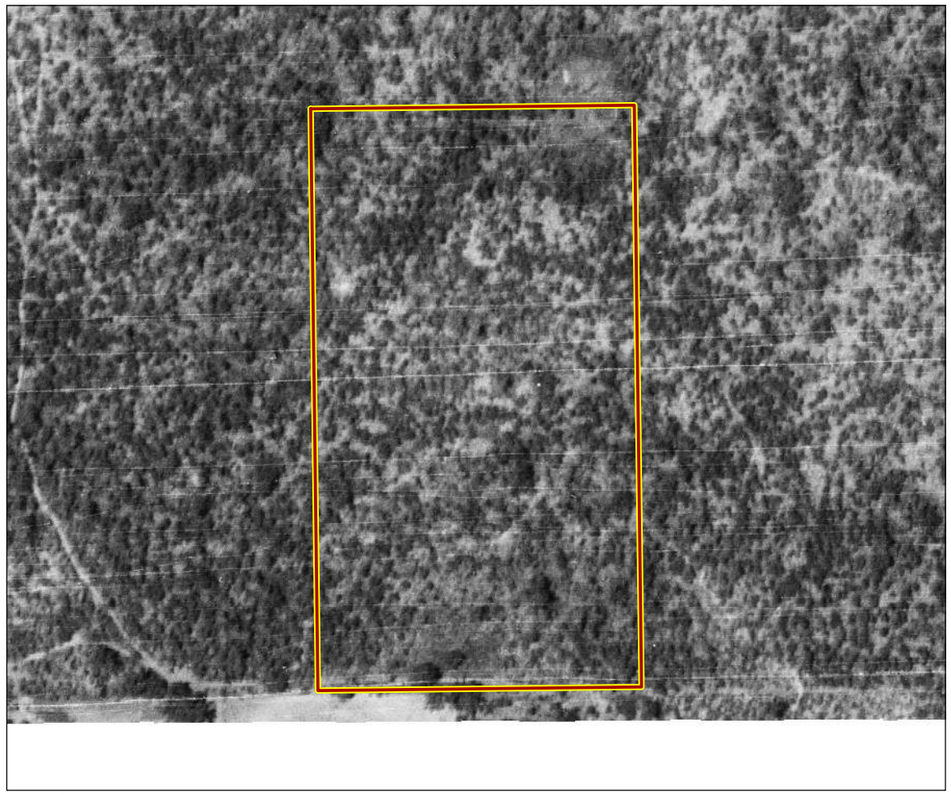
SITE	WATTLEUP RD HAMMOND PARK
LOCATION	343, 357 AND 361 WATTLEUP ROAD HAMMOND PARK
TITLE	GROUNDWATER CONTOURS - GNANGARA TO
Job No	WAE230106
Fig No	FIGURE 3 E
Rev	A

MAP 1 - 1953



MAP 2 - 1961

MAP 3 - 1965

MAP 4 - 1970

LEGEND

Site Boundary

N

0 60 120 180 240 300

Meters

NOTES

Aerial Imagery and Cadastre sourced from Landgate/SLIP

SCALE	1:4,000	(A3)
DRAWN	CED	
DATE DRAWN	17/10/2023	
CHECKED	–	
DATE CHECKED	–	
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SITE	WATTLEUP RD HAMMOND PARK
LOCATION	343, 357 AND 361 WATTLEUP ROAD HAMMOND PARK
TITLE	AERIAL IMAGERY (1953 - 1970)

Job No	Fig No	Rev
WAE230106	FIGURE 4A	A

MAP 5 - 1974

MAP 6 - 1977

MAP 7 - 1979

MAP 8 - 1981

LEGEND

Site Boundary

N

0 60 120 180 240 300

Meters

NOTES

Aerial Imagery and Cadastre sourced from Landgate/SLIP

SCALE	1:4,000	(A3)
DRAWN	CED	
DATE DRAWN	17/10/2023	
CHECKED	–	
DATE CHECKED	–	
PROJECTION	GDA 1994 MGA Zone 50	

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SITE	WATTLEUP RD HAMMOND PARK
LOCATION	343, 357 AND 361 WATTLEUP ROAD HAMMOND PARK
TITLE	AERIAL IMAGERY (1974 - 1981)

Job No	Fig No	Rev
WAE230106	FIGURE 4B	A

MAP 9 - 1983

MAP 10 - 1985

MAP 11 - 1989

MAP 12 - 1995

LEGEND

Site Boundary

N

0 60 120 180 240 300

Meters

NOTES

Aerial Imagery and Cadastre sourced from Landgate/SLIP

SCALE	1:4,000	(A3)
DRAWN	CED	
DATE DRAWN	17/10/2023	
CHECKED	–	
DATE CHECKED	–	
PROJECTION	GDA 1994 MGA Zone 50	

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SITE	WATTLEUP RD HAMMOND PARK
LOCATION	343, 357 AND 361 WATTLEUP ROAD HAMMOND PARK
TITLE	AERIAL IMAGERY (1983 - 1995)

Job No	Fig No	Rev
WAE230106	FIGURE 4C	A

MAP 13 - 2000

MAP 14 - 2001

MAP 15 - 2002

MAP 16 - 2003

LEGEND

Site Boundary

N

0 60 120 180 240 300

Meters

NOTES

Aerial Imagery and Cadastre sourced from Landgate/SLIP

SCALE	1:4,000	(A3)
DRAWN	CED	
DATE DRAWN	17/10/2023	
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DATE CHECKED	–	
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SITE	WATTLEUP RD HAMMOND PARK
LOCATION	343, 357 AND 361 WATTLEUP ROAD HAMMOND PARK
TITLE	AERIAL IMAGERY (2000 - 2003)

Job No	Fig No	Rev
WAE230106	FIGURE 4D	A

MAP 17 - 2004

MAP 18 - 2005

MAP 19 - 2006

MAP 20 - 2006

LEGEND

Site Boundary

N

0 60 120 180 240 300

Meters

NOTES

Aerial Imagery and Cadastre sourced from Landgate/SLIP

SCALE	1:4,000	(A3)
DRAWN	CED	
DATE DRAWN	17/10/2023	
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DATE CHECKED	–	
PROJECTION	GDA 1994 MGA Zone 50	

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SITE	WATTLEUP RD HAMMOND PARK
LOCATION	343, 357 AND 361 WATTLEUP ROAD HAMMOND PARK
TITLE	AERIAL IMAGERY (2004 - 2006)

Job No	Fig No	Rev
WAE230106	FIGURE 4E	A

MAP 21 - 2007

MAP 22 - 2007

MAP 23 - 2008

MAP 24 - 2008

LEGEND

Site Boundary

N

0 60 120 180 240 300

Meters

NOTES

Aerial Imagery and Cadastre sourced from Landgate/SLIP

SCALE	1:4,000	(A3)
DRAWN	CED	
DATE DRAWN	17/10/2023	
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DATE CHECKED	–	
PROJECTION	GDA 1994 MGA Zone 50	

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SITE	WATTLEUP RD HAMMOND PARK
LOCATION	343, 357 AND 361 WATTLEUP ROAD HAMMOND PARK
TITLE	AERIAL IMAGERY (2007 - 2008)

Job No	Fig No	Rev
WAE230106	FIGURE 4F	A

MAP 25 - 2009

MAP 26 - 2009

MAP 27 - 2010

MAP 28 - Summer 2011

LEGEND

Site Boundary

N

0 60 120 180 240 300

Meters

NOTES

Aerial Imagery and Cadastre sourced from Landgate/SLIP

SCALE	1:4,000	(A3)
DRAWN	CED	
DATE DRAWN	17/10/2023	
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DATE CHECKED	–	
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SITE	WATTLEUP RD HAMMOND PARK
LOCATION	343, 357 AND 361 WATTLEUP ROAD HAMMOND PARK
TITLE	AERIAL IMAGERY (2009 - SUMMER 2011)

Job No	Fig No	Rev
WAE230106	FIGURE 4G	A

MAP 29 - Winter 2011

MAP 30 - Summer 2012

MAP 31 - Winter 2012

MAP 32 - Summer 2013

LEGEND

Site Boundary

N

0 60 120 180 240 300

Meters

NOTES

Aerial Imagery and Cadastre sourced from Landgate/SLIP

SCALE	1:4,000	(A3)
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DATE CHECKED	–	
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SITE	WATTLEUP RD HAMMOND PARK
LOCATION	343, 357 AND 361 WATTLEUP ROAD HAMMOND PARK
TITLE	AERIAL IMAGERY (WINTER 2011 - SUMMER 2013)

Job No	Fig No	Rev
WAE230106	FIGURE 4H	A

MAP 33 - Winter 2013

MAP 34 - Summer 2014

MAP 35 - Autumn 2014

MAP 36 - Winter 2014

LEGEND

Site Boundary

N

0 60 120 180 240 300

Meters

NOTES

Aerial Imagery and Cadastre sourced from Landgate/SLIP

SCALE	1:4,000	(A3)
DRAWN	CED	
DATE DRAWN	17/10/2023	
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SITE	WATTLEUP RD HAMMOND PARK
LOCATION	343, 357 AND 361 WATTLEUP ROAD HAMMOND PARK
TITLE	AERIAL IMAGERY (WINTER 2013 - WINTER 2014)

Job No	Fig No	Rev
WAE230106	FIGURE 4I	A

MAP 37 - Spring 2014

MAP 38 - Summer 2015

MAP 39 - Autumn 2015

MAP 40 - Winter 2015

LEGEND

Site Boundary

N

0 60 120 180 240 300

Meters

NOTES

Aerial Imagery and Cadastre sourced from Landgate/SLIP

SCALE	1:4,000	(A3)
DRAWN	CED	
DATE DRAWN	17/10/2023	
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DATE CHECKED	–	
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SITE	WATTLEUP RD HAMMOND PARK
LOCATION	343, 357 AND 361 WATTLEUP ROAD HAMMOND PARK
TITLE	AERIAL IMAGERY (SPRING 2014 - WINTER 2015)

Job No	Fig No	Rev
WAE230106	FIGURE 4J	A

MAP 41 - Spring 2015

MAP 42 - Summer 2016

MAP 43 - Autumn 2016

MAP 44 - Winter 2016

LEGEND

Site Boundary

N

0 60 120 180 240 300

Meters

NOTES

Aerial Imagery and Cadastre sourced from Landgate/SLIP

SCALE	1:4,000	(A3)
DRAWN	CED	
DATE DRAWN	17/10/2023	
CHECKED	–	
DATE CHECKED	–	
PROJECTION	GDA 1994 MGA Zone 50	

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SITE	WATTLEUP RD HAMMOND PARK
LOCATION	343, 357 AND 361 WATTLEUP ROAD HAMMOND PARK
TITLE	AERIAL IMAGERY (SPRING 2015 - WINTER 2016)

Job No	Fig No	Rev
WAE230106	FIGURE 4K	A

MAP 45 - Spring 2016

MAP 46 - Jan Inset 2017

MAP 47 - Summer 2017

MAP 48 - Autumn 2017

LEGEND

Site Boundary

N

0 60 120 180 240 300

Meters

NOTES

Aerial Imagery and Cadastre sourced from Landgate/SLIP

SCALE	1:4,000	(A3)
DRAWN	CED	
DATE DRAWN	17/10/2023	
CHECKED	–	
DATE CHECKED	–	
PROJECTION	GDA 1994 MGA Zone 50	

Galt Environmental Pty Ltd
ACN : 161 708 998
Tel : +61 (0)8 6272-0200
Address : 50 Edward Street
Osborne Park WA 6017

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SITE	WATTLEUP RD HAMMOND PARK
LOCATION	343, 357 AND 361 WATTLEUP ROAD HAMMOND PARK
TITLE	AERIAL IMAGERY (SPRING 2016 - AUTUMN 2017)

Job No	Fig No	Rev
WAE230106	FIGURE 4L	A

MAP 49 - Winter 2017

MAP 50 - Oct Inset 2017

MAP 51 - Spring 2017

MAP 52 - Summer 2018

LEGEND

Site Boundary

N

0 60 120 180 240 300

Meters

NOTES

Aerial Imagery and Cadastre sourced from Landgate/SLIP

SCALE	1:4,000	(A3)
DRAWN	CED	
DATE DRAWN	17/10/2023	
CHECKED	–	
DATE CHECKED	–	
PROJECTION	GDA 1994 MGA Zone 50	

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Address : 50 Edward Street
Osborne Park WA 6017

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SITE	WATTLEUP RD HAMMOND PARK
LOCATION	343, 357 AND 361 WATTLEUP ROAD HAMMOND PARK
TITLE	AERIAL IMAGERY (WINTER 2017 - SUMMER 2018)

Job No	Fig No	Rev
WAE230106	FIGURE 4M	A

MAP 53 - Autumn 2018

MAP 54 - Winter 2018

MAP 55 - Dec Inset 2018

MAP 56 - Summer 2019

LEGEND

Site Boundary

N

0 60 120 180 240 300

Meters

NOTES

Aerial Imagery and Cadastre sourced from Landgate/SLIP

SCALE	1:4,000	(A3)
DRAWN	CED	
DATE DRAWN	17/10/2023	
CHECKED	–	
DATE CHECKED	–	
PROJECTION	GDA 1994 MGA Zone 50	

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Tel : +61 (0)8 6272-0200
Address : 50 Edward Street
Osborne Park WA 6017

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SITE	WATTLEUP RD HAMMOND PARK
LOCATION	343, 357 AND 361 WATTLEUP ROAD HAMMOND PARK
TITLE	AERIAL IMAGERY (AUTUMN 2018 - SUMMER 2019)

Job No	Fig No	Rev
WAE230106	FIGURE 4N	A

MAP 57 - Apr Inset 2019

MAP 58 - Winter 2019

MAP 59 - Nov Inset 2019

MAP 60 - Summer 2020

LEGEND

Site Boundary

N

0 60 120 180 240 300

Meters

NOTES

Aerial Imagery and Cadastre sourced from Landgate/SLIP

SCALE	1:4,000	(A3)
DRAWN	CED	
DATE DRAWN	17/10/2023	
CHECKED	–	
DATE CHECKED	–	
PROJECTION	GDA 1994 MGA Zone 50	

Galt Environmental Pty Ltd
ACN : 161 708 998
Tel : +61 (0)8 6272-0200
Address : 50 Edward Street
Osborne Park WA 6017

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SITE	WATTLEUP RD HAMMOND PARK
LOCATION	343, 357 AND 361 WATTLEUP ROAD HAMMOND PARK
TITLE	AERIAL IMAGERY (APR INSET 2019 - SUMMER 2020)

Job No	Fig No	Rev
WAE230106	FIGURE 4O	A

MAP 61 - Apr Inset 2020

MAP 62 - Winter 2020

MAP 63 - Dec Inset 2020

MAP 64 - Summer 2021

LEGEND

Site Boundary

N

0 60 120 180 240 300

Meters

NOTES

Aerial Imagery and Cadastre sourced from Landgate/SLIP

SCALE	1:4,000	(A3)
DRAWN	CED	
DATE DRAWN	17/10/2023	
CHECKED	–	
DATE CHECKED	–	
PROJECTION	GDA 1994 MGA Zone 50	

Galt Environmental Pty Ltd
ACN : 161 708 998
Tel : +61 (0)8 6272-0200
Address : 50 Edward Street
Osborne Park WA 6017

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SITE	WATTLEUP RD HAMMOND PARK
LOCATION	343, 357 AND 361 WATTLEUP ROAD HAMMOND PARK
TITLE	AERIAL IMAGERY (APR INSET 2020 - SUMMER 2021)

Job No	Fig No	Rev
WAE230106	FIGURE 4P	A

MAP 65 - May Inset 2021

MAP 66 - Winter 2021

MAP 67 - Summer 2022

MAP 68 - Winter 2022

LEGEND

Site Boundary

N

0 60 120 180 240 300

Meters

NOTES

Aerial Imagery and Cadastre sourced from Landgate/SLIP

SCALE	1:4,000	(A3)
DRAWN	CED	
DATE DRAWN	17/10/2023	
CHECKED	–	
DATE CHECKED	–	
PROJECTION	GDA 1994 MGA Zone 50	

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SITE	WATTLEUP RD HAMMOND PARK
LOCATION	343, 357 AND 361 WATTLEUP ROAD HAMMOND PARK
TITLE	AERIAL IMAGERY (MAY INSET 2021 - WINTER 2022)

Job No	Fig No	Rev
WAE230106	FIGURE 4Q	A

MAP 69 - Summer 2023

LEGEND

Site Boundary

N

0 60 120 180 240 300

Meters

NOTES

Aerial Imagery and Cadastre sourced from Landgate/SLIP

SCALE	1:4,000	(A3)
DRAWN	CED	
DATE DRAWN	17/10/2023	
CHECKED	_	
DATE CHECKED	_	
PROJECTION	GDA 1994 MGA Zone 50	

Galt Environmental Pty Ltd
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SITE	WATTLEUP RD HAMMOND PARK
LOCATION	343, 357 AND 361 WATTLEUP ROAD HAMMOND PARK
TITLE	AERIAL IMAGERY (SUMMER 2023)

Job No	Fig No	Rev
WAE230106	FIGURE 4R	A

Western Power Legend

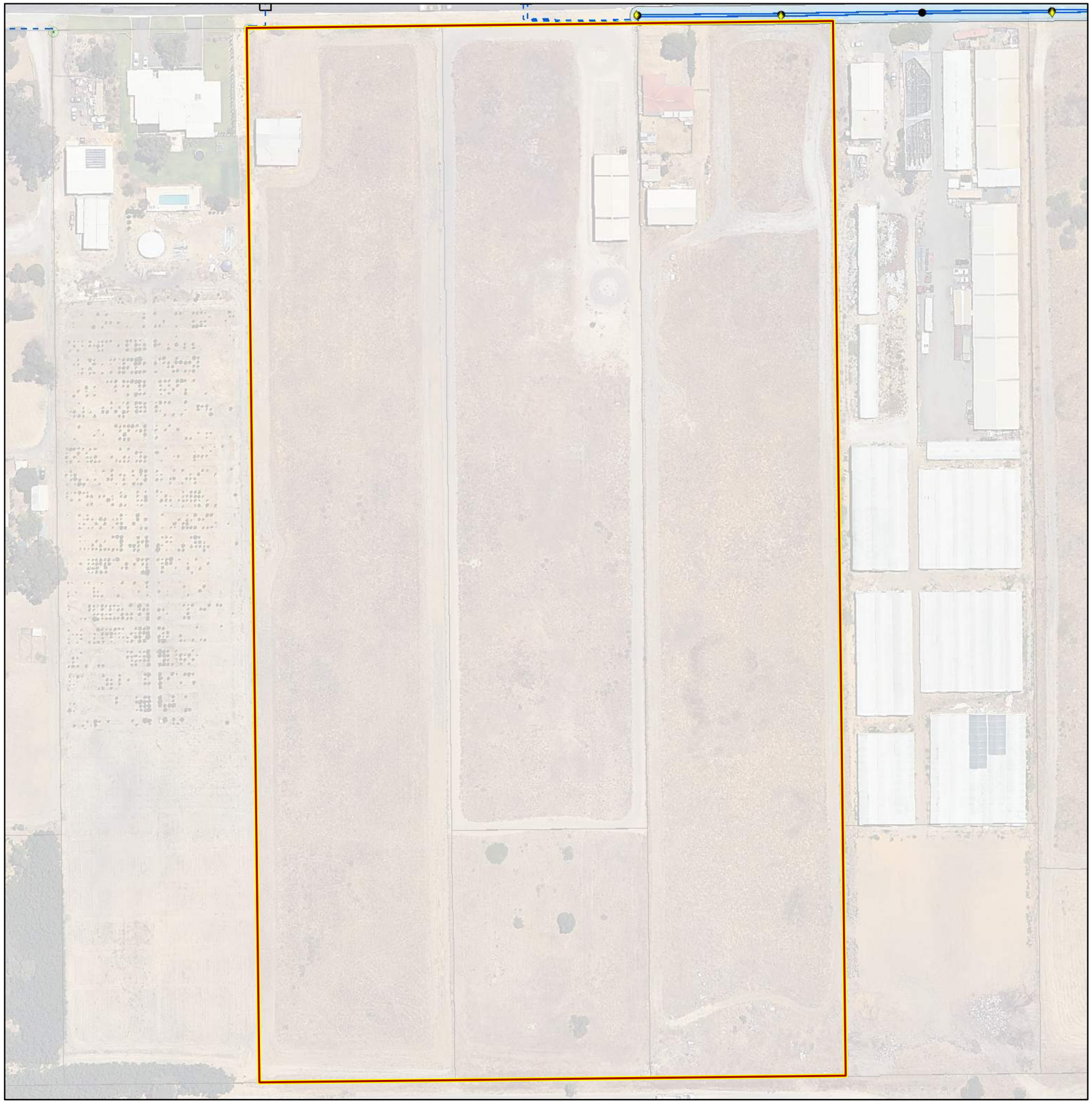
- Streetlights (WP-043)
- Transmission Pole (WP-030)
- Distribution Pole (WP-029)
- Electrical Service Pits (WP-038)
- Electrical Pillars (WP-041)
- Electrical Transformers (WP-039)
- Other Overhead Lines (WP-033)
- Other Underground Cables (WP-036)
- Distribution Underground Cables (WP-034)
- Transmission Underground Cables (WP-035)
- Distribution Overhead Powerlines (WP-031)
- Transmission Overhead Powerlines (WP-032)
- Underground Structures (WP-037)
- Electrical Enclosures (WP-040)
- Restriction Zone (WP-044)

Watercorp Legend

- Water Meter (WCORP-006)
- Sewer Manhole (WCORP-026)
- Water Hydrant (WCORP-070)
- Water Standpipe (WCORP-071)
- Water Treatment Plant (WCORP-072)
- Water Bore (WCORP-073)
- Water Tank (WCORP-076)
- Water Pump Station (WCORP-077)
- Drainage Pump Station (WCORP-082)
- Sewer Gravity Pipe (WCORP-068)
- Sewer Pressure Main (WCORP-069)
- Sewer Connection (WCORP-084)
- Drainage Rising Main (WCORP-074)
- Drainage Gravity Pipe (WCORP-080)
- Drainage Open Channel (WCORP-083)
- Drainage Compensating Basin (WCORP-079)
- Water Dam (WCORP-075)
- Water Reservoir (WCORP-078)

Gas Legend

- DBNGP 50m Buffer (Created by Galt)



Legend

- Site Boundary

N

0 20 40 60 80 100
Meters

NOTES
Aerial Imagery sourced from Landgate / SLIP

SCALE	1:1,500	(A3)
DRAWN	CED	
DATE DRAWN	17/10/2023	
CHECKED	–	
DATE CHECKED	–	
PROJECTION	GDA 1994 MGA Zone 50	

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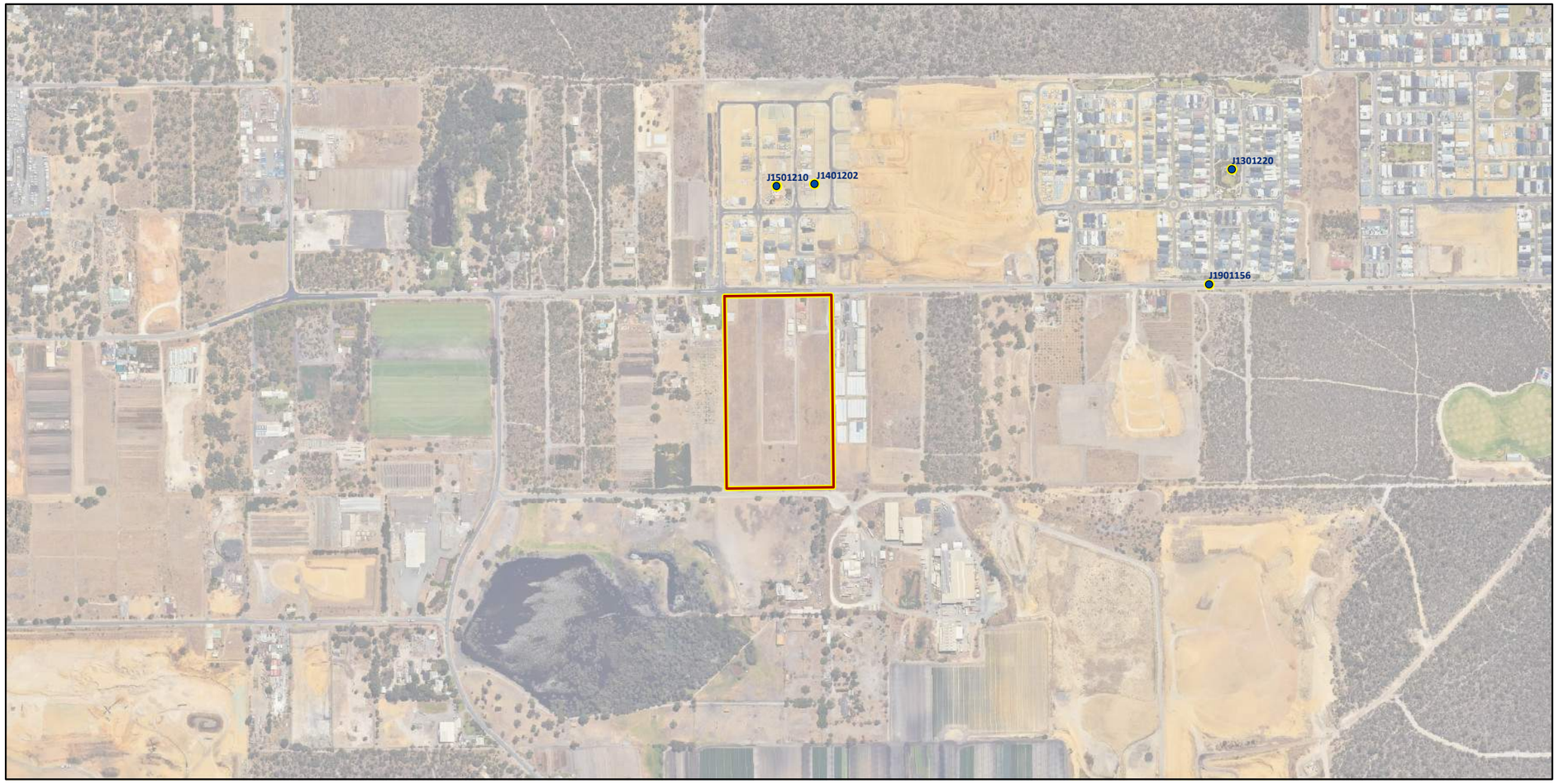
SITE	WATTLEUP RD HAMMOND PARK
LOCATION	343, 357 AND 361 WATTLEUP ROAD HAMMOND PARK
TITLE	INDICATIVE UTILITIES & SERVICES

Job No	Fig No	Rev
WAE230106	FIGURE 5	A



PREVIOUS JOBS

J1301220 QUBE DD Hammond Park Due Diligence Geotechnical & Environmental Study 436, 444 And 456 Wattleup Road, Hammond Park

J1401202 Qube DD Hammond Park Geotechnical Due Diligence & Environmental Study Proposed Residential Subdivision Lot 605 Wattleup Road, Hammond Park.

J1501210 Qube SI Wattleup Rd Hammond Park Geotechnical Due Diligence Study Proposed Residential Subdivision Lot 305 Wattleup Road, Hammond Park.

J1901156 Pavement Assessment, Wattleup Road Upgrade, Hammond Park

Legend

Site Boundary

Geotechnical Job

N

0 160 320 480 640 800
Meters

NOTES
Aerial Imagery sourced from Landgate/SLIP

SCALE	1:10,000	(A3)
DRAWN	CED	
DATE DRAWN	17/10/2023	
CHECKED	–	
DATE CHECKED	–	
PROJECTION	GDA 1994 MGA Zone 50	

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SITE	WATTLEUP RD HAMMOND PARK		
LOCATION	343, 357 AND 361 WATTLEUP ROAD HAMMOND PARK		
TITLE	PREVIOUS JOBS AND PROPOSALS		
Job No	WAE230106	Fig No FIGURE 6	Rev A

Appendix A: Site Photographs

www.galtenv.com.au
50 Edward Street OSBORNE PARK WA 6017
ABN: 96 520 810 622

Photograph 1: View from north-west corner of Lot 343

Photograph 2: Northern portion of Lot 357 during test pit excavation

Photograph 3: Northern portion of Lot 361

Photograph 4: Handstands and sheds, Lots 357 and 361

Photograph 5: Test pit excavation at TP53

Photograph 6: View from southern portion of Lot 357

Photograph 7: Drilling at MW01

Photograph 8: Spoil recovered from MW01 drilling

Appendix B: Test Pit Reports

www.galtenv.com.au
50 Edward Street OSBORNE PARK WA 6017
ABN: 96 520 810 622

REPORT OF TESTPIT: TP01

Job No	: WAE230106	Easting	: 389701.27	Sheet	: 1 OF 1
Client	: Qube	Northing	: 6439335.59	Logged	: Tim Dunton
Project	: Environmental & Geotechnical Due Diligence	UTM	: 50H	Logged Date	: 01/11/2023
Location	: Wattleup Road, Hammond Park	Drill Rig	:	Checked	:
Contractor	: ANH Contracting	Inclination	: -90 deg	Checked Date	: 05/11/2023

Excavator Attachment	Excavation Resistance	PSP	DCP graph	Water	Depth (m)	Soil Origin	Graphic Log	Classification Code	Material Description	Moisture	Consistency/Density	Remarks	Sample
		-				Natural		SW	Natural SAND: grey, fine to medium grained, trace fines trace organics, roots present.	D	MD-D		
		2			0.3								
		5				Natural		SW	Natural SAND: yellow, fine to medium grained, trace fines.	M-D			
		5											
		5											
		4											
		5			1								
		5											
		4											
		5											
		5											
		5											
		5											
		6			2								
									TP01 Terminated at 2.3 m (collapse)				

REPORT OF TESTPIT: TP02

Job No	: WAE230106	Easting	: 389756.22	Sheet	: 1 OF 1
Client	: Qube	Northing	: 6439365.22	Logged	: Tim Dunton
Project	: Environmental & Geotechnical Due Diligence	UTM	: 50H	Logged Date	: 01/11/2023
Location	: Wattleup Road, Hammond Park	Drill Rig	:	Checked	:
Contractor	: ANH Contracting	Inclination	: -90 deg	Checked Date	: 05/11/2023

Excavator Attachment	Excavation Resistance	PSP	DCP graph	Water	Depth (m)	Soil Origin	Graphic Log	Classification Code	Material Description	Moisture	Consistency/Density	Remarks	Sample
		-				Natural		SW	Natural SAND: grey, fine to medium grained, trace fines trace organics, roots present.	D	MD-D		
		3			0.3								
		4				Natural		SW	Natural SAND: yellow, fine to medium grained, trace fines.	M-D			
		5											
		4											
		5											
		4			1								
		5											
		4											
		6											
		4											
		4											
		4											
		4			2								
									TP02 Terminated at 2.5 m (Target Depth)				

REPORT OF TESTPIT: TP03

Job No	: WAE230106	Easting	: 389908.46	Sheet	: 1 OF 1
Client	: Qube	Northing	: 6439307.30	Logged	: Tim Dunton
Project	: Environmental & Geotechnical Due Diligence	UTM	: 50H	Logged Date	: 01/11/2023
Location	: Wattleup Road, Hammond Park	Drill Rig	:	Checked	:
Contractor	: ANH Contracting	Inclination	: -90 deg	Checked Date	: 05/11/2023

Excavator Attachment	Excavation Resistance	PSP	DCP graph	Water	Depth (m)	Soil Origin	Graphic Log	Classification Code	Material Description	Moisture	Consistency/Density	Remarks	Sample
		-				Natural		SW	Natural SAND: grey, fine to medium grained, trace fines trace organics, roots present.	D	MD-D		
		4											
					0.3								
		4				Natural		SW	Natural SAND: yellow, fine to medium grained, trace fines.	M-D			
		5											
		3											
		4											
		4			1								
		4											
		4											
		5											
		4											
		5											
		4											
		4			2								
									TP03 Terminated at 2.5 m (Target Depth)				

REPORT OF TESTPIT: TP04

Job No	: WAE230106	Easting	: 389018.72	Sheet	: 1 OF 1
Client	: Qube	Northing	: 6439129.47	Logged	: Tim Dunton
Project	: Environmental & Geotechnical Due Diligence	UTM	: 50H	Logged Date	: 01/11/2023
Location	: Wattleup Road, Hammond Park	Drill Rig	:	Checked	:
Contractor	: ANH Contracting	Inclination	: -90 deg	Checked Date	: 05/11/2023

Excavator Attachment	Excavation Resistance	PSP	DCP graph	Water	Depth (m)	Soil Origin	Graphic Log	Classification Code	Material Description	Moisture	Consistency/Density	Remarks	Sample
		-				Natural		SW	Natural SAND: grey, fine to medium grained, trace fines trace organics, roots present.	D	MD-D		
		3											
					0.3								
		3				Natural		SW	Natural SAND: yellow, fine to medium grained, trace fines.	M-D			
		3											
		3											
		2											
		3			1								
		4											
		3											
		4											
		3											
		4											
		3											
		4			2								
									TP04 Terminated at 2.5 m (Target Depth)				

REPORT OF TESTPIT: TP05

Job No	: WAE230106	Easting	: 389018.72	Sheet	: 1 OF 1
Client	: Qube	Northing	: 6439129.47	Logged	: Tim Dunton
Project	: Environmental & Geotechnical Due Diligence	UTM	: 50H	Logged Date	: 01/11/2023
Location	: Wattleup Road, Hammond Park	Drill Rig	:	Checked	:
Contractor	: ANH Contracting	Inclination	: -90 deg	Checked Date	: 05/11/2023

Excavator Attachment	Excavation Resistance	PSP	DCP graph	Water	Depth (m)	Soil Origin	Graphic Log	Classification Code	Material Description	Moisture	Consistency/Density	Remarks	Sample
		-				Natural		SW	Natural SAND: grey, fine to medium grained, trace fines trace organics, roots present.	D	MD-D		
		4			0.3								
		4				Natural		SW	Natural SAND: yellow, fine to medium grained, trace fines.	M-D			
		4											
		4											
		3											
		4			1								
		5											
		4											
		4											
		5											
		4											
		4											
		4			2								
									TP05 Terminated at 2.3 m (collapse)				

REPORT OF TESTPIT: TP06

Job No	: WAE230106	Easting	: 388788.46	Sheet	: 1 OF 1
Client	: Qube	Northing	: 6441053.42	Logged	: Tim Dunton
Project	: Environmental & Geotechnical Due Diligence	UTM	: 50H	Logged Date	: 01/11/2023
Location	: Wattleup Road, Hammond Park	Drill Rig	:	Checked	:
Contractor	: ANH Contracting	Inclination	: -90 deg	Checked Date	: 05/11/2023

Excavator Attachment	Excavation Resistance	PSP	DCP graph	Water	Depth (m)	Soil Origin	Graphic Log	Classification Code	Material Description	Moisture	Consistency/Density	Remarks	Sample
		-				Natural		SW	Natural SAND: grey, fine to medium grained, trace fines trace organics, roots present.	D	MD-D		
		4											
					0.3								
		5				Natural		SW	Natural SAND: yellow, fine to medium grained, trace fines.	M-D			
		6											
		5											
		4											
		5			1								
		6											
		5											
		5											
		4											
		5											
		5											
		4			2								
									TP06 Terminated at 2.5 m (Target Depth)				

REPORT OF TESTPIT: TP07

Job No	: WAE230106	Easting	: 389611.70	Sheet	: 1 OF 1
Client	: Qube	Northing	: 6439287.77	Logged	: Tim Dunton
Project	: Environmental & Geotechnical Due Diligence	UTM	: 50H	Logged Date	: 01/11/2023
Location	: Wattleup Road, Hammond Park	Drill Rig	:	Checked	:
Contractor	: ANH Contracting	Inclination	: -90 deg	Checked Date	: 05/11/2023

Excavator Attachment	Excavation Resistance	PSP	DCP graph	Water	Depth (m)	Soil Origin	Graphic Log	Classification Code	Material Description	Moisture	Consistency/Density	Remarks	Sample
		-				Natural		SW	Natural SAND: grey, fine to medium grained, trace fines trace organics, roots present.	D	MD-D		
		2			0.3								
		3				Natural		SW	Natural SAND: pale grey, fine to medium grained, trace fines.	M-D			
		5											
		4											
		3			0.9								
		3				Natural		SW	Natural SAND: yellow, fine to medium grained, trace fines.				
		3			1								
		3											
		3											
		3											
		3											
		3											
		4											
		4			2								
									TP07 Terminated at 2 m (collapse)				

REPORT OF TESTPIT: TP08

Job No	: WAE230106	Easting	: 388788.46	Sheet	: 1 OF 1
Client	: Qube	Northing	: 6441053.42	Logged	: Tim Dunton
Project	: Environmental & Geotechnical Due Diligence	UTM	: 50H	Logged Date	: 01/11/2023
Location	: Wattleup Road, Hammond Park	Drill Rig	:	Checked	:
Contractor	: ANH Contracting	Inclination	: -90 deg	Checked Date	: 05/11/2023

Excavator Attachment	Excavation Resistance	PSP	DCP graph	Water	Depth (m)	Soil Origin	Graphic Log	Classification Code	Material Description	Moisture	Consistency/Density	Remarks	Sample
		-				Natural		SW	Natural SAND: grey, fine to medium grained, trace fines trace organics, roots present (50 -100mm dia).	D	MD-D		
		3			0.3								
		4				Natural		SW	Natural SAND: yellow, fine to medium grained, trace fines.	M-D			
		4											
		4											
		5											
		4			1								
		5											
		5											
		5											
		5											
		4											
		4											
		5			2								
									TP08 Terminated at 2.5 m (Target Depth)				

REPORT OF TESTPIT: TP09

Job No	: WAE230106	Easting	: 389858.86	Sheet	: 1 OF 1
Client	: Qube	Northing	: 6439273.46	Logged	: Tim Dunton
Project	: Environmental & Geotechnical Due Diligence	UTM	: 50H	Logged Date	: 01/11/2023
Location	: Wattleup Road, Hammond Park	Drill Rig	:	Checked	:
Contractor	: ANH Contracting	Inclination	: -90 deg	Checked Date	: 05/11/2023

Excavator Attachment	Excavation Resistance	PSP	DCP graph	Water	Depth (m)	Soil Origin	Graphic Log	Classification Code	Material Description	Moisture	Consistency/Density	Remarks	Sample
		-				Natural		SW	Natural SAND: grey, fine to medium grained, trace fines trace organics, roots present.	D	MD-D		
		4			0.3								
		5				Natural		SW	Natural SAND: yellow, fine to medium grained, trace fines.	M-D			
		6											
		5											
		4											
		4			1								
		4											
		4											
		4											
		5											
		5											
		4											
		4			2								
									TP09 Terminated at 2.5 m (Target Depth)				

REPORT OF TESTPIT: TP10

Job No	: WAE230106	Easting	: 391698.92	Sheet	: 1 OF 1
Client	: Qube	Northing	: 6436246.01	Logged	: Tim Dunton
Project	: Environmental & Geotechnical Due Diligence	UTM	: 50H	Logged Date	: 01/11/2023
Location	: Wattleup Road, Hammond Park	Drill Rig	:	Checked	:
Contractor	: ANH Contracting	Inclination	: -90 deg	Checked Date	: 05/11/2023

Excavator Attachment	Excavation Resistance	PSP	DCP graph	Water	Depth (m)	Soil Origin	Graphic Log	Classification Code	Material Description	Moisture	Consistency/Density	Remarks	Sample
		-				Natural		SW	Natural SAND: grey, fine to medium grained, trace fines trace organics, roots present.	D	MD-D		
		2			0.3								
		4				Natural		SW	Natural SAND: pale grey, fine to medium grained, trace fines.	M-D			
		5											
		4			0.7								
		4				Natural		SW	Natural SAND: yellow, fine to medium grained, trace fines.				
		4											
		4			1								
		3											
		4											
		3											
		4											
		4											
		4											
		4			2								
									TP10 Terminated at 2 m (collapse)				

REPORT OF TESTPIT: TP11

Job No	: WAE230106	Easting	: 388788.46	Sheet	: 1 OF 1
Client	: Qube	Northing	: 6441053.42	Logged	: Tim Dunton
Project	: Environmental & Geotechnical Due Diligence	UTM	: 50H	Logged Date	: 01/11/2023
Location	: Wattleup Road, Hammond Park	Drill Rig	:	Checked	:
Contractor	: ANH Contracting	Inclination	: -90 deg	Checked Date	: 05/11/2023

Excavator Attachment	Excavation Resistance	PSP	DCP graph	Water	Depth (m)	Soil Origin	Graphic Log	Classification Code	Material Description	Moisture	Consistency/Density	Remarks	Sample
		-				Natural		SW	Natural SAND: grey, fine to medium grained, trace fines trace organics, roots present.	D			
		2											
		5											
		5											
		5											
		5			0.9								
		4			1	Natural		SW	Natural SAND: yellow, fine to medium grained, trace fines.	M-D			
		5											
		5											
		5											
		6											
		5											
		5											
		5			2								
									TP11 Terminated at 2.5 m (Target Depth)				

REPORT OF TESTPIT: TP12

Job No	: WAE230106	Easting	: 388788.46	Sheet	: 1 OF 1
Client	: Qube	Northing	: 6441053.42	Logged	: Tim Dunton
Project	: Environmental & Geotechnical Due Diligence	UTM	: 50H	Logged Date	: 01/11/2023
Location	: Wattleup Road, Hammond Park	Drill Rig	:	Checked	:
Contractor	: ANH Contracting	Inclination	: -90 deg	Checked Date	: 05/11/2023

Excavator Attachment	Excavation Resistance	PSP	DCP graph	Water	Depth (m)	Soil Origin	Graphic Log	Classification Code	Material Description	Moisture	Consistency/Density	Remarks	Sample
		-				Natural		SW	Natural SAND: grey, fine to medium grained, trace fines trace organics, roots present.	D	MD-D		
		2			0.2	Natural		SW	Natural SAND: yellow, fine to medium grained, trace fines.	M-D			
		5											
		6											
		5											
		6											
		6			1								
		6											
		6											
		6											
		6											
		6											
		5											
		6			2								
									TP12 Terminated at 2.5 m (Target Depth)				

REPORT OF TESTPIT: TP13

Job No	: WAE230106	Easting	: 388788.46	Sheet	: 1 OF 1
Client	: Qube	Northing	: 6441053.42	Logged	: Tim Dunton
Project	: Environmental & Geotechnical Due Diligence	UTM	: 50H	Logged Date	: 01/11/2023
Location	: Wattleup Road, Hammond Park	Drill Rig	:	Checked	:
Contractor	: ANH Contracting	Inclination	: -90 deg	Checked Date	: 05/11/2023

Excavator Attachment	Excavation Resistance	PSP	DCP graph	Water	Depth (m)	Soil Origin	Graphic Log	Classification Code	Material Description	Moisture	Consistency/Density	Remarks	Sample
		-				Natural		SW	Natural SAND: grey, fine to medium grained, trace fines trace organics, roots present.	D	MD-D		
		5			0.3								
		6				Natural		SW	Natural SAND: yellow, fine to medium grained, trace fines.	M-D			
		6											
		6											
		6											
		7			1								
		7											
		7											
		7											
		7											
		5											
		5											
		6			2								
									TP13 Terminated at 2.5 m (Target Depth)				

REPORT OF TESTPIT: TP14

Job No	: WAE230106	Easting	: 389018.72	Sheet	: 1 OF 1
Client	: Qube	Northing	: 6439129.47	Logged	: Tim Dunton
Project	: Environmental & Geotechnical Due Diligence	UTM	: 50H	Logged Date	: 01/11/2023
Location	: Wattleup Road, Hammond Park	Drill Rig	:	Checked	:
Contractor	: ANH Contracting	Inclination	: -90 deg	Checked Date	: 05/11/2023

Excavator Attachment	Excavation Resistance	PSP	DCP graph	Water	Depth (m)	Soil Origin	Graphic Log	Classification Code	Material Description	Moisture	Consistency/Density	Remarks	Sample
		-				Natural		SW	Natural SAND: pale yellow grey, fine to medium grained, trace fines, large roots (100-200mm dia).	M-D	MD-D		
		2			0.2								
		3				Natural		SW	Natural SAND: pale yellow grey, fine to medium grained, trace fines trace organics, roots present.	D			
		5											
		4											
		4			0.9								
		3			1	Natural		SW	Natural SAND: yellow, fine to medium grained, trace fines.	M-D			
		3											
		3											
		4											
		4											
		3											
		3											
		4			2								
									TP14 Terminated at 2.5 m (Target Depth)				

REPORT OF TESTPIT: TP15

Job No	: WAE230106	Easting	: 388788.46	Sheet	: 1 OF 1
Client	: Qube	Northing	: 6441053.42	Logged	: Tim Dunton
Project	: Environmental & Geotechnical Due Diligence	UTM	: 50H	Logged Date	: 01/11/2023
Location	: Wattleup Road, Hammond Park	Drill Rig	:	Checked	:
Contractor	: ANH Contracting	Inclination	: -90 deg	Checked Date	: 05/11/2023

Excavator Attachment	Excavation Resistance	PSP	DCP graph	Water	Depth (m)	Soil Origin	Graphic Log	Classification Code	Material Description	Moisture	Consistency/Density	Remarks	Sample
		-				Natural		SW	Natural SAND: grey, fine to medium grained, trace fines trace organics, roots present.	D	MD-D		
		4											
					0.3								
		6				Natural		SW	Natural SAND: yellow, fine to medium grained, trace fines.	M-D			
		6											
		4											
		4											
		4			1								
		4											
		4											
		5											
		4											
		4											
		4											
		4			2								
									TP15 Terminated at 2.5 m (Target Depth)				

REPORT OF TESTPIT: TP16

Job No	: WAE230106	Easting	: 388788.46	Sheet	: 1 OF 1
Client	: Qube	Northing	: 6441053.42	Logged	: Tim Dunton
Project	: Environmental & Geotechnical Due Diligence	UTM	: 50H	Logged Date	: 01/11/2023
Location	: Wattleup Road, Hammond Park	Drill Rig	:	Checked	:
Contractor	: ANH Contracting	Inclination	: -90 deg	Checked Date	: 05/11/2023

Excavator Attachment	Excavation Resistance	PSP	DCP graph	Water	Depth (m)	Soil Origin	Graphic Log	Classification Code	Material Description	Moisture	Consistency/Density	Remarks	Sample
		-				Natural		SW	Natural SAND: grey, fine to medium grained, trace fines trace organics, roots present.	D	MD-D		
		3			0.2	Natural		SW	Natural SAND: yellow, fine to medium grained, trace fines.	M-D			
		2											
		3											
		4											
		4											
		4			1								
		3											
		3											
		4											
		3											
		4											
		3											
		4			2								
									TP16 Terminated at 2.5 m (Target Depth)				

REPORT OF TESTPIT: TP17

Job No	: WAE230106	Easting	: 388788.46	Sheet	: 1 OF 1
Client	: Qube	Northing	: 6441053.42	Logged	: Tim Dunton
Project	: Environmental & Geotechnical Due Diligence	UTM	: 50H	Logged Date	: 01/11/2023
Location	: Wattleup Road, Hammond Park	Drill Rig	:	Checked	:
Contractor	: ANH Contracting	Inclination	: -90 deg	Checked Date	: 05/11/2023

Excavator Attachment	Excavation Resistance	PSP	DCP graph	Water	Depth (m)	Soil Origin	Graphic Log	Classification Code	Material Description	Moisture	Consistency/Density	Remarks	Sample
		-				Natural		SW	Natural SAND: grey, fine to medium grained, trace fines trace organics, roots present.	D	MD-D		
		4			0.3								
		6				Natural		SW	Natural SAND: yellow, fine to medium grained, trace fines.	M-D			
		3											
		2											
		2											
		3			1								
		3											
		4											
		3											
		4											
		3											
		4											
		4			2								
									TP17 Terminated at 2.5 m (Target Depth)				

REPORT OF TESTPIT: TP18

Job No	: WAE230106	Easting	: 389946.85	Sheet	: 1 OF 1
Client	: Qube	Northing	: 6439253.95	Logged	: Tim Dunton
Project	: Environmental & Geotechnical Due Diligence	UTM	: 50H	Logged Date	: 01/11/2023
Location	: Wattleup Road, Hammond Park	Drill Rig	:	Checked	:
Contractor	: ANH Contracting	Inclination	: -90 deg	Checked Date	: 05/11/2023

Excavator Attachment	Excavation Resistance	PSP	DCP graph	Water	Depth (m)	Soil Origin	Graphic Log	Classification Code	Material Description	Moisture	Consistency/Density	Remarks	Sample
		-				Natural		SW	Natural SAND: grey, fine to medium grained, trace fines trace organics, roots present.	D	MD-D		
		6			0.2	Natural		SW	Natural SAND: yellow, fine to medium grained, trace fines, containing limestone boulders.	M-D			
		6											
		4											
		5											
		6											
		5			1								
		7											
		8											
		6											
		5											
		6											
		5											
		4			2								
									TP18 Terminated at 2.5 m (Target Depth)				

REPORT OF TESTPIT: TP19

Job No	: WAE230106	Easting	: 389018.72	Sheet	: 1 OF 1
Client	: Qube	Northing	: 6439129.47	Logged	: Tim Dunton
Project	: Environmental & Geotechnical Due Diligence	UTM	: 50H	Logged Date	: 01/11/2023
Location	: Wattleup Road, Hammond Park	Drill Rig	:	Checked	:
Contractor	: ANH Contracting	Inclination	: -90 deg	Checked Date	: 05/11/2023

Excavator Attachment	Excavation Resistance	PSP	DCP graph	Water	Depth (m)	Soil Origin	Graphic Log	Classification Code	Material Description	Moisture	Consistency/Density	Remarks	Sample
		-				Natural		SW	Natural SAND: grey, fine to medium grained, trace fines trace organics, roots present.	D	MD-D		
		4			0.2	Natural		SW	Natural SAND: yellow, fine to medium grained, trace fines.	M-D			
		5											
		7											
		4											
		4											
		3			1								
		4											
		4											
		3											
		4											
		3											
		4											
		7			2								
									TP19 Terminated at 2.5 m (Target Depth)				

REPORT OF TESTPIT: TP20

Job No	: WAE230106	Easting	: 389018.72	Sheet	: 1 OF 1
Client	: Qube	Northing	: 6439129.47	Logged	: Tim Dunton
Project	: Environmental & Geotechnical Due Diligence	UTM	: 50H	Logged Date	: 01/11/2023
Location	: Wattleup Road, Hammond Park	Drill Rig	:	Checked	:
Contractor	: ANH Contracting	Inclination	: -90 deg	Checked Date	: 05/11/2023

Excavator Attachment	Excavation Resistance	PSP	DCP graph	Water	Depth (m)	Soil Origin	Graphic Log	Classification Code	Material Description	Moisture	Consistency/Density	Remarks	Sample
		-				Natural		SW	Natural SAND: grey, fine to medium grained, trace fines trace organics, roots present.	D	MD-D		
		6			0.2	Natural		SW	Natural SAND: yellow, fine to medium grained, trace fines, containing limestone boulders .	M-D			
		7											
		6											
		6											
		5											
		4			1								
		3											
		5											
		7											
		5											
		5											
		4											
		5			2								
									TP20 Terminated at 2.5 m (Target Depth)				

REPORT OF TESTPIT: TP21

Job No	: WAE230106	Easting	: 388858.79	Sheet	: 1 OF 1
Client	: Qube	Northing	: 6440998.72	Logged	: Tim Dunton
Project	: Environmental & Geotechnical Due Diligence	UTM	: 50H	Logged Date	: 01/11/2023
Location	: Wattleup Road, Hammond Park	Drill Rig	:	Checked	:
Contractor	: ANH Contracting	Inclination	: -90 deg	Checked Date	: 05/11/2023

Excavator Attachment	Excavation Resistance	PSP	DCP graph	Water	Depth (m)	Soil Origin	Graphic Log	Classification Code	Material Description	Moisture	Consistency/Density	Remarks	Sample
		-			0.1	Natural		SW	Natural SAND: grey, fine to medium grained, trace fines trace organics, roots present.	D	MD-D		
		7				Natural		SW	Natural SAND: yellow, fine to medium grained, trace fines.	M-D			
		10											
		7											
		6											
		4											
		5			1								
		7											
		5											
		5											
		6											
		5											
		5											
		5			2								
									TP21 Terminated at 2.5 m (Target Depth)				

REPORT OF TESTPIT: TP22

Job No	: WAE230106	Easting	: 389939.14	Sheet	: 1 OF 1
Client	: Qube	Northing	: 6439249.23	Logged	: Tim Dunton
Project	: Environmental & Geotechnical Due Diligence	UTM	: 50H	Logged Date	: 01/11/2023
Location	: Wattleup Road, Hammond Park	Drill Rig	:	Checked	:
Contractor	: ANH Contracting	Inclination	: -90 deg	Checked Date	: 05/11/2023

Excavator Attachment	Excavation Resistance	PSP	DCP graph	Water	Depth (m)	Soil Origin	Graphic Log	Classification Code	Material Description	Moisture	Consistency/Density	Remarks	Sample
		-				Natural		SW	Natural SAND: grey, fine to medium grained, trace fines trace organics, roots present.	D	MD-D		
		7			0.2	Natural		SW	Natural SAND: yellow, fine to medium grained, trace fines .	M-D			
		5											
		6											
		7											
		5											
		5			1								
		6											
		6											
		6											
		5											
		6											
		6											
		5			2								
									TP22 Terminated at 2.5 m (Target Depth)				

REPORT OF TESTPIT: TP23

Job No	: WAE230106	Easting	: 389802.27	Sheet	: 1 OF 1
Client	: Qube	Northing	: 6439328.03	Logged	: Tim Dunton
Project	: Environmental & Geotechnical Due Diligence	UTM	: 50H	Logged Date	: 01/11/2023
Location	: Wattleup Road, Hammond Park	Drill Rig	:	Checked	:
Contractor	: ANH Contracting	Inclination	: -90 deg	Checked Date	: 05/11/2023

Excavator Attachment	Excavation Resistance	PSP	DCP graph	Water	Depth (m)	Soil Origin	Graphic Log	Classification Code	Material Description	Moisture	Consistency/Density	Remarks	Sample
		-			0.1	Natural		SW	Natural SAND: grey, fine to medium grained, trace fines trace organics, roots present.	D	MD-D		
		7				Natural		SW	Natural SAND: yellow, fine to medium grained, trace fines .	M-D			
		8											
		10											
		9											
		7											
		8			1								
		5											
		7											
		7											
		6											
		6											
		6											
		6			2								
									TP23 Terminated at 2.5 m (Target Depth)				

REPORT OF TESTPIT: TP24

Job No	: WAE230106	Easting	: 388788.46	Sheet	: 1 OF 1
Client	: Qube	Northing	: 6441053.42	Logged	: Tim Dunton
Project	: Environmental & Geotechnical Due Diligence	UTM	: 50H	Logged Date	: 01/11/2023
Location	: Wattleup Road, Hammond Park	Drill Rig	:	Checked	:
Contractor	: ANH Contracting	Inclination	: -90 deg	Checked Date	: 05/11/2023

Excavator Attachment	Excavation Resistance	PSP	DCP graph	Water	Depth (m)	Soil Origin	Graphic Log	Classification Code	Material Description	Moisture	Consistency/Density	Remarks	Sample
		-			0.1	Natural		SW	Natural SAND: grey, fine to medium grained, trace fines trace organics, roots present.	D	MD-D		
		5				Natural		SW	Natural SAND: yellow, fine to medium grained, trace fines .	M-D			
		7											
		10											
		9											
		7											
		7			1								
		5											
		6											
		7											
		6											
		5											
		7											
		6			2								
									TP24 Terminated at 2.5 m (Target Depth)				

REPORT OF TESTPIT: TP25

Job No	: WAE230106	Easting	: 388858.79	Sheet	: 1 OF 1
Client	: Qube	Northing	: 6440998.72	Logged	: Tim Dunton
Project	: Environmental & Geotechnical Due Diligence	UTM	: 50H	Logged Date	: 01/11/2023
Location	: Wattleup Road, Hammond Park	Drill Rig	:	Checked	:
Contractor	: ANH Contracting	Inclination	: -90 deg	Checked Date	: 05/11/2023

Excavator Attachment	Excavation Resistance	PSP	DCP graph	Water	Depth (m)	Soil Origin	Graphic Log	Classification Code	Material Description	Moisture	Consistency/Density	Remarks	Sample
					0.1	Natural		SW	Natural SAND: grey, fine to medium grained, trace fines trace organics, roots present.	D	MD-D		
						Natural		SW	Natural SAND: yellow, fine to medium grained, trace fines .	M-D			
		10											
		10											
		6											
		6											
		6											
		5			1								
		6											
		5											
		5											
		5											
		5											
		5											
		5			2								
									TP25 Terminated at 2.5 m (Target Depth)				

REPORT OF TESTPIT: TP26

Job No	: WAE230106	Easting	: 391331.19	Sheet	: 1 OF 1
Client	: Qube	Northing	: 6441293.75	Logged	: Tim Dunton
Project	: Environmental & Geotechnical Due Diligence	UTM	: 50H	Logged Date	: 02/11/2023
Location	: Wattleup Road, Hammond Park	Drill Rig	:	Checked	:
Contractor	: ANH Contracting	Inclination	: -90 deg	Checked Date	: 05/11/2023

Excavator Attachment	Excavation Resistance	PSP	DCP graph	Water	Depth (m)	Soil Origin	Graphic Log	Classification Code	Material Description	Moisture	Consistency/Density	Remarks	Sample
		-			0.1	Natural		SW	Natural SAND: grey, fine to medium grained, trace fines trace organics, roots present.	D	MD-D		
		8				Natural		SW	Natural SAND: yellow, fine to medium grained, trace fines .	M-D			
		12											
		5											
		4											
		4											
		3			1								
		4											
		8											
		9											
		10											
		9											
		6											
		8			2								
									TP26 Terminated at 2.5 m (Target Depth)				

REPORT OF TESTPIT: TP27

Job No	: WAE230106	Easting	: 389938.42	Sheet	: 1 OF 1
Client	: Qube	Northing	: 6439246.80	Logged	: Tim Dunton
Project	: Environmental & Geotechnical Due Diligence	UTM	: 50H	Logged Date	: 02/11/2023
Location	: Wattleup Road, Hammond Park	Drill Rig	:	Checked	:
Contractor	: ANH Contracting	Inclination	: -90 deg	Checked Date	: 05/11/2023

Excavator Attachment	Excavation Resistance	PSP	DCP graph	Water	Depth (m)	Soil Origin	Graphic Log	Classification Code	Material Description	Moisture	Consistency/Density	Remarks	Sample
		-			0.1	Natural		SW	Natural SAND: grey, fine to medium grained, trace fines trace organics, roots present.	D	MD-D		
		3				Natural		SW	Natural SAND: yellow, fine to medium grained, trace fines .	M-D			
		7											
		12											
		10											
		10											
		7			1								
		7											
		8											
		7											
		7											
		7											
		7											
		6			2								
									TP27 Terminated at 2.5 m (Target Depth)				

REPORT OF TESTPIT: TP28

Job No	: WAE230106	Easting	: 388858.79	Sheet	: 1 OF 1
Client	: Qube	Northing	: 6440998.72	Logged	: Tim Dunton
Project	: Environmental & Geotechnical Due Diligence	UTM	: 50H	Logged Date	: 02/11/2023
Location	: Wattleup Road, Hammond Park	Drill Rig	:	Checked	:
Contractor	: ANH Contracting	Inclination	: -90 deg	Checked Date	: 05/11/2023

Excavator Attachment	Excavation Resistance	PSP	DCP graph	Water	Depth (m)	Soil Origin	Graphic Log	Classification Code	Material Description	Moisture	Consistency/Density	Remarks	Sample
		-			0.1	Natural		SW	Natural SAND: grey, fine to medium grained, trace fines trace organics, roots present.	D	MD-D		
		5				Natural		SW	Natural SAND: yellow, fine to medium grained, trace fines .	M-D			
		5											
		12											
		8											
		9											
		7			1								
		8											
		8											
		7											
		8											
		7											
		7											
		6			2								
									TP28 Terminated at 2.5 m (Target Depth)				

REPORT OF TESTPIT: TP29

Job No	: WAE230106	Easting	: 388788.46	Sheet	: 1 OF 1
Client	: Qube	Northing	: 6441053.42	Logged	: Tim Dunton
Project	: Environmental & Geotechnical Due Diligence	UTM	: 50H	Logged Date	: 02/11/2023
Location	: Wattleup Road, Hammond Park	Drill Rig	:	Checked	:
Contractor	: ANH Contracting	Inclination	: -90 deg	Checked Date	: 05/11/2023

Excavator Attachment	Excavation Resistance	PSP	DCP graph	Water	Depth (m)	Soil Origin	Graphic Log	Classification Code	Material Description	Moisture	Consistency/Density	Remarks	Sample
		-			0.1	Natural		SW	Natural SAND: grey, fine to medium grained, trace fines trace organics, roots present.	D	MD-D		
		2				Natural		SW	Natural SAND: yellow, fine to medium grained, trace fines .	M-D			
		3											
		6											
		5											
		6											
		4			1								
		4											
		4											
		6											
		6											
		6											
		6											
		5			2								
									TP29 Terminated at 2.5 m (Target Depth)				

REPORT OF TESTPIT: TP30

Job No	: WAE230106	Easting	: 388858.79	Sheet	: 1 OF 1
Client	: Qube	Northing	: 6440998.72	Logged	: Tim Dunton
Project	: Environmental & Geotechnical Due Diligence	UTM	: 50H	Logged Date	: 02/11/2023
Location	: Wattleup Road, Hammond Park	Drill Rig	:	Checked	:
Contractor	: ANH Contracting	Inclination	: -90 deg	Checked Date	: 05/11/2023

Excavator Attachment	Excavation Resistance	PSP	DCP graph	Water	Depth (m)	Soil Origin	Graphic Log	Classification Code	Material Description	Moisture	Consistency/Density	Remarks	Sample
		-			0.1	Natural		SW	Natural SAND: grey, fine to medium grained, trace fines trace organics, roots present.	D	MD-D		
		3				Natural		SW	Natural SAND: yellow, fine to medium grained, trace fines .	M-D			
		5											
		5											
		7											
		7											
		6			1								
		8											
		8											
		5											
		6											
		6											
		6											
		5			2								
									TP30 Terminated at 2.5 m				

REPORT OF TESTPIT: TP31

Job No	: WAE230106	Easting	: 388788.46	Sheet	: 1 OF 1
Client	: Qube	Northing	: 6441053.42	Logged	: Tim Dunton
Project	: Environmental & Geotechnical Due Diligence	UTM	: 50H	Logged Date	: 02/11/2023
Location	: Wattleup Road, Hammond Park	Drill Rig	:	Checked	:
Contractor	: ANH Contracting	Inclination	: -90 deg	Checked Date	: 05/11/2023

Excavator Attachment	Excavation Resistance	PSP	DCP graph	Water	Depth (m)	Soil Origin	Graphic Log	Classification Code	Material Description	Moisture	Consistency/Density	Remarks	Sample
		-			0.1	Natural		SW	Natural SAND: grey, fine to medium grained, trace fines trace organics, roots present.	D	MD-D		
		3				Natural		SW	Natural SAND: pale grey, fine to coarse grained, trace fines .	M-D			
		5											
		6											
		7											
		7											
		7			1								
		7											
		7											
		7											
		8											
		8											
		8											
		9			2								
					2.3	Natural		SW	Natural SAND: brown, fine to medium grained, trace fines.	D			
									TP31 Terminated at 2.5 m (Target Depth)				

REPORT OF TESTPIT: TP32

Job No	: WAE230106	Easting	: 389893.70	Sheet	: 1 OF 1
Client	: Qube	Northing	: 6438812.62	Logged	: Tim Dunton
Project	: Environmental & Geotechnical Due Diligence	UTM	: 50H	Logged Date	: 02/11/2023
Location	: Wattleup Road, Hammond Park	Drill Rig	:	Checked	:
Contractor	: ANH Contracting	Inclination	: -90 deg	Checked Date	: 05/11/2023

Excavator Attachment	Excavation Resistance	PSP	DCP graph	Water	Depth (m)	Soil Origin	Graphic Log	Classification Code	Material Description	Moisture	Consistency/Density	Remarks	Sample
		-				Natural		SW	Natural SAND: grey, fine to medium grained, trace fines trace organics, roots present.	D	MD-D		
		3			0.2	Natural		SW	Natural SAND: pale grey, fine to coarse grained, trace fines, large roots present (100 -200 mm).	M-D			
		4											
		6											
		7											
		8											
		8			1								
		11											
		10											
		10											
		10											
		10											
		8											
		7			2								
									TP32 Terminated at 2.2 m (collapse)				

REPORT OF TESTPIT: TP33

Job No	: WAE230106	Easting	: 389893.70	Sheet	: 1 OF 1
Client	: Qube	Northing	: 6438812.62	Logged	: Tim Dunton
Project	: Environmental & Geotechnical Due Diligence	UTM	: 50H	Logged Date	: 02/11/2023
Location	: Wattleup Road, Hammond Park	Drill Rig	:	Checked	:
Contractor	: ANH Contracting	Inclination	: -90 deg	Checked Date	: 05/11/2023

Excavator Attachment	Excavation Resistance	PSP	DCP graph	Water	Depth (m)	Soil Origin	Graphic Log	Classification Code	Material Description	Moisture	Consistency/Density	Remarks	Sample
		-				Fill		SW	Fill Gravelly SAND: pale grey and pale yellow grey, very dense, fine to coarse grained, fine to coarse sized gravel, trace fines.	D	VD		
		15.			0.2	Natural		SW	Natural SAND: grey, fine to medium grained, trace fines trace organics, roots present.		MD-D		
					0.4	Natural		SW	Natural SAND: pale grey, fine to coarse grained, trace fines .	M-D			
					1								
					2								
									TP33 Terminated at 2.3 m (Collapse)				

REPORT OF TESTPIT: TP34

Job No	: WAE230106	Easting	: 388788.46	Sheet	: 1 OF 1
Client	: Qube	Northing	: 6441053.42	Logged	: Tim Dunton
Project	: Environmental & Geotechnical Due Diligence	UTM	: 50H	Logged Date	: 02/11/2023
Location	: Wattleup Road, Hammond Park	Drill Rig	:	Checked	:
Contractor	: ANH Contracting	Inclination	: -90 deg	Checked Date	: 05/11/2023

Excavator Attachment	Excavation Resistance	PSP	DCP graph	Water	Depth (m)	Soil Origin	Graphic Log	Classification Code	Material Description	Moisture	Consistency/Density	Remarks	Sample
		-				Natural		SW	Natural SAND: pale grey, fine to coarse grained, trace fines trace organics and rootless at surface.	M-D	MD-D		
		3											
		4											
		5											
		7											
		8											
		8			1								
		12											
		11											
		7											
		10											
		7											
		10											
		7			2								
									TP34 Terminated at 2.5 m (Target Depth)				

REPORT OF TESTPIT: TP35

Job No	: WAE230106	Easting	: 388788.46	Sheet	: 1 OF 1
Client	: Qube	Northing	: 6441053.42	Logged	: Tim Dunton
Project	: Environmental & Geotechnical Due Diligence	UTM	: 50H	Logged Date	: 02/11/2023
Location	: Wattleup Road, Hammond Park	Drill Rig	:	Checked	:
Contractor	: ANH Contracting	Inclination	: -90 deg	Checked Date	: 05/11/2023

Excavator Attachment	Excavation Resistance	PSP	DCP graph	Water	Depth (m)	Soil Origin	Graphic Log	Classification Code	Material Description	Moisture	Consistency/Density	Remarks	Sample
		-			0.1	Fill		SW	Fill Gravelly SAND: pale yellow grey, very dense, fine to coarse grained, fine to coarse sized gravel, trace fines.	D	VD		
		5				Natural		SW	Natural SAND: grey, fine to coarse grained, trace fines .	M-D	MD-D		
		6											
		7											
		10											
		7											
		8			1								
		9											
		8											
		8											
		10											
		9											
		9											
		8			2								
									TP35 Terminated at 2.5 m (Target Depth)				

REPORT OF TESTPIT: TP36

Job No	: WAE230106	Easting	: 389799.36	Sheet	: 1 OF 1
Client	: Qube	Northing	: 6439321.83	Logged	: Tim Dunton
Project	: Environmental & Geotechnical Due Diligence	UTM	: 50H	Logged Date	: 02/11/2023
Location	: Wattleup Road, Hammond Park	Drill Rig	:	Checked	:
Contractor	: ANH Contracting	Inclination	: -90 deg	Checked Date	: 05/11/2023

Excavator Attachment	Excavation Resistance	PSP	DCP graph	Water	Depth (m)	Soil Origin	Graphic Log	Classification Code	Material Description	Moisture	Consistency/Density	Remarks	Sample
		-				Natural		SW	Natural SAND: pale grey, fine to coarse grained, trace fines trace organics and rootless at surface. containing buried rubbish .	M-D	MD-D		
		4											
		4											
		5											
		4											
		4											
		3			1								
		3											
		2											
		2											
		3											
		4											
		5											
		5			2								
									TP36 Terminated at 2.5 m (Target Depth)				

REPORT OF TESTPIT: TP37

Job No	: WAE230106	Easting	: 389018.72	Sheet	: 1 OF 1
Client	: Qube	Northing	: 6439129.47	Logged	: Tim Dunton
Project	: Environmental & Geotechnical Due Diligence	UTM	: 50H	Logged Date	: 02/11/2023
Location	: Wattleup Road, Hammond Park	Drill Rig	:	Checked	:
Contractor	: ANH Contracting	Inclination	: -90 deg	Checked Date	: 05/11/2023

Excavator Attachment	Excavation Resistance	PSP	DCP graph	Water	Depth (m)	Soil Origin	Graphic Log	Classification Code	Material Description	Moisture	Consistency/Density	Remarks	Sample
		-				Natural		SW	Natural SAND: pale grey, fine to coarse grained, trace fines trace organics and rootless at surface.	M-D	MD-D		
		4											
		5											
		7											
		9											
		8											
		8			1								
		11											
		7											
		10											
		10											
		8											
		8											
		7			2								
					2.4	Natural		SW	Natural SAND: brown, fine to coarse grained, trace fines.	W-M			
									TP37 Terminated at 2.5 m (Target Depth)				

REPORT OF TESTPIT: TP38

Job No	: WAE230106	Easting	: 388788.46	Sheet	: 1 OF 1
Client	: Qube	Northing	: 6441053.42	Logged	: Tim Dunton
Project	: Environmental & Geotechnical Due Diligence	UTM	: 50H	Logged Date	: 02/11/2023
Location	: Wattleup Road, Hammond Park	Drill Rig	:	Checked	:
Contractor	: ANH Contracting	Inclination	: -90 deg	Checked Date	: 05/11/2023

Excavator Attachment	Excavation Resistance	PSP	DCP graph	Water	Depth (m)	Soil Origin	Graphic Log	Classification Code	Material Description	Moisture	Consistency/Density	Remarks	Sample
		-				Natural		SW	Natural SAND: pale grey, fine to coarse grained, trace fines trace organics and rootless at surface.	M-D	MD-D		
		3											
		5											
		8											
		7											
		8											
		6			1								
		6											
		6											
		6											
		8											
		7											
		7											
		6			2								
									TP38 Terminated at 2.5 m (Target Depth)				

REPORT OF TESTPIT: TP39

Job No	: WAE230106	Easting	: 388788.46	Sheet	: 1 OF 1
Client	: Qube	Northing	: 6441053.42	Logged	: Tim Dunton
Project	: Environmental & Geotechnical Due Diligence	UTM	: 50H	Logged Date	: 02/11/2023
Location	: Wattleup Road, Hammond Park	Drill Rig	:	Checked	:
Contractor	: ANH Contracting	Inclination	: -90 deg	Checked Date	: 05/11/2023

Excavator Attachment	Excavation Resistance	PSP	DCP graph	Water	Depth (m)	Soil Origin	Graphic Log	Classification Code	Material Description	Moisture	Consistency/Density	Remarks	Sample
		-				Natural		SW	Natural SAND: pale grey, fine to coarse grained, trace fines. trace organics and rootless at surface. building rubble at surface.	M-D	MD-D		
		8											
		15											
		15.											
					1								
					2								
					2.7	Natural		SW	Natural SAND: brown dark brown, fine to coarse grained, containing cemented sand (coffee rock?).	W-M	D		

REPORT OF TESTPIT: TP40

Job No	: WAE230106	Easting	: 388858.79	Sheet	: 1 OF 1
Client	: Qube	Northing	: 6440998.72	Logged	: Tim Dunton
Project	: Environmental & Geotechnical Due Diligence	UTM	: 50H	Logged Date	: 02/11/2023
Location	: Wattleup Road, Hammond Park	Drill Rig	:	Checked	:
Contractor	: ANH Contracting	Inclination	: -90 deg	Checked Date	: 05/11/2023

Excavator Attachment	Excavation Resistance	PSP	DCP graph	Water	Depth (m)	Soil Origin	Graphic Log	Classification Code	Material Description	Moisture	Consistency/Density	Remarks	Sample
		-				Natural		SW	Natural SAND: brown, fine to coarse grained, trace fine to medium sized gravel, trace fines.	M			
		4											
		5											
		8											
		7											
		8											
		8			1								
		9											
		8											
		7											
		9											
		11											
		10											
		12			2								
					2.3	Natural		SW	Natural SAND: pale brown, fine to coarse grained, trace fine to medium sized gravel, trace fines.	M-D			
									TP40 Terminated at 2.5 m (Target Depth)				

REPORT OF TESTPIT: TP41

Job No	: WAE230106	Easting	: 389802.21	Sheet	: 1 OF 1
Client	: Qube	Northing	: 6439331.27	Logged	: Tim Dunton
Project	: Environmental & Geotechnical Due Diligence	UTM	: 50H	Logged Date	: 02/11/2023
Location	: Wattleup Road, Hammond Park	Drill Rig	:	Checked	:
Contractor	: ANH Contracting	Inclination	: -90 deg	Checked Date	: 05/11/2023

Excavator Attachment	Excavation Resistance	PSP	DCP graph	Water	Depth (m)	Soil Origin	Graphic Log	Classification Code	Material Description	Moisture	Consistency/Density	Remarks	Sample
		-				Natural		SW	Natural SAND: grey and pale grey, fine to coarse grained, trace fine to medium sized gravel, trace fines.	M			
		3											
		6											
		6											
		9											
		9											
		7			1								
		6											
		6											
		7											
		6											
		5											
		6											
		7			2								
									TP41 Terminated at 2.5 m (Target Depth)				

REPORT OF TESTPIT: TP42

Job No	: WAE230106	Easting	: 389823.18	Sheet	: 1 OF 1
Client	: Qube	Northing	: 6439419.13	Logged	: Tim Dunton
Project	: Environmental & Geotechnical Due Diligence	UTM	: 50H	Logged Date	: 02/11/2023
Location	: Wattleup Road, Hammond Park	Drill Rig	:	Checked	:
Contractor	: ANH Contracting	Inclination	: -90 deg	Checked Date	: 05/11/2023

Excavator Attachment	Excavation Resistance	PSP	DCP graph	Water	Depth (m)	Soil Origin	Graphic Log	Classification Code	Material Description	Moisture	Consistency/Density	Remarks	Sample
		-				Natural		SW	Natural SAND: grey and pale grey, fine to coarse grained, trace fine to medium sized gravel, trace fines.	M			
		3											
		6											
		8											
		5											
		6											
		6			1								
		6											
		8											
		9			1.5								
		8				Natural		SW	Natural SAND: brown, fine to medium grained, trace fines, containing cemented sand (coffee rock) .		MD-D		
		7											
		7											
		8			2								
									TP42 Terminated at 2.5 m (Target Depth)				

REPORT OF TESTPIT: TP43

Job No	: WAE230106	Easting	: 388788.46	Sheet	: 1 OF 1
Client	: Qube	Northing	: 6441053.42	Logged	: Tim Dunton
Project	: Environmental & Geotechnical Due Diligence	UTM	: 50H	Logged Date	: 02/11/2023
Location	: Wattleup Road, Hammond Park	Drill Rig	:	Checked	:
Contractor	: ANH Contracting	Inclination	: -90 deg	Checked Date	: 05/11/2023

Excavator Attachment	Excavation Resistance	PSP	DCP graph	Water	Depth (m)	Soil Origin	Graphic Log	Classification Code	Material Description	Moisture	Consistency/Density	Remarks	Sample
		-				Natural		SW	Natural SAND: grey and pale grey, fine to coarse grained, trace fine to medium sized gravel, trace fines.	M			
		2											
		6											
		6											
		6											
		6											
		5			1								
		6											
		8											
		10											
		7											
		9											
		9											
		8			2								
									TP43 Terminated at 2.5 m (Target Depth)				

REPORT OF TESTPIT: TP44

Job No	: WAE230106	Easting	: 389929.69	Sheet	: 1 OF 1
Client	: Qube	Northing	: 6439281.06	Logged	: Tim Dunton
Project	: Environmental & Geotechnical Due Diligence	UTM	: 50H	Logged Date	: 02/11/2023
Location	: Wattleup Road, Hammond Park	Drill Rig	:	Checked	:
Contractor	: ANH Contracting	Inclination	: -90 deg	Checked Date	: 05/11/2023

Excavator Attachment	Excavation Resistance	PSP	DCP graph	Water	Depth (m)	Soil Origin	Graphic Log	Classification Code	Material Description	Moisture	Consistency/Density	Remarks	Sample
		-				Natural		SW	Natural SAND: grey and pale grey, fine to coarse grained, trace fine to medium sized gravel, trace fines.	M			
		3											
		5											
		7											
		6											
		5											
		5			1								
		7											
		6											
		6											
		6											
		5											
		6											
		5			2								
					2.2	Natural		SW	Natural SAND: brown, fine to medium grained, trace fines.	W-M			
									TP44 Terminated at 2.5 m (Target Depth)				

REPORT OF TESTPIT: TP45

Job No	: WAE230106	Easting	: 388788.46	Sheet	: 1 OF 1
Client	: Qube	Northing	: 6441053.42	Logged	: Tim Dunton
Project	: Environmental & Geotechnical Due Diligence	UTM	: 50H	Logged Date	: 02/11/2023
Location	: Wattleup Road, Hammond Park	Drill Rig	:	Checked	:
Contractor	: ANH Contracting	Inclination	: -90 deg	Checked Date	: 05/11/2023

Excavator Attachment	Excavation Resistance	PSP	DCP graph	Water	Depth (m)	Soil Origin	Graphic Log	Classification Code	Material Description	Moisture	Consistency/Density	Remarks	Sample
		-				Natural		SW	Natural SAND: grey and pale grey, fine to coarse grained, trace fine to medium sized gravel, trace fines.	M			
		3											
		3											
		5											
		7											
		6											
		7			1								
		6											
		7											
		9											
		11											
		11											
		10											
		10			2								
									TP45 Terminated at 2.5 m (Target Depth)				

REPORT OF TESTPIT: TP46

Job No	: WAE230106	Easting	: 388788.46	Sheet	: 1 OF 1
Client	: Qube	Northing	: 6441053.42	Logged	: Tim Dunton
Project	: Environmental & Geotechnical Due Diligence	UTM	: 50H	Logged Date	: 02/11/2023
Location	: Wattleup Road, Hammond Park	Drill Rig	:	Checked	:
Contractor	: ANH Contracting	Inclination	: -90 deg	Checked Date	: 05/11/2023

Excavator Attachment	Excavation Resistance	PSP	DCP graph	Water	Depth (m)	Soil Origin	Graphic Log	Classification Code	Material Description	Moisture	Consistency/Density	Remarks	Sample
		-				Natural		SW	Natural SAND: grey and pale grey, fine to coarse grained, trace fine to medium sized gravel, trace fines.	M			
		2											
		4											
		5											
		5											
		4											
		3			1								
		5											
		4											
		3											
		4											
		4											
		3											
		3			2								
					2.2	Natural		SW	Natural SAND: brown, fine to medium grained, trace fines.				
									TP46 Terminated at 2.5 m (Target Depth)				

REPORT OF TESTPIT: TP47

Job No	: WAE230106	Easting	: 388788.46	Sheet	: 1 OF 1
Client	: Qube	Northing	: 6441053.42	Logged	: Tim Dunton
Project	: Environmental & Geotechnical Due Diligence	UTM	: 50H	Logged Date	: 02/11/2023
Location	: Wattleup Road, Hammond Park	Drill Rig	:	Checked	:
Contractor	: ANH Contracting	Inclination	: -90 deg	Checked Date	: 05/11/2023

Excavator Attachment	Excavation Resistance	PSP	DCP graph	Water	Depth (m)	Soil Origin	Graphic Log	Classification Code	Material Description	Moisture	Consistency/Density	Remarks	Sample
		-				Natural		SW	Natural SAND: grey and pale grey, fine to coarse grained, trace fine to medium sized gravel, trace fines.	M			
		2											
		5											
		6											
		4											
		5											
		5			1								
		4											
		3											
		3											
		4											
		3											
		4											
		4			2								
					2.2	Natural		SW	Natural SAND: brown, fine to medium grained, trace fines.				
									TP47 Terminated at 2.5 m (Target Depth)				

REPORT OF TESTPIT: TP48

Job No	: WAE230106	Easting	: 388788.46	Sheet	: 1 OF 1
Client	: Qube	Northing	: 6441053.42	Logged	: Tim Dunton
Project	: Environmental & Geotechnical Due Diligence	UTM	: 50H	Logged Date	: 02/11/2023
Location	: Wattleup Road, Hammond Park	Drill Rig	:	Checked	:
Contractor	: ANH Contracting	Inclination	: -90 deg	Checked Date	: 05/11/2023

Excavator Attachment	Excavation Resistance	PSP	DCP graph	Water	Depth (m)	Soil Origin	Graphic Log	Classification Code	Material Description	Moisture	Consistency/Density	Remarks	Sample
		-				Natural		SW	Natural SAND: grey, fine to coarse grained, trace fine to medium sized gravel, trace fines, grass and rootlets at surface..	M			
		5			0.3								
		8				Natural		SW	Natural SAND: yellow, fine to medium grained, trace fines.		MD-D		
		4											
		3											
		4											
		3			1								
		4											
		3											
		4											
		3											
		4											
		3											
		4			2								
									TP48 Terminated at 2.5 m (Target Depth)				

REPORT OF TESTPIT: TP49

Job No	: WAE230106	Easting	: 388788.46	Sheet	: 1 OF 1
Client	: Qube	Northing	: 6441053.42	Logged	: Tim Dunton
Project	: Environmental & Geotechnical Due Diligence	UTM	: 50H	Logged Date	: 02/11/2023
Location	: Wattleup Road, Hammond Park	Drill Rig	:	Checked	:
Contractor	: ANH Contracting	Inclination	: -90 deg	Checked Date	: 05/11/2023

Excavator Attachment	Excavation Resistance	PSP	DCP graph	Water	Depth (m)	Soil Origin	Graphic Log	Classification Code	Material Description	Moisture	Consistency/Density	Remarks	Sample
		-				Natural		SW	Natural SAND: grey, fine to coarse grained, trace fine to medium sized gravel, trace fines, grass and rootlets at surface..	M			
		3											
		5			0.4								
		6				Natural		SW	Natural SAND: yellow, fine to medium grained, trace fines.		MD-D		
		4											
		4											
		4			1								
		4											
		5											
		4											
		4											
		4											
		4											
		4			2								
									TP49 Terminated at 2.5 m (Target Depth)				

REPORT OF TESTPIT: TP50

Job No	: WAE230106	Easting	: 388788.46	Sheet	: 1 OF 1
Client	: Qube	Northing	: 6441053.42	Logged	: Tim Dunton
Project	: Environmental & Geotechnical Due Diligence	UTM	: 50H	Logged Date	: 02/11/2023
Location	: Wattleup Road, Hammond Park	Drill Rig	:	Checked	:
Contractor	: ANH Contracting	Inclination	: -90 deg	Checked Date	: 05/11/2023

Excavator Attachment	Excavation Resistance	PSP	DCP graph	Water	Depth (m)	Soil Origin	Graphic Log	Classification Code	Material Description	Moisture	Consistency/Density	Remarks	Sample
		-				Natural		SW	Natural SAND: grey, fine to coarse grained, trace fine to medium sized gravel, trace fines, grass and rootlets at surface..	M			
		4											
					0.3								
		6				Natural		SW	Natural SAND: yellow, fine to medium grained, trace fines.		MD-D		
		4											
		3											
		3											
		3											
					1								
		3											
		3											
		3											
		4											
		3											
		4											
		3											
					2								
									TP50 Terminated at 2.5 m (Target Depth)				

REPORT OF TESTPIT: TP51

Job No	: WAE230106	Easting	: 388788.46	Sheet	: 1 OF 1
Client	: Qube	Northing	: 6441053.42	Logged	: Tim Dunton
Project	: Environmental & Geotechnical Due Diligence	UTM	: 50H	Logged Date	: 03/11/2023
Location	: Wattleup Road, Hammond Park	Drill Rig	:	Checked	:
Contractor	: ANH Contracting	Inclination	: -90 deg	Checked Date	: 05/11/2023

Excavator Attachment	Excavation Resistance	PSP	DCP graph	Water	Depth (m)	Soil Origin	Graphic Log	Classification Code	Material Description	Moisture	Consistency/Density	Remarks	Sample
		-				Natural		SW	Natural SAND: grey, fine to coarse grained, trace fine to medium sized gravel, trace fines, grass and rootlets at surface..	M			
		5			0.3								
		8				Natural		SW	Natural SAND: yellow, fine to medium grained, trace fines.		MD-D		
		6											
		3											
		4											
		4			1								
		3											
		4											
		4											
		4											
		4											
		4											
		3			2								
									TP51 Terminated at 2.5 m (Target Depth)				

REPORT OF TESTPIT: TP52

Job No	: WAE230106	Easting	: 389873.44	Sheet	: 1 OF 1
Client	: Qube	Northing	: 6439331.29	Logged	: Tim Dunton
Project	: Environmental & Geotechnical Due Diligence	UTM	: 50H	Logged Date	: 03/11/2023
Location	: Wattleup Road, Hammond Park	Drill Rig	:	Checked	:
Contractor	: ANH Contracting	Inclination	: -90 deg	Checked Date	: 05/11/2023

Excavator Attachment	Excavation Resistance	PSP	DCP graph	Water	Depth (m)	Soil Origin	Graphic Log	Classification Code	Material Description	Moisture	Consistency/Density	Remarks	Sample
		-				Natural		SW	Natural SAND: grey, fine to coarse grained, trace fine to medium sized gravel, trace fines, grass and rootlets at surface..	M			
		5			0.3								
		6				Natural		SW	Natural SAND: yellow, fine to medium grained, trace fines.		MD-D		
		6											
		4											
		3											
		3			1								
		3											
		4											
		4											
		4											
		4											
		4											
		4			2								
									TP52 Terminated at 2.5 m (Target Depth)				

REPORT OF TESTPIT: TP53

Job No	: WAE230106	Easting	: 389866.71	Sheet	: 1 OF 1
Client	: Qube	Northing	: 6439335.60	Logged	: Tim Dunton
Project	: Environmental & Geotechnical Due Diligence	UTM	: 50H	Logged Date	: 03/11/2023
Location	: Wattleup Road, Hammond Park	Drill Rig	:	Checked	:
Contractor	: ANH Contracting	Inclination	: -90 deg	Checked Date	: 05/11/2023

Excavator Attachment	Excavation Resistance	PSP	DCP graph	Water	Depth (m)	Soil Origin	Graphic Log	Classification Code	Material Description	Moisture	Consistency/Density	Remarks	Sample
		-				Natural		SW	Natural SAND: grey, fine to coarse grained, trace fine to medium sized gravel, trace fines, grass and rootlets at surface..	M			
		5											
					0.3								
		6				Natural		SW	Natural SAND: yellow, fine to medium grained, trace fines.		MD-D		
		7											
		5											
		6											
		4			1								
		4											
		4											
		5											
		4											
		4											
		4											
		4			2								
									TP53 Terminated at 2.5 m (Target Depth)				

REPORT OF TESTPIT: TP54

Job No	: WAE230106	Easting	: 388788.46	Sheet	: 1 OF 1
Client	: Qube	Northing	: 6441053.42	Logged	: Tim Dunton
Project	: Environmental & Geotechnical Due Diligence	UTM	: 50H	Logged Date	: 03/11/2023
Location	: Wattleup Road, Hammond Park	Drill Rig	:	Checked	:
Contractor	: ANH Contracting	Inclination	: -90 deg	Checked Date	: 05/11/2023

Excavator Attachment	Excavation Resistance	PSP	DCP graph	Water	Depth (m)	Soil Origin	Graphic Log	Classification Code	Material Description	Moisture	Consistency/Density	Remarks	Sample
		-				Natural		SW	Natural SAND: grey, fine to coarse grained, trace fine to medium sized gravel, trace fines, grass and rootlets at surface..	M			
		5			0.3								
		8				Natural		SW	Natural SAND: yellow, fine to medium grained, trace fines.		MD-D		
		3											
		4											
		3											
		3			1								
		3											
		3											
		4											
		3											
		3											
		4											
		4			2								
									TP54 Terminated at 2.5 m (Target Depth)				

REPORT OF TESTPIT: TP55

Job No	: WAE230106	Easting	: 388788.46	Sheet	: 1 OF 1
Client	: Qube	Northing	: 6441053.42	Logged	: Tim Dunton
Project	: Environmental & Geotechnical Due Diligence	UTM	: 50H	Logged Date	: 03/11/2023
Location	: Wattleup Road, Hammond Park	Drill Rig	:	Checked	:
Contractor	: ANH Contracting	Inclination	: -90 deg	Checked Date	: 05/11/2023

Excavator Attachment	Excavation Resistance	PSP	DCP graph	Water	Depth (m)	Soil Origin	Graphic Log	Classification Code	Material Description	Moisture	Consistency/Density	Remarks	Sample
		-				Natural		SW	Natural SAND: grey, fine to coarse grained, trace fine to medium sized gravel, trace fines, grass and rootlets at surface..	M			
		6			0.3								
		7				Natural		SW	Natural SAND: yellow, fine to medium grained, trace fines.		MD-D		
		5											
		4											
		4											
		3			1								
		3											
		3											
		4											
		3											
		4											
		3											
		4			2								
									TP55 Terminated at 2.5 m (Target Depth)				

REPORT OF TESTPIT: TP56

Job No	: WAE230106	Easting	: 388788.46	Sheet	: 1 OF 1
Client	: Qube	Northing	: 6441053.42	Logged	: Tim Dunton
Project	: Environmental & Geotechnical Due Diligence	UTM	: 50H	Logged Date	: 03/11/2023
Location	: Wattleup Road, Hammond Park	Drill Rig	:	Checked	:
Contractor	: ANH Contracting	Inclination	: -90 deg	Checked Date	: 05/11/2023

Excavator Attachment	Excavation Resistance	PSP	DCP graph	Water	Depth (m)	Soil Origin	Graphic Log	Classification Code	Material Description	Moisture	Consistency/Density	Remarks	Sample
		-				Natural		SW	Natural SAND: grey, fine to coarse grained, trace fine to medium sized gravel, trace fines, grass and rootlets at surface..	M			
		4											
					0.3								
		7				Natural		SW	Natural SAND: yellow, fine to medium grained, trace fines.		MD-D		
		5											
		5											
		3											
		3			1								
		4											
		4											
		3											
		4											
		3											
		4											
		4			2								
									TP56 Terminated at 2.5 m (Target Depth)				

REPORT OF TESTPIT: TP57

Job No	: WAE230106	Easting	: 388788.46	Sheet	: 1 OF 1
Client	: Qube	Northing	: 6441053.42	Logged	: Tim Dunton
Project	: Environmental & Geotechnical Due Diligence	UTM	: 50H	Logged Date	: 03/11/2023
Location	: Wattleup Road, Hammond Park	Drill Rig	:	Checked	:
Contractor	: ANH Contracting	Inclination	: -90 deg	Checked Date	: 05/11/2023

Excavator Attachment	Excavation Resistance	PSP	DCP graph	Water	Depth (m)	Soil Origin	Graphic Log	Classification Code	Material Description	Moisture	Consistency/Density	Remarks	Sample
		-				Natural		SW	Natural SAND: grey, fine to coarse grained, trace fine to medium sized gravel, trace fines, grass and rootlets at surface..	M			
		4											
					0.3								
		5				Natural		SW	Natural SAND: yellow, fine to medium grained, trace fines.		MD-D		
		7											
		5											
		4											
		3			1								
		4											
		3											
		3											
		4											
		3											
		4											
		3			2								
									TP57 Terminated at 2.5 m (Target Depth)				

REPORT OF TESTPIT: TP58

Job No	: WAE230106	Easting	: 388788.46	Sheet	: 1 OF 1
Client	: Qube	Northing	: 6441053.42	Logged	: Tim Dunton
Project	: Environmental & Geotechnical Due Diligence	UTM	: 50H	Logged Date	: 03/11/2023
Location	: Wattleup Road, Hammond Park	Drill Rig	:	Checked	:
Contractor	: ANH Contracting	Inclination	: -90 deg	Checked Date	: 05/11/2023

Excavator Attachment	Excavation Resistance	PSP	DCP graph	Water	Depth (m)	Soil Origin	Graphic Log	Classification Code	Material Description	Moisture	Consistency/Density	Remarks	Sample
		-				Natural		SW	Natural SAND: grey, fine to coarse grained, trace fine to medium sized gravel, trace fines, grass and rootlets at surface..	M			
		10											
		7			0.4								
		6				Natural		SW	Natural SAND: yellow, fine to medium grained, trace fines.		MD-D		
		5											
		4											
		3			1								
		2											
		4											
		3											
		3											
		8											
		15.							**TP58 refusal at 1.8 m (limestone)**				
					2								

REPORT OF TESTPIT: TP59

Job No	: WAE230106	Easting	: 391698.92	Sheet	: 1 OF 1
Client	: Qube	Northing	: 6436246.01	Logged	: Tim Dunton
Project	: Environmental & Geotechnical Due Diligence	UTM	: 50H	Logged Date	: 03/11/2023
Location	: Wattleup Road, Hammond Park	Drill Rig	:	Checked	:
Contractor	: ANH Contracting	Inclination	: -90 deg	Checked Date	: 05/11/2023

Excavator Attachment	Excavation Resistance	PSP	DCP graph	Water	Depth (m)	Soil Origin	Graphic Log	Classification Code	Material Description	Moisture	Consistency/Density	Remarks	Sample
		-				Fill		SW	Fill SAND: grey, medium dense to dense, fine to coarse grained, trace fines, grass and organics.	D	MD-D		
		5											
		7			0.4								
		7				Natural		SW	Natural SAND: grey, fine to coarse grained, trace fine to medium sized gravel, trace fines, grass and rootlets at surface..	M			
		5			0.7								
		4				Natural		SW	Natural SAND: yellow, fine to medium grained, trace fines.		MD-D		
		4			1								
		4											
		4											
		4											
		4											
		4											
		4											
		4			2								
									TP59 Terminated at 2.5 m (Target Depth)				

REPORT OF TESTPIT: TP60

Job No	: WAE230106	Easting	: 388788.46	Sheet	: 1 OF 1
Client	: Qube	Northing	: 6441053.42	Logged	: Tim Dunton
Project	: Environmental & Geotechnical Due Diligence	UTM	: 50H	Logged Date	: 03/11/2023
Location	: Wattleup Road, Hammond Park	Drill Rig	:	Checked	:
Contractor	: ANH Contracting	Inclination	: -90 deg	Checked Date	: 05/11/2023

Excavator Attachment	Excavation Resistance	PSP	DCP graph	Water	Depth (m)	Soil Origin	Graphic Log	Classification Code	Material Description	Moisture	Consistency/Density	Remarks	Sample
		-				Natural		SW	Natural SAND: grey, fine to coarse grained, trace fine to medium sized gravel, trace fines, grass and rootlets at surface..	M			
		3											
		7			0.4								
		4				Natural		SW	Natural SAND: yellow, fine to medium grained, trace fines.		MD-D		
		3											
		4											
		3			1								
		4											
		4											
		4											
		3											
		4											
		4											
		4			2								
									TP60 Terminated at 2.5 m (Target Depth)				

Appendix C: Perth Sand Penetrometer Test Results

www.galtenv.com.au
50 Edward Street OSBORNE PARK WA 6017
ABN: 96 520 810 622

PERTH SAND PENETROMETER FIELD TEST DATA
(AS 1289.6.3.3)

Client:	Qube	**Job No:**	WAE230106
Project:	Due Diligence, Proposed Subdivision	**Date:**	1-Nov to 3-Nov 2023
Location:	Wattleup Road, Hammond Park	**Engineer:**	TD

Test No:	PSP01	PSP02	PSP03	PSP04	PSP05	PSP06	PSP07	PSP08
Location:	TP01	TP02	TP03	TP04	TP05	TP06	TP07	TP08
Depth (mm)	**N° of Penetrometer Blows per 150 mm Depth Interval**							
0-150	SET	SET	SET	SET	SET	SET	SET	SET
150-300	2	3	4	3	4	4	2	3
300-450	5	4	4	3	4	5	3	4
450-600	5	5	5	3	4	6	5	4
600-750	5	4	3	3	4	5	4	4
750-900	4	5	4	2	3	4	3	5
900-1050	5	4	4	3	4	5	3	4
1050-1200	5	5	4	4	5	6	3	5
1200-1350	4	4	4	3	4	5	3	5
1350-1500	5	6	5	4	4	5	3	5
1500-1650	5	4	4	3	5	4	3	5
1650-1800	5	4	5	4	4	5	3	4
1800-1950	5	4	4	3	4	5	4	4
1950-2100	6	4	4	4	4	4	4	5

Test No:	PSP09	PSP10	PSP11	PSP12	PSP13	PSP14	PSP15	PSP16
Location:	TP09	TP10	TP11	TP12	TP13	TP14	TP15	TP16
Depth (mm)	**N° of Penetrometer Blows per 150 mm Depth Interval**							
0-150	SET	SET	SET	SET	SET	SET	SET	SET
150-300	4	2	2	2	5	2	4	3
300-450	5	4	5	5	6	3	6	2
450-600	6	5	5	6	6	5	6	3
600-750	5	4	5	5	6	4	4	4
750-900	4	4	5	6	6	4	4	4
900-1050	4	4	4	6	7	3	4	4
1050-1200	4	3	5	6	7	3	4	3
1200-1350	4	4	5	6	7	3	4	3
1350-1500	4	3	5	6	7	4	5	4
1500-1650	5	4	6	6	7	4	4	3
1650-1800	5	4	5	6	5	3	4	4
1800-1950	4	4	5	5	5	3	4	3
1950-2100	4	4	5	6	6	4	4	4

Perth Sand Penetrometer tests done in accordance with AS 1289.6.3.3 (except blow counts are reported per 150 mm, rather than 300 mm)
HB: Hammer bounce (refusal)
0 = Penetration due to hammer weight only
R: Refusal

PERTH SAND PENETROMETER FIELD TEST DATA
(AS 1289.6.3.3)

Client:	Qube	**Job No:**	WAE230106
Project:	Due Diligence, Proposed Subdivision	**Date:**	1-Nov to 3-Nov 2023
Location:	Wattleup Road, Hammond Park	**Engineer:**	TD

Test No:	PSP17	PSP18	PSP19	PSP20	PSP21	PSP22	PSP23	PSP24
Location:	TP17	TP18	TP19	TP20	TP21	TP22	TP23	TP24
Depth (mm)	**N° of Penetrometer Blows per 150 mm Depth Interval**							
0-150	SET	SET	SET	SET	SET	SET	SET	SET
150-300	4	6	4	6	7	7	7	5
300-450	6	6	5	7	10	5	8	7
450-600	3	4	7	6	7	6	10	10
600-750	2	5	4	6	6	7	9	9
750-900	2	6	4	5	4	5	7	7
900-1050	3	5	3	4	5	5	8	7
1050-1200	3	7	4	3	7	6	5	5
1200-1350	4	8	4	5	5	6	7	6
1350-1500	3	6	3	7	5	6	7	7
1500-1650	4	5	4	5	6	5	6	6
1650-1800	3	6	3	5	5	6	6	5
1800-1950	4	5	4	4	5	6	6	7
1950-2100	4	4	7	5	5	5	6	6

Test No:	PSP25	PSP26	PSP27	PSP28	PSP29	PSP30	PSP31	PSP32
Location:	TP25	TP26	TP27	TP28	TP29	TP30	TP31	TP32
Depth (mm)	**N° of Penetrometer Blows per 150 mm Depth Interval**							
0-150	SET	SET	SET	SET	SET	SET	SET	SET
150-300	10	8	3	5	2	3	3	3
300-450	10	12	7	5	3	5	5	4
450-600	6	5	12	12	6	5	6	6
600-750	6	4	10	8	5	7	7	7
750-900	6	4	10	9	6	7	7	8
900-1050	5	3	7	7	4	6	7	8
1050-1200	6	4	7	8	4	8	7	11
1200-1350	5	8	8	8	4	8	7	10
1350-1500	5	9	7	7	6	5	7	10
1500-1650	5	10	7	8	6	6	8	10
1650-1800	5	9	7	7	6	6	8	10
1800-1950	5	6	7	7	6	6	8	8
1950-2100	5	8	6	6	5	5	9	7

Perth Sand Penetrometer tests done in accordance with AS 1289.6.3.3 (except blow counts are reported per 150 mm, rather than 300 mm)
HB: Hammer bounce (refusal)
0 = Penetration due to hammer weight only
R: Refusal

PERTH SAND PENETROMETER FIELD TEST DATA
(AS 1289.6.3.3)

Client:	Qube	**Job No:**	WAE230106
Project:	Due Diligence, Proposed Subdivision	**Date:**	1-Nov to 3-Nov 2023
Location:	Wattleup Road, Hammond Park	**Engineer:**	TD

Test No:	PSP33	PSP34	PSP35	PSP36	PSP37	PSP38	PSP39	PSP40
Location:	TP33	TP34	TP35	TP36	TP37	TP38	TP39	TP40
Depth (mm)	**N° of Penetrometer Blows per 150 mm Depth Interval**							
0-150	SET	SET	SET	SET	SET	SET	SET	SET
150-300	15	3	5	4	4	3	8	4
300-450		4	6	4	5	5	15	5
450-600		5	7	5	7	8	15	8
600-750		7	10	4	9	7		7
750-900		8	7	4	8	8		8
900-1050		8	8	3	8	6		8
1050-1200		12	9	3	11	6		9
1200-1350		11	8	2	7	6		8
1350-1500		7	8	2	10	6		7
1500-1650		10	10	3	10	8		9
1650-1800		7	9	4	8	7		11
1800-1950		10	9	5	8	7		10
1950-2100		7	8	6	7	6		12

Test No:	PSP41	PSP42	PSP43	PSP44	PSP45	PSP46	PSP47	PSP48
Location:	TP41	TP42	TP43	TP44	TP45	TP46	TP47	TP48
Depth (mm)	**N° of Penetrometer Blows per 150 mm Depth Interval**							
0-150	SET	SET	SET	SET	SET	SET	SET	SET
150-300	3	3	2	3	3	2	2	5
300-450	6	6	6	5	3	4	5	8
450-600	6	8	6	7	5	5	6	4
600-750	9	5	6	6	7	5	4	3
750-900	9	6	6	5	6	4	5	4
900-1050	7	6	5	5	7	3	5	3
1050-1200	6	6	6	7	6	5	4	4
1200-1350	6	8	8	6	7	4	3	3
1350-1500	7	9	10	6	9	3	3	4
1500-1650	6	8	7	6	11	4	4	3
1650-1800	5	7	9	5	11	4	3	4
1800-1950	6	7	9	6	10	3	4	3
1950-2100	7	8	8	5	10	3	4	4

Perth Sand Penetrometer tests done in accordance with AS 1289.6.3.3 (except blow counts are reported per 150 mm, rather than 300 mm)
HB: Hammer bounce (refusal)
0 = Penetration due to hammer weight only
R: Refusal

Appendix D: Infiltration Testing Results

www.galtenv.com.au
50 Edward Street OSBORNE PARK WA 6017
ABN: 96 520 810 622

Hydraulic Conductivity Calculation - Inverse Auger Hole Method

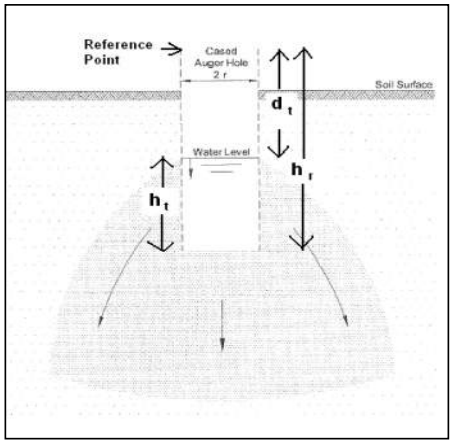
Galt Geotechnics

Job No:	WAE230106
Client:	Qube
Project:	Proposed Subdivision
Location:	Wattleup Road
	Hammond Park
BH Name:	IT01
Test Depth:	0.70 m

Spreadsheet author:	ORW	17-Oct-09

$$K = 1.15r \frac{\log_{10}(h_0 + \frac{1}{2}r) - \log_{10}(h_t + \frac{1}{2}r)}{t - t_0}$$

REFERENCE: Cocks, G. *Disposal of Stormwater Runoff by Soakage in Perth Western Australia*, Journal and News of the Australian Geomechanics Society, Volume 42 No 3 September 2007, pp101-114



Spreadsheet Legend	
	Required input
	Calculated field
	Comment field
	Field not used
	Fixed field

Parameter	Description	Value	Units
K	Hydraulic Conductivity		m/s
r	radius of test hole	0.045	m
t	time since start of measurement		s
h_r	reference point height above base	0.8	m
d_t	depth from reference point to water at time t		m
h_t	Water column height at time t		m
Sup	reference point stickup from ground level	0.1	m
h_0	h_t at t=0		m

Test 1

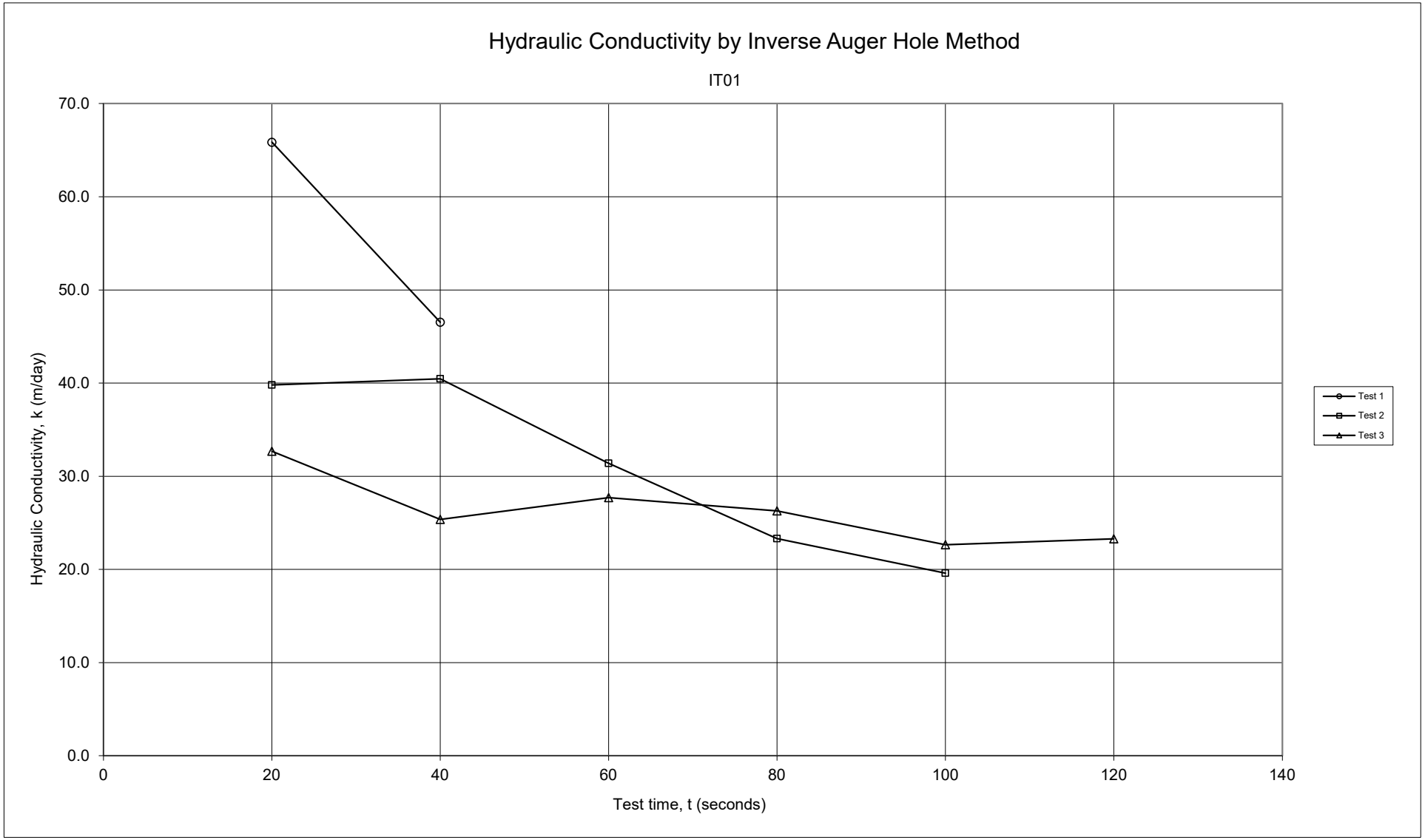
t (s)	d_w (m)	h_t (m)	K (m/s)	K (m/day)
0	0.3675	0.4325		
20	0.5916	0.2084	7.6E-04	65.9
40	0.648	0.152	5.4E-04	46.5
		AVERAGE	6.5E-04	56.2

Test 2

t (s)	d_w (m)	h_t (m)	K (m/s)	K (m/day)
0	0.2955	0.5045		
20	0.4727	0.3273	4.6E-04	39.8
40	0.5935	0.2065	4.7E-04	40.5
60	0.6227	0.1773	3.6E-04	31.4
80	0.6208	0.1792	2.7E-04	23.3
100	0.6305	0.1695	2.3E-04	19.6
		AVERAGE	3.6E-04	30.9

Test 3

t (s)	d_w (m)	h_t (m)	K (m/s)	K (m/day)
0	0.3246	0.4754		
20	0.4669	0.3331	3.8E-04	32.7
40	0.5273	0.2727	2.9E-04	25.4
60	0.611	0.189	3.2E-04	27.7
80	0.6539	0.1461	3.0E-04	26.3
100	0.6675	0.1325	2.6E-04	22.7
120	0.7045	0.0955	2.7E-04	23.3
		AVERAGE	3.0E-04	26.3


Hydraulic Conductivity by Inverse Auger Hole Method
IT01
Hydraulic Conductivity, k (m/day)
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
0
20
40
60
80
100
120
140
Test time, t (seconds)
Test 1
Test 2
Test 3

Hydraulic Conductivity Calculation - Inverse Auger Hole Method

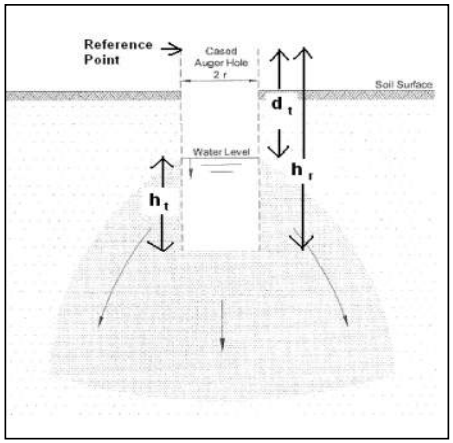
Galt Geotechnics

Job No:	WAE230106
Client:	Qube
Project:	Proposed Subdivision
Location:	Wattleup Road
	Hammond Park
BH Name:	IT02
Test Depth:	0.65 m

Spreadsheet author:	ORW	17-Oct-09

$$K = 1.15r \frac{\log_{10}(h_0 + \frac{1}{2}r) - \log_{10}(h_t + \frac{1}{2}r)}{t - t_0}$$

REFERENCE: Cocks, G. *Disposal of Stormwater Runoff by Soakage in Perth Western Australia*, Journal and News of the Australian Geomechanics Society, Volume 42 No 3 September 2007, pp101-114



Spreadsheet Legend

	Required input
	Calculated field
	Comment field
	Field not used
	Fixed field

Parameter	Description	Value	Units
K	Hydraulic Conductivity		m/s
r	radius of test hole	0.045	m
t	time since start of measurement		s
h_r	reference point height above base	0.85	m
d_t	depth from reference point to water at time t		m
h_t	Water column height at time t		m
Sup	reference point stickup from ground level	0.2	m
h_0	h_t at t=0		m

Test 1

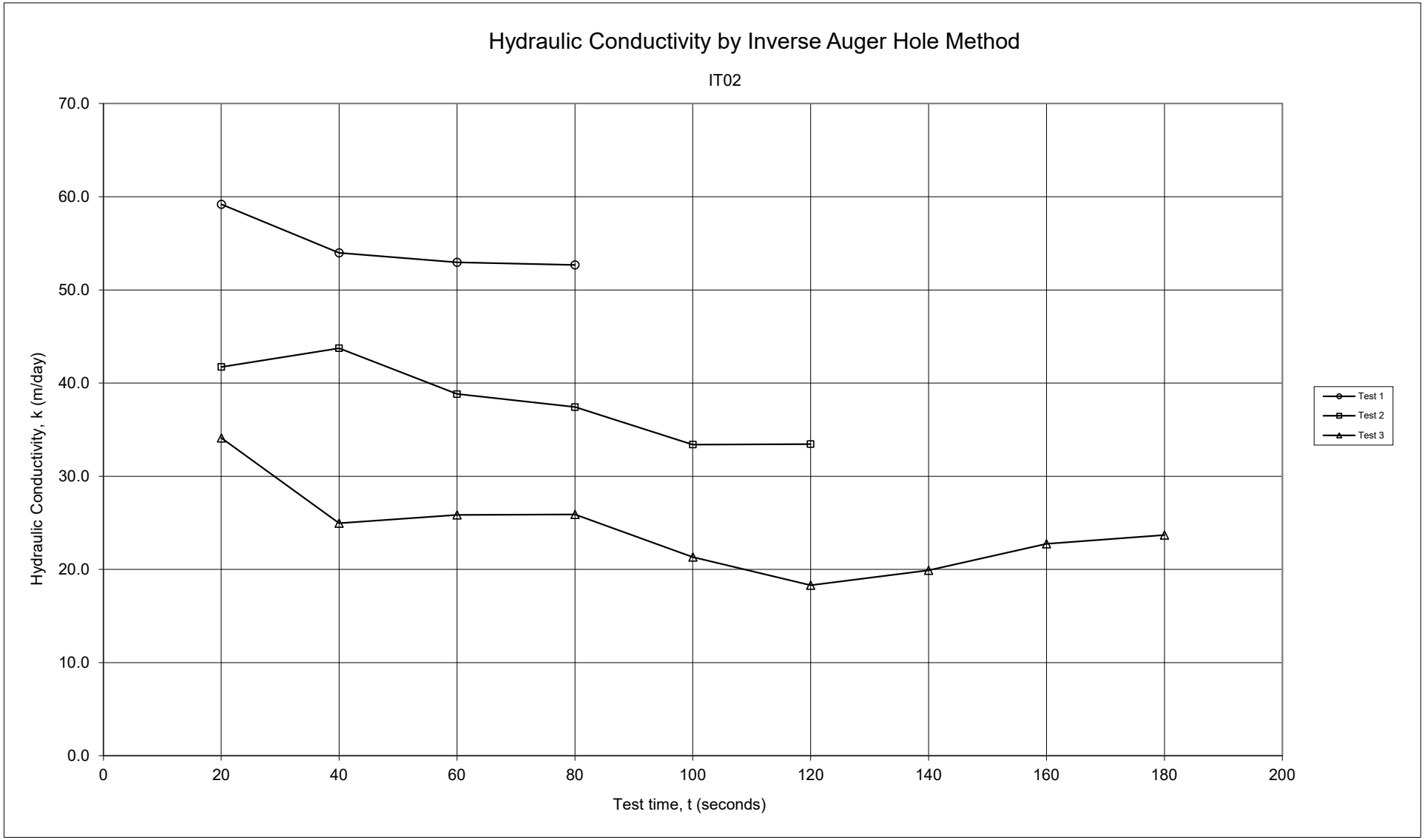
t (s)	d_w (m)	h_t (m)	K (m/s)	K (m/day)
0	0.5	0.35		
20	0.67	0.18	6.8E-04	59.2
40	0.75	0.1	6.2E-04	54.0
60	0.8	0.05	6.1E-04	53.0
80	0.83	0.02	6.1E-04	52.7
		AVERAGE	6.3E-04	54.7

Test 2

t (s)	d_w (m)	h_t (m)	K (m/s)	K (m/day)
0	0.3	0.55		
20	0.5	0.35	4.8E-04	41.7
40	0.64	0.21	5.1E-04	43.7
60	0.7	0.15	4.5E-04	38.8
80	0.75	0.1	4.3E-04	37.4
100	0.77	0.08	3.9E-04	33.4
120	0.8	0.05	3.9E-04	33.4
		AVERAGE	4.4E-04	38.1

Test 3

t (s)	d_w (m)	h_t (m)	K (m/s)	K (m/day)
0	0.4	0.45		
20	0.54	0.31	3.9E-04	34.1
40	0.59	0.26	2.9E-04	25.0
60	0.66	0.19	3.0E-04	25.9
80	0.71	0.14	3.0E-04	25.9
100	0.715	0.135	2.5E-04	21.3
120	0.72	0.13	2.1E-04	18.3
140	0.76	0.09	2.3E-04	19.9
160	0.8	0.05	2.6E-04	22.7
180	0.82	0.03	2.7E-04	23.7
		AVERAGE	2.8E-04	24.1


Hydraulic Conductivity by Inverse Auger Hole Method
IT02
Hydraulic Conductivity, k (m/day)
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
0
20
40
60
80
100
120
140
160
180
200
Test time, t (seconds)
Test 1
Test 2
Test 3

Hydraulic Conductivity Calculation - Inverse Auger Hole Method

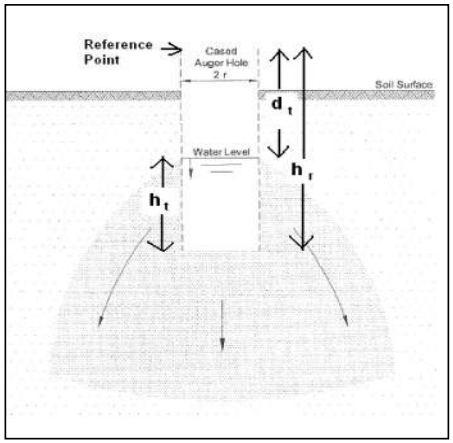
Galt Geotechnics

Job No:	WAE230106
Client:	Qube
Project:	Proposed Subdivision
Location:	Wattleup Road
	Hammond Park
BH Name:	IT03
Test Depth:	0.63 m

Spreadsheet author:	ORW	17-Oct-09

$$K = 1.15r \frac{\log_{10}(h_0 + \frac{1}{2}r) - \log_{10}(h_t + \frac{1}{2}r)}{t - t_0}$$

REFERENCE: Cocks, G. *Disposal of Stormwater Runoff by Soakage in Perth Western Australia*, Journal and News of the Australian Geomechanics Society, Volume 42 No 3 September 2007, pp101-114



Spreadsheet Legend

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	Calculated field
	Comment field
	Field not used
	Fixed field

Parameter	Description	Value	Units
K	Hydraulic Conductivity		m/s
r	radius of test hole	0.045	m
t	time since start of measurement		s
h_r	reference point height above base	0.83	m
d_t	depth from reference point to water at time t		m
h_t	Water column height at time t		m
Sup	reference point stickup from ground level	0.2	m
h_0	h_t at t=0		m

Test 1

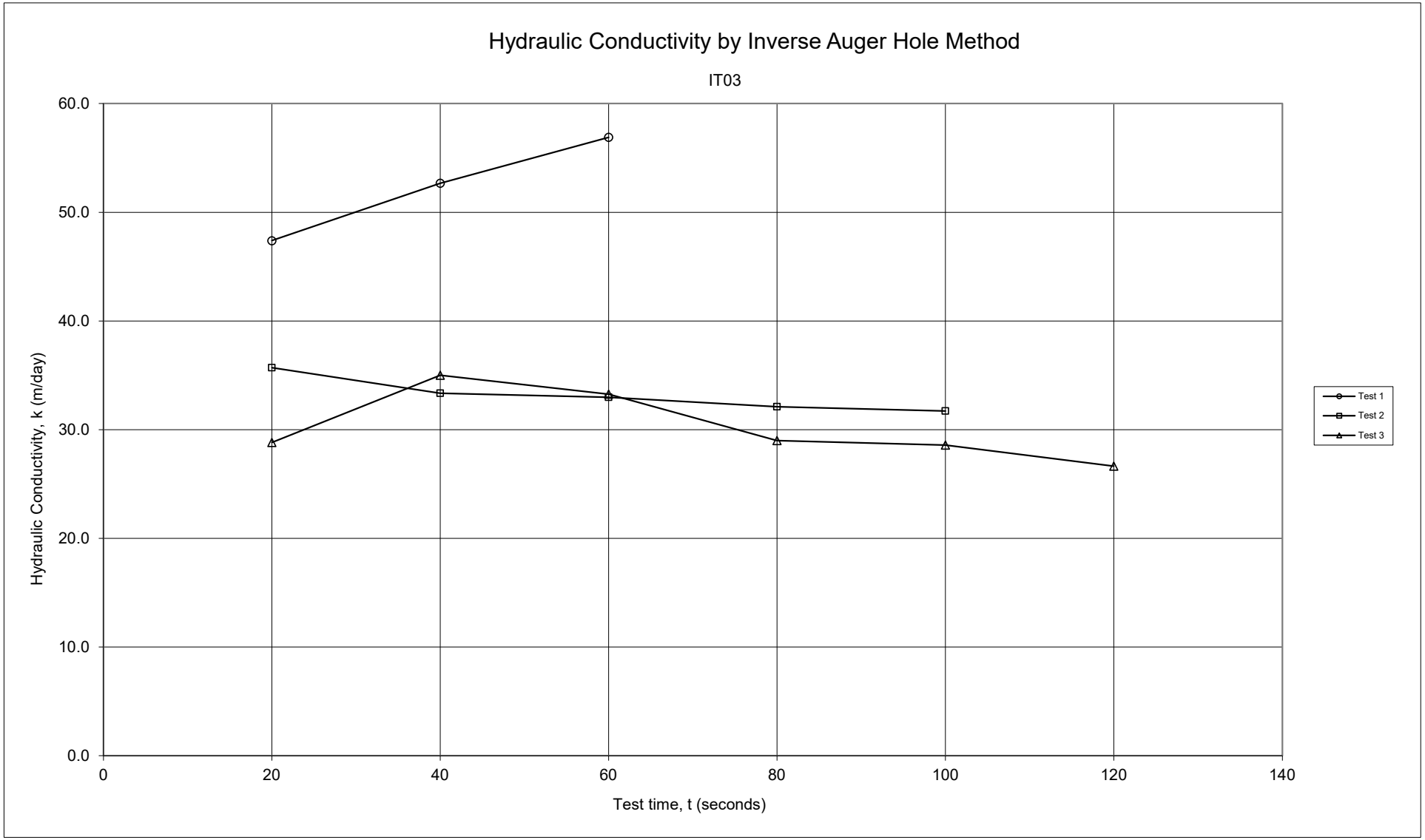
t (s)	d_w (m)	h_t (m)	K (m/s)	K (m/day)
0	0.49	0.34		
20	0.63	0.2	5.5E-04	47.4
40	0.73	0.1	6.1E-04	52.7
60	0.79	0.04	6.6E-04	56.9
		AVERAGE	6.1E-04	52.3

Test 2

t (s)	d_w (m)	h_t (m)	K (m/s)	K (m/day)
0	0.43	0.4		
20	0.56	0.27	4.1E-04	35.7
40	0.64	0.19	3.9E-04	33.4
60	0.7	0.13	3.8E-04	33.0
80	0.74	0.09	3.7E-04	32.1
100	0.77	0.06	3.7E-04	31.7
		AVERAGE	3.8E-04	33.2

Test 3

t (s)	d_w (m)	h_t (m)	K (m/s)	K (m/day)
0	0.58	0.25		
20	0.65	0.18	3.3E-04	28.8
40	0.72	0.11	4.1E-04	35.0
60	0.755	0.075	3.8E-04	33.3
80	0.77	0.06	3.4E-04	29.0
100	0.79	0.04	3.3E-04	28.6
120	0.8	0.03	3.1E-04	26.6
		AVERAGE	3.5E-04	30.2


Hydraulic Conductivity by Inverse Auger Hole Method
IT03
60.0
50.0
40.0
30.0
20.0
10.0
0.0
Hydraulic Conductivity, k (m/day)
0
20
40
60
80
100
120
140
Test time, t (seconds)
Test 1
Test 2
Test 3

Hydraulic Conductivity Calculation - Inverse Auger Hole Method

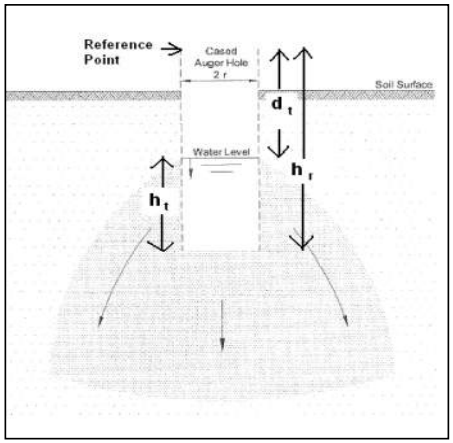
Galt Geotechnics

Job No:	WAE230106
Client:	Qube
Project:	Proposed Subdivision
Location:	Wattleup Road
	Hammond Park
BH Name:	IT04
Test Depth:	0.57 m

Spreadsheet author:	ORW	17-Oct-09

$$K = 1.15r \frac{\log_{10}(h_0 + \frac{1}{2}r) - \log_{10}(h_t + \frac{1}{2}r)}{t - t_0}$$

REFERENCE: Cocks, G. *Disposal of Stormwater Runoff by Soakage in Perth Western Australia*, Journal and News of the Australian Geomechanics Society, Volume 42 No 3 September 2007, pp101-114



Spreadsheet Legend

	Required input
	Calculated field
	Comment field
	Field not used
	Fixed field

Parameter	Description	Value	Units
K	Hydraulic Conductivity		m/s
r	radius of test hole	0.045	m
t	time since start of measurement		s
h_r	reference point height above base	0.77	m
d_t	depth from reference point to water at time t		m
h_t	Water column height at time t		m
Sup	reference point stickup from ground level	0.2	m
h_0	h_t at t=0		m

0.58
0.6

Test 1

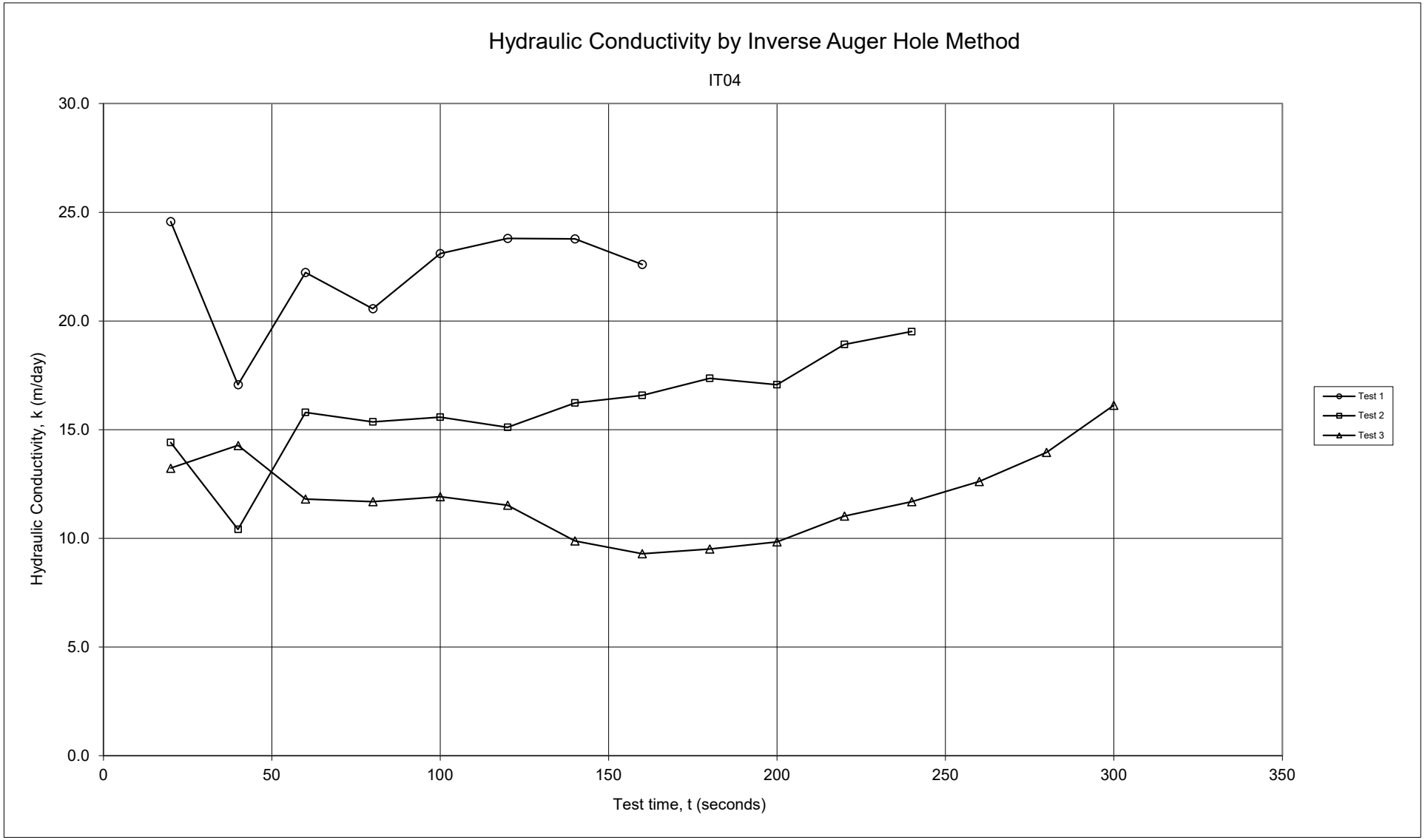
t (s)	d_w (m)	h_t (m)	K (m/s)	K (m/day)
0	0.39	0.38		
20	0.48	0.29	2.8E-04	24.6
40	0.5093	0.2607	2.0E-04	17.1
60	0.59	0.18	2.6E-04	22.2
80	0.62	0.15	2.4E-04	20.6
100	0.67	0.1	2.7E-04	23.1
120	0.7	0.07	2.8E-04	23.8
140	0.72	0.05	2.8E-04	23.8
160	0.73	0.04	2.6E-04	22.6
		AVERAGE	2.6E-04	22.2

Test 2

t (s)	d_w (m)	h_t (m)	K (m/s)	K (m/day)
0	0.43	0.34		
20	0.48	0.29	1.7E-04	14.4
40	0.5	0.27	1.2E-04	10.4
60	0.57	0.2	1.8E-04	15.8
80	0.6	0.17	1.8E-04	15.4
100	0.63	0.14	1.8E-04	15.6
120	0.65	0.12	1.7E-04	15.1
140	0.68	0.09	1.9E-04	16.2
160	0.7	0.07	1.9E-04	16.6
180	0.72	0.05	2.0E-04	17.4
200	0.73	0.04	2.0E-04	17.1
220	0.75	0.02	2.2E-04	18.9
240	0.76	0.01	2.3E-04	19.5
		AVERAGE	1.9E-04	16.0

Test 3

t (s)	d_w (m)	h_t (m)	K (m/s)	K (m/day)
0	0.4	0.37		
20	0.45	0.32	1.5E-04	13.2
40	0.5	0.27	1.7E-04	14.3
60	0.52	0.25	1.4E-04	11.8
80	0.55	0.22	1.4E-04	11.7
100	0.58	0.19	1.4E-04	11.9
120	0.6	0.17	1.3E-04	11.5
140	0.6	0.17	1.1E-04	9.9
160	0.61	0.16	1.1E-04	9.3
180	0.63	0.14	1.1E-04	9.5
200	0.65	0.12	1.1E-04	9.8
220	0.68	0.09	1.3E-04	11.0
240	0.7	0.07	1.4E-04	11.7
260	0.72	0.05	1.5E-04	12.6
280	0.74	0.03	1.6E-04	14.0
300	0.76	0.01	1.9E-04	16.1
		AVERAGE	1.4E-04	11.9


Hydraulic Conductivity by Inverse Auger Hole Method
IT04
Hydraulic Conductivity, k (m/day)
30.0
25.0
20.0
15.0
10.0
5.0
0.0
0
50
100
150
200
250
300
350
Test time, t (seconds)
Test 1
Test 2
Test 3

Hydraulic Conductivity Calculation - Inverse Auger Hole Method

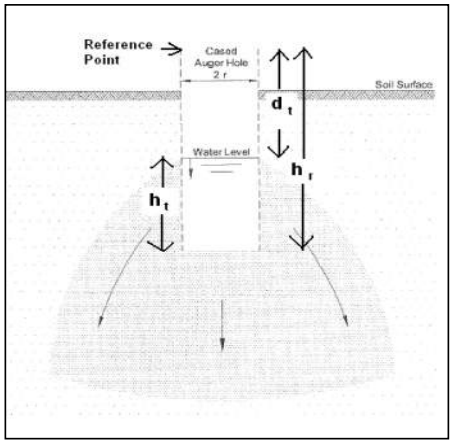
Galt Geotechnics

Job No:	WAE230106
Client:	Qube
Project:	Proposed Subdivision
Location:	Wattleup Road
	Hammond Park
BH Name:	IT05
Test Depth:	0.45 m

Spreadsheet author:	ORW	17-Oct-09

$$K = 1.15r \frac{\log_{10}(h_0 + \frac{1}{2}r) - \log_{10}(h_t + \frac{1}{2}r)}{t - t_0}$$

REFERENCE: Cocks, G. *Disposal of Stormwater Runoff by Soakage in Perth Western Australia*, Journal and News of the Australian Geomechanics Society, Volume 42 No 3 September 2007, pp101-114



Spreadsheet Legend	
	Required input
	Calculated field
	Comment field
	Field not used
	Fixed field

Parameter	Description	Value	Units
K	Hydraulic Conductivity		m/s
r	radius of test hole	0.045	m
t	time since start of measurement		s
h_r	reference point height above base	0.85	m
d_t	depth from reference point to water at time t		m
h_t	Water column height at time t		m
Sup	reference point stickup from ground level	0.4	m
h_0	h_t at t=0		m

Test 1

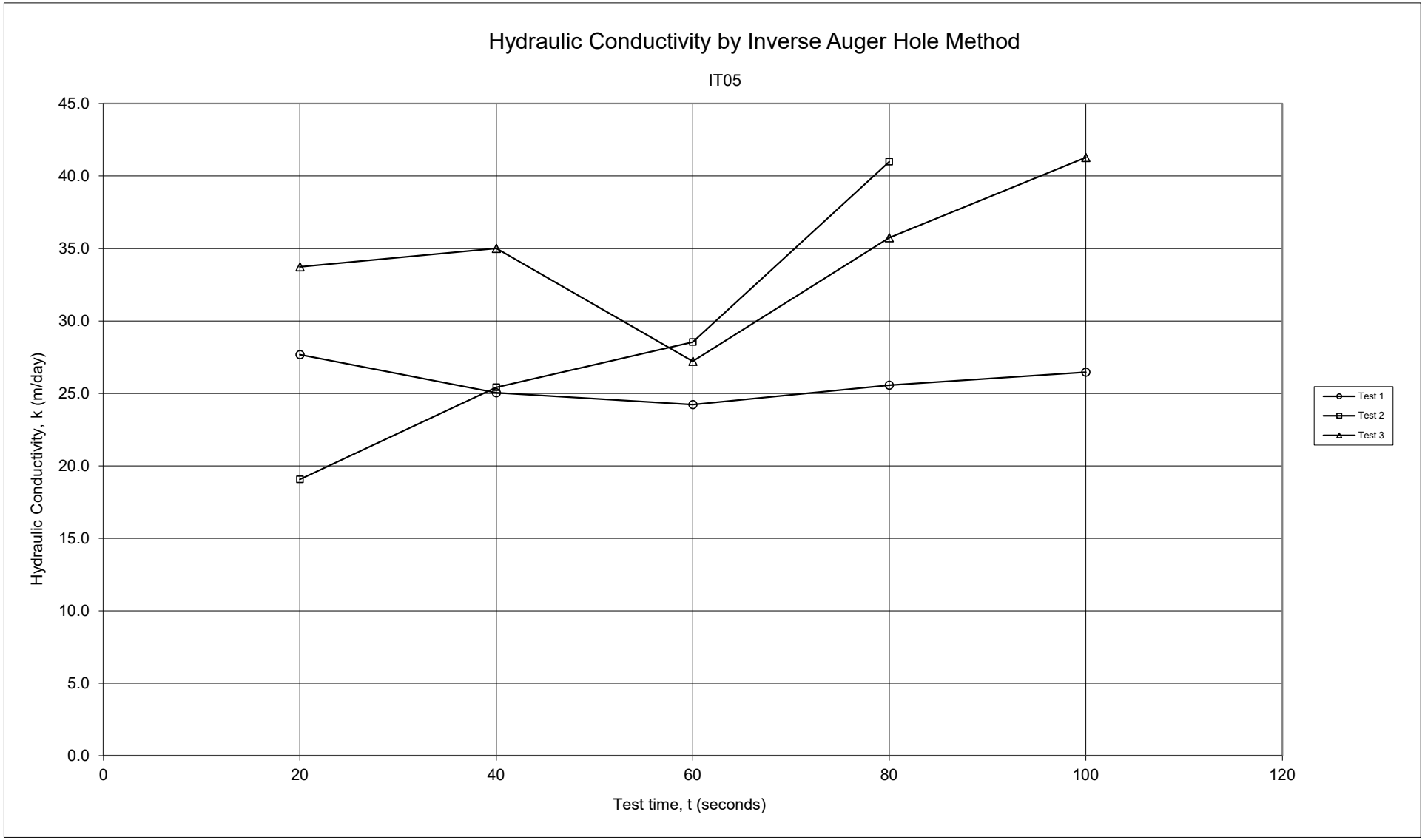
t (s)	d_w (m)	h_t (m)	K (m/s)	K (m/day)
0	0.55	0.3		
20	0.63	0.22	3.2E-04	27.7
40	0.68	0.17	2.9E-04	25.0
60	0.72	0.13	2.8E-04	24.2
80	0.76	0.09	3.0E-04	25.6
100	0.79	0.06	3.1E-04	26.5
		AVERAGE	3.0E-04	25.8

Test 2

t (s)	d_w (m)	h_t (m)	K (m/s)	K (m/day)
0	0.48	0.37		
20	0.55	0.3	2.2E-04	19.1
40	0.64	0.21	2.9E-04	25.4
60	0.71	0.14	3.3E-04	28.5
80	0.8	0.05	4.7E-04	41.0
		AVERAGE	3.3E-04	28.5

Test 3

t (s)	d_w (m)	h_t (m)	K (m/s)	K (m/day)
0	0.6	0.25		
20	0.68	0.17	3.9E-04	33.7
40	0.74	0.11	4.1E-04	35.0
60	0.755	0.095	3.2E-04	27.2
80	0.81	0.04	4.1E-04	35.7
100	0.84	0.01	4.8E-04	41.3
		AVERAGE	4.0E-04	34.6


Hydraulic Conductivity by Inverse Auger Hole Method
IT05
Hydraulic Conductivity, k (m/day)
45.0
40.0
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0.0
0
20
40
60
80
100
120
Test time, t (seconds)
Test 1
Test 2
Test 3

Hydraulic Conductivity Calculation - Inverse Auger Hole Method

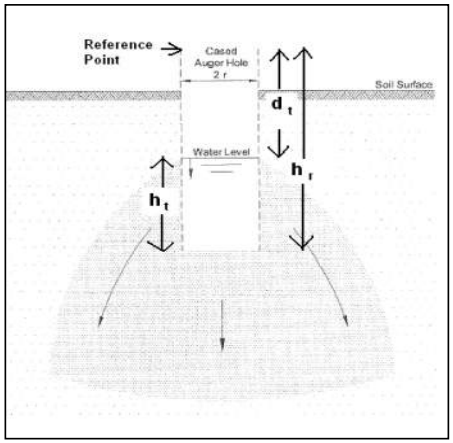
Galt Geotechnics

Job No:	WAE230106
Client:	Qube
Project:	Proposed Subdivision
Location:	Wattleup Road
	Hammond Park
BH Name:	IT06
Test Depth:	0.55 m

Spreadsheet author:	ORW	17-Oct-09

$$K = 1.15r \frac{\log_{10}(h_0 + \frac{1}{2}r) - \log_{10}(h_t + \frac{1}{2}r)}{t - t_0}$$

REFERENCE: Cocks, G. *Disposal of Stormwater Runoff by Soakage in Perth Western Australia*, Journal and News of the Australian Geomechanics Society, Volume 42 No 3 September 2007, pp101-114



Spreadsheet Legend	
	Required input
	Calculated field
	Comment field
	Field not used
	Fixed field

Parameter	Description	Value	Units
K	Hydraulic Conductivity		m/s
r	radius of test hole	0.045	m
t	time since start of measurement		s
h_r	reference point height above base	0.85	m
d_t	depth from reference point to water at time t		m
h_t	Water column height at time t		m
Sup	reference point stickup from ground level	0.3	m
h_0	h_t at t=0		m

Test 1

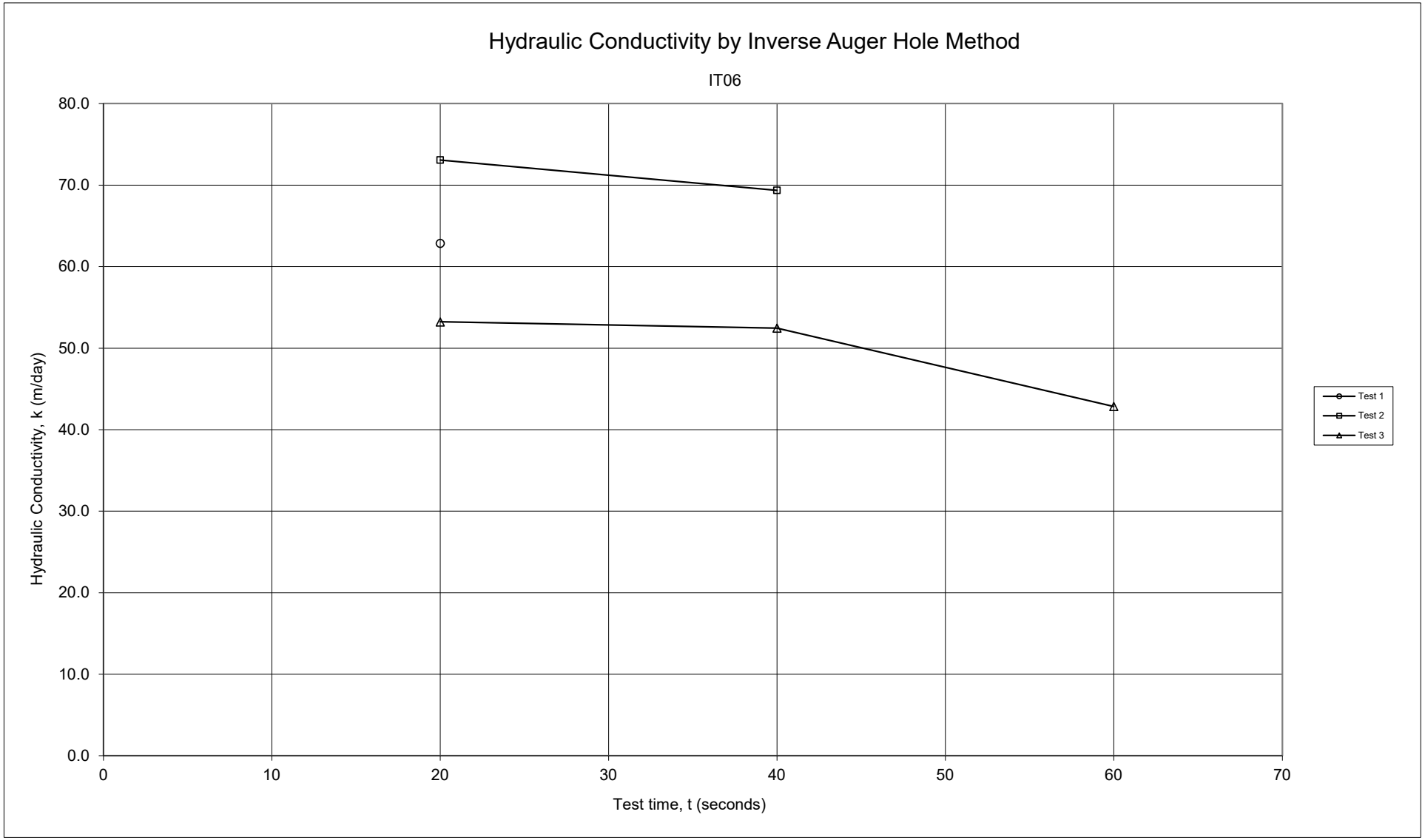
t (s)	d_w (m)	h_t (m)	K (m/s)	K (m/day)
0	0.562	0.288		
20	0.71	0.14	7.3E-04	62.9
		AVERAGE	7.3E-04	62.9

Test 2

t (s)	d_w (m)	h_t (m)	K (m/s)	K (m/day)
0	0.57	0.28		
20	0.73	0.12	8.5E-04	73.1
40	0.8	0.05	8.0E-04	69.3
		AVERAGE	8.2E-04	71.2

Test 3

t (s)	d_w (m)	h_t (m)	K (m/s)	K (m/day)
0	0.6	0.25		
20	0.715	0.135	6.2E-04	53.2
40	0.78	0.07	6.1E-04	52.4
60	0.8	0.05	5.0E-04	42.9
		AVERAGE	5.7E-04	49.5


Hydraulic Conductivity by Inverse Auger Hole Method
IT06
Hydraulic Conductivity, k (m/day)
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
0
10
20
30
40
50
60
70
Test time, t (seconds)
Test 1
Test 2
Test 3

Hydraulic Conductivity Calculation - Inverse Auger Hole Method

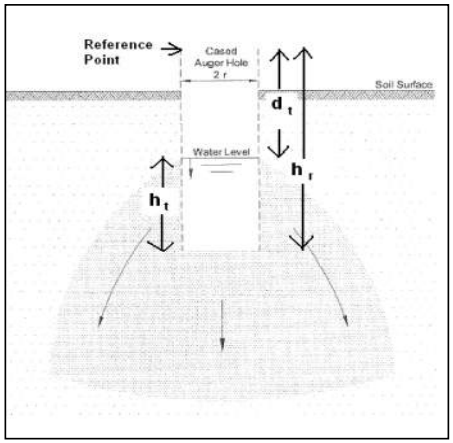
Galt Geotechnics

Job No:	WAE230106
Client:	Qube
Project:	Proposed Subdivision
Location:	Wattleup Road
	Hammond Park
BH Name:	IT07
Test Depth:	0.52 m

Spreadsheet author:	ORW	17-Oct-09

$$K = 1.15r \frac{\log_{10}(h_0 + \frac{1}{2}r) - \log_{10}(h_t + \frac{1}{2}r)}{t - t_0}$$

REFERENCE: Cocks, G. *Disposal of Stormwater Runoff by Soakage in Perth Western Australia*, Journal and News of the Australian Geomechanics Society, Volume 42 No 3 September 2007, pp101-114



Spreadsheet Legend

	Required input
	Calculated field
	Comment field
	Field not used
	Fixed field

Parameter	Description	Value	Units
K	Hydraulic Conductivity		m/s
r	radius of test hole	0.045	m
t	time since start of measurement		s
h_r	reference point height above base	0.82	m
d_t	depth from reference point to water at time t		m
h_t	Water column height at time t		m
Sup	reference point stickup from ground level	0.3	m
h_0	h_t at t=0		m

Test 1

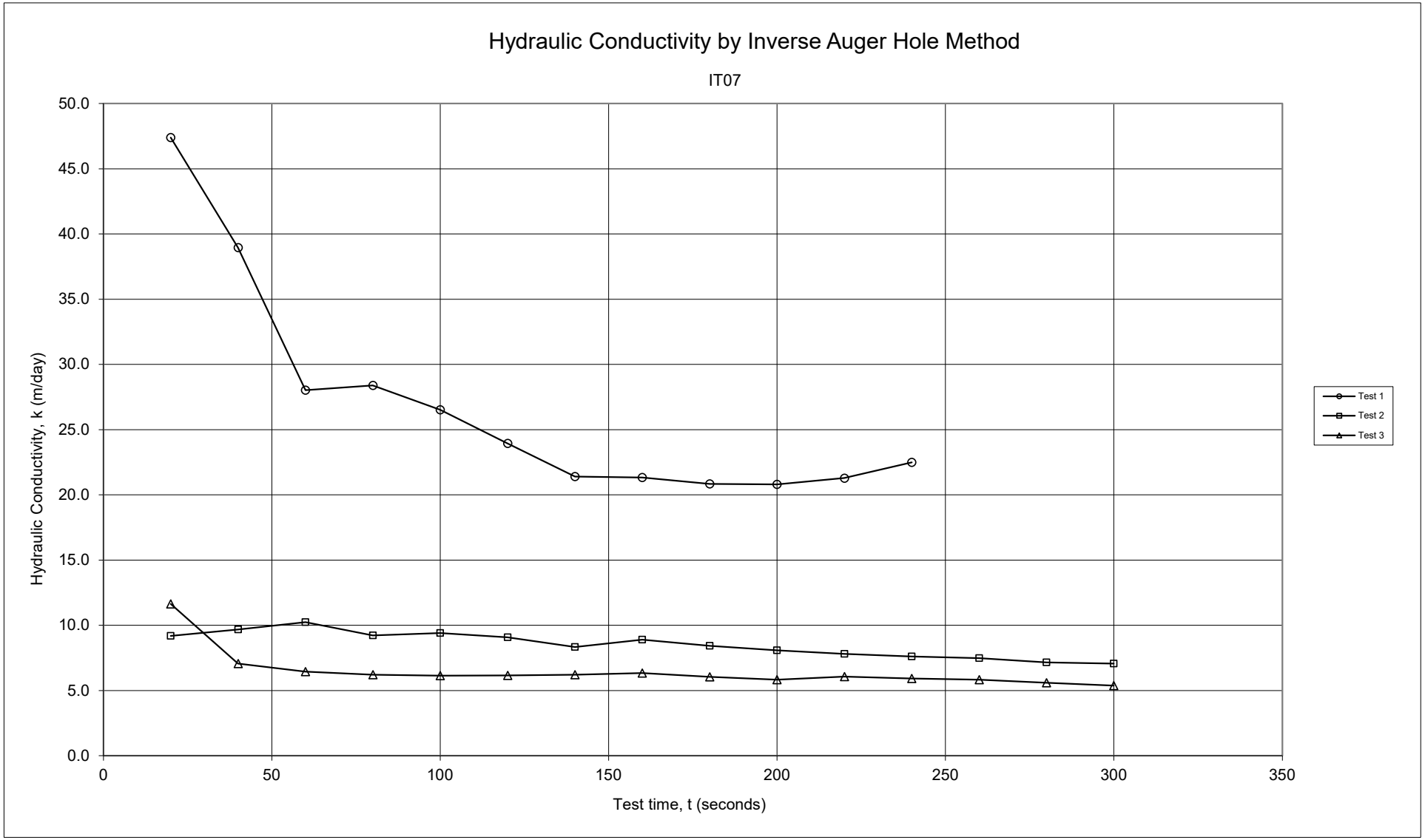
t (s)	d_w (m)	h_t (m)	K (m/s)	K (m/day)
0	0.48	0.34		
20	0.62	0.2	5.5E-04	47.4
40	0.68	0.14	4.5E-04	39.0
60	0.69	0.13	3.2E-04	28.0
80	0.73	0.09	3.3E-04	28.4
100	0.75	0.07	3.1E-04	26.5
120	0.76	0.06	2.8E-04	24.0
140	0.765	0.055	2.5E-04	21.4
160	0.78	0.04	2.5E-04	21.3
180	0.79	0.03	2.4E-04	20.8
200	0.8	0.02	2.4E-04	20.8
220	0.81	0.01	2.5E-04	21.3
240	0.82	0	2.6E-04	22.5
		AVERAGE	3.1E-04	26.8

Test 2

t (s)	d_w (m)	h_t (m)	K (m/s)	K (m/day)
0	0.4	0.42		
20	0.44	0.38	1.1E-04	9.2
40	0.48	0.34	1.1E-04	9.7
60	0.52	0.3	1.2E-04	10.2
80	0.54	0.28	1.1E-04	9.2
100	0.57	0.25	1.1E-04	9.4
120	0.59	0.23	1.1E-04	9.1
140	0.6	0.22	9.7E-05	8.3
160	0.63	0.19	1.0E-04	8.9
180	0.64	0.18	9.8E-05	8.4
200	0.65	0.17	9.4E-05	8.1
220	0.66	0.16	9.0E-05	7.8
240	0.67	0.15	8.8E-05	7.6
260	0.68	0.14	8.7E-05	7.5
280	0.685	0.135	8.3E-05	7.2
300	0.694	0.126	8.2E-05	7.1
		AVERAGE	9.9E-05	8.5

Test 3

t (s)	d_w (m)	h_t (m)	K (m/s)	K (m/day)
0	0.4	0.42		
20	0.45	0.37	1.3E-04	11.6
40	0.46	0.36	8.2E-05	7.1
60	0.48	0.34	7.5E-05	6.5
80	0.5	0.32	7.2E-05	6.2
100	0.52	0.3	7.1E-05	6.1
120	0.54	0.28	7.1E-05	6.2
140	0.56	0.26	7.2E-05	6.2
160	0.58	0.24	7.3E-05	6.3
180	0.59	0.23	7.0E-05	6.1
200	0.6	0.22	6.8E-05	5.8
220	0.62	0.2	7.0E-05	6.1
240	0.63	0.19	6.9E-05	5.9
260	0.64	0.18	6.8E-05	5.8
280	0.645	0.175	6.5E-05	5.6
300	0.65	0.17	6.2E-05	5.4
		AVERAGE	7.5E-05	6.5


Hydraulic Conductivity by Inverse Auger Hole Method
IT07
Hydraulic Conductivity, k (m/day)
50.0
45.0
40.0
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0.0
0
50
100
150
200
250
300
350
Test time, t (seconds)
Test 1
Test 2
Test 3

Hydraulic Conductivity Calculation - Inverse Auger Hole Method

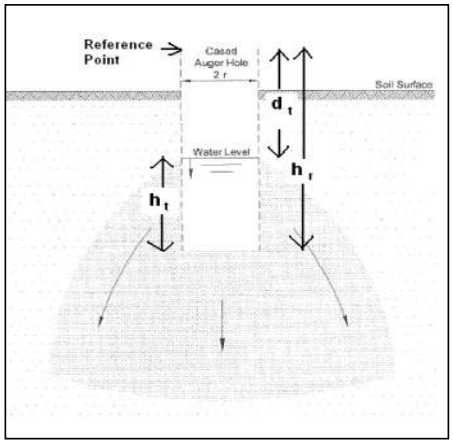
Galt Geotechnics

Job No:	WAE230106
Client:	Qube
Project:	Proposed Subdivision
Location:	Wattleup Road
	Hammond Park
BH Name:	IT08
Test Depth:	0.65 m

Spreadsheet author:	ORW	17-Oct-09

$$K = 1.15r \frac{\log_{10}(h_0 + \frac{1}{2}r) - \log_{10}(h_t + \frac{1}{2}r)}{t - t_0}$$

REFERENCE: Cocks, G. *Disposal of Stormwater Runoff by Soakage in Perth Western Australia*, Journal and News of the Australian Geomechanics Society, Volume 42 No 3 September 2007, pp101-114



Spreadsheet Legend

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	Calculated field
	Comment field
	Field not used
	Fixed field

Parameter	Description	Value	Units
K	Hydraulic Conductivity		m/s
r	radius of test hole	0.045	m
t	time since start of measurement		s
h_r	reference point height above base	0.85	m
d_t	depth from reference point to water at time t		m
h_t	Water column height at time t		m
Sup	reference point stickup from ground level	0.2	m
h_0	h_t at t=0		m

Test 1

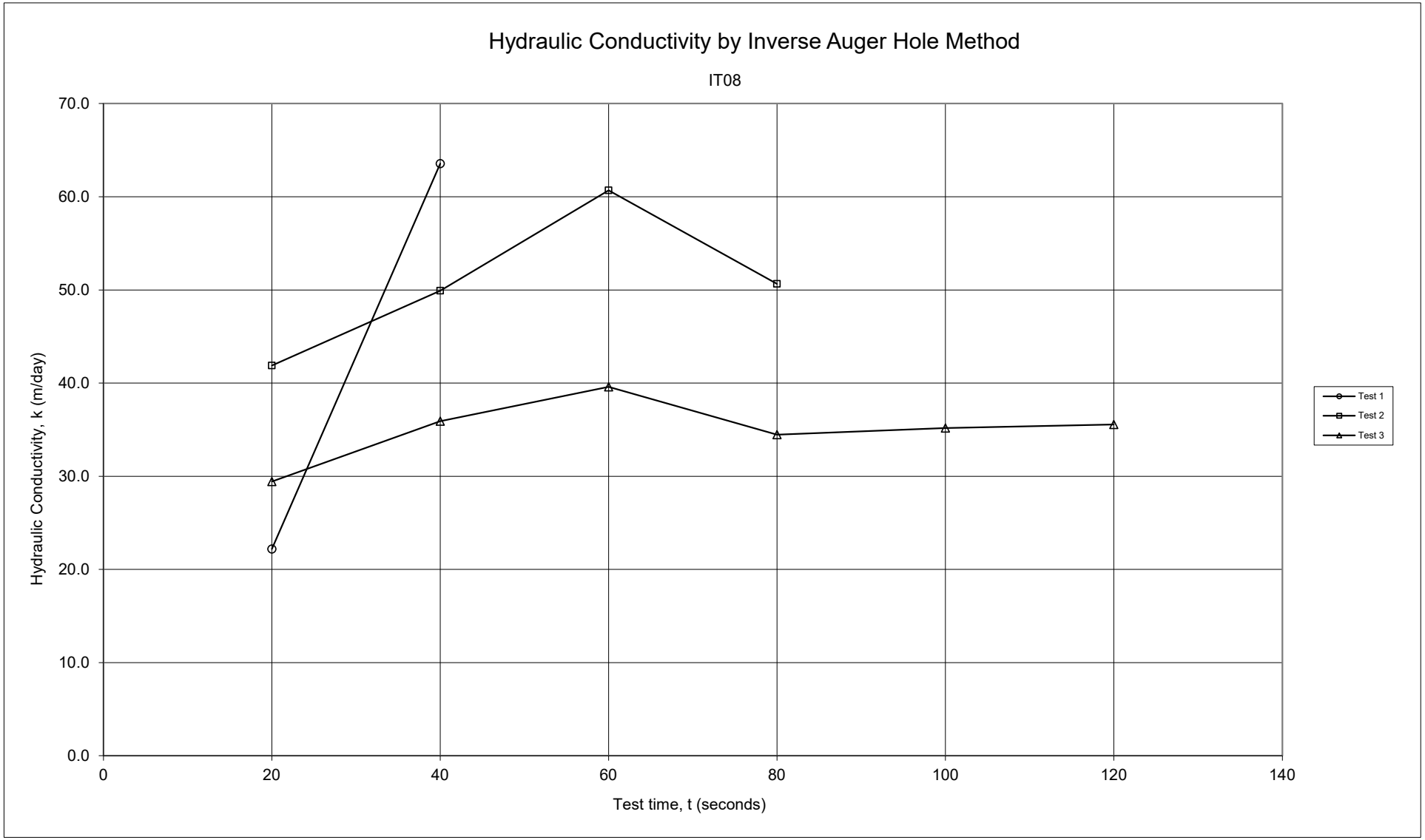
t (s)	d_w (m)	h_t (m)	K (m/s)	K (m/day)
0	0.53	0.32		
20	0.6	0.25	2.6E-04	22.2
40	0.78	0.07	7.4E-04	63.5
		AVERAGE	5.0E-04	42.9

Test 2

t (s)	d_w (m)	h_t (m)	K (m/s)	K (m/day)
0	0.53	0.32		
20	0.65	0.2	4.8E-04	41.9
40	0.75	0.1	5.8E-04	49.9
60	0.82	0.03	7.0E-04	60.7
80	0.83	0.02	5.9E-04	50.7
		AVERAGE	5.9E-04	50.8

Test 3

t (s)	d_w (m)	h_t (m)	K (m/s)	K (m/day)
0	0.49	0.36		
20	0.59	0.26	3.4E-04	29.4
40	0.69	0.16	4.2E-04	35.9
60	0.76	0.09	4.6E-04	39.6
80	0.78	0.07	4.0E-04	34.5
100	0.81	0.04	4.1E-04	35.2
120	0.83	0.02	4.1E-04	35.6
		AVERAGE	4.1E-04	35.0


Hydraulic Conductivity by Inverse Auger Hole Method
IT08
Hydraulic Conductivity, k (m/day)
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
0
20
40
60
80
100
120
140
Test time, t (seconds)
Test 1
Test 2
Test 3

Hydraulic Conductivity Calculation - Inverse Auger Hole Method

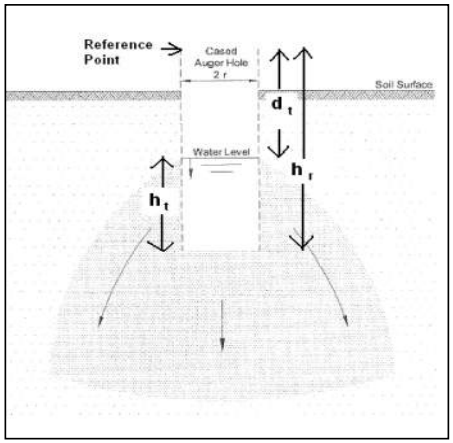
Galt Geotechnics

Job No:	WAE230106
Client:	Qube
Project:	Proposed Subdivision
Location:	Wattleup Road
	Hammond Park
BH Name:	IT09
Test Depth:	0.50 m

Spreadsheet author:	ORW	17-Oct-09

$$K = 1.15r \frac{\log_{10}(h_0 + \frac{1}{2}r) - \log_{10}(h_t + \frac{1}{2}r)}{t - t_0}$$

REFERENCE: Cocks, G. *Disposal of Stormwater Runoff by Soakage in Perth Western Australia*, Journal and News of the Australian Geomechanics Society, Volume 42 No 3 September 2007, pp101-114



Spreadsheet Legend

	Required input
	Calculated field
	Comment field
	Field not used
	Fixed field

Parameter	Description	Value	Units
K	Hydraulic Conductivity		m/s
r	radius of test hole	0.045	m
t	time since start of measurement		s
h_r	reference point height above base	0.8	m
d_t	depth from reference point to water at time t		m
h_t	Water column height at time t		m
Sup	reference point stickup from ground level	0.3	m
h_0	h_t at t=0		m

Test 1

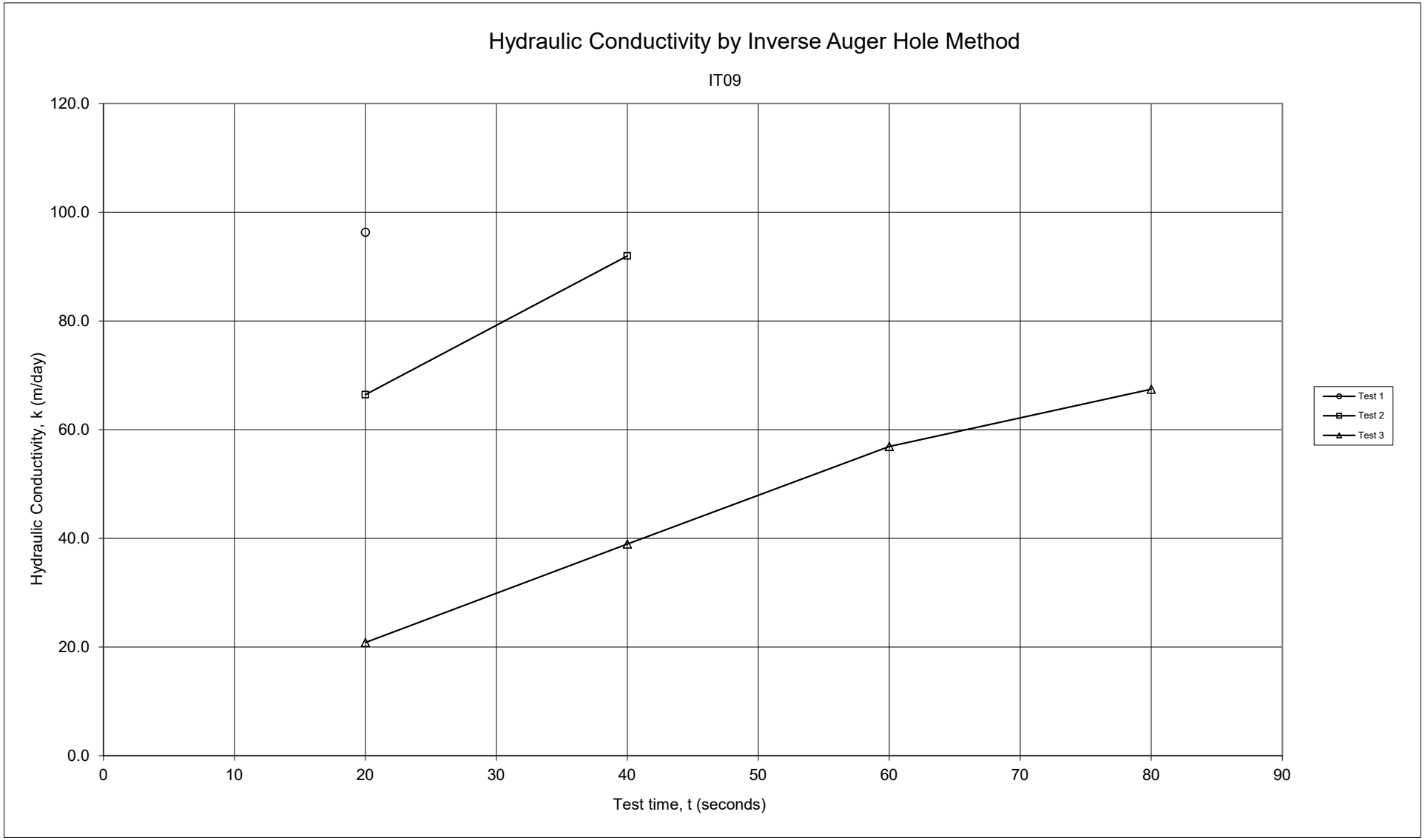
t (s)	d_w (m)	h_t (m)	K (m/s)	K (m/day)
0	0.6	0.2		
20	0.74	0.06	1.1E-03	96.3
		AVERAGE	1.1E-03	96.3

Test 2

t (s)	d_w (m)	h_t (m)	K (m/s)	K (m/day)
0	0.54	0.26		
20	0.68	0.12	7.7E-04	66.4
40	0.78	0.02	1.1E-03	92.0
		AVERAGE	9.2E-04	79.2

Test 3

t (s)	d_w (m)	h_t (m)	K (m/s)	K (m/day)
0	0.46	0.34		
20	0.53	0.27	2.4E-04	20.8
40	0.66	0.14	4.5E-04	39.0
60	0.76	0.04	6.6E-04	56.9
80	0.8	0	7.8E-04	67.5
		AVERAGE	5.3E-04	46.0


Hydraulic Conductivity by Inverse Auger Hole Method
IT09
Hydraulic Conductivity, k (m/day)
120.0
100.0
80.0
60.0
40.0
20.0
0.0
0
10
20
30
40
50
60
70
80
90
Test time, t (seconds)
Test 1
Test 2
Test 3

Hydraulic Conductivity Calculation - Inverse Auger Hole Method

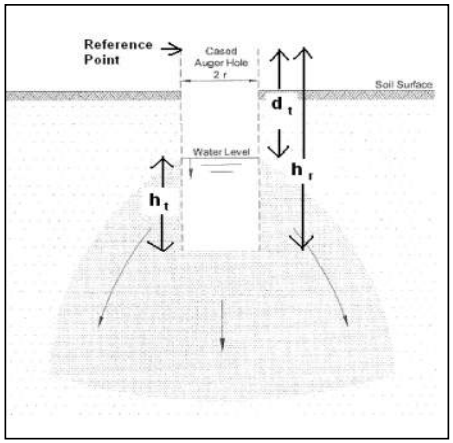
Galt Geotechnics

Job No:	WAE230106
Client:	Qube
Project:	Proposed Subdivision
Location:	Wattleup Road
	Hammond Park
BH Name:	IT10
Test Depth:	0.52 m

Spreadsheet author:	ORW	17-Oct-09

$$K = 1.15r \frac{\log_{10}(h_0 + \frac{1}{2}r) - \log_{10}(h_t + \frac{1}{2}r)}{t - t_0}$$

REFERENCE: Cocks, G. *Disposal of Stormwater Runoff by Soakage in Perth Western Australia*, Journal and News of the Australian Geomechanics Society, Volume 42 No 3 September 2007, pp101-114



Spreadsheet Legend	
	Required input
	Calculated field
	Comment field
	Field not used
	Fixed field

Parameter	Description	Value	Units
K	Hydraulic Conductivity		m/s
r	radius of test hole	0.045	m
t	time since start of measurement		s
h_r	reference point height above base	0.82	m
d_t	depth from reference point to water at time t		m
h_t	Water column height at time t		m
Sup	reference point stickup from ground level	0.3	m
h_0	h_t at t=0		m

Test 1

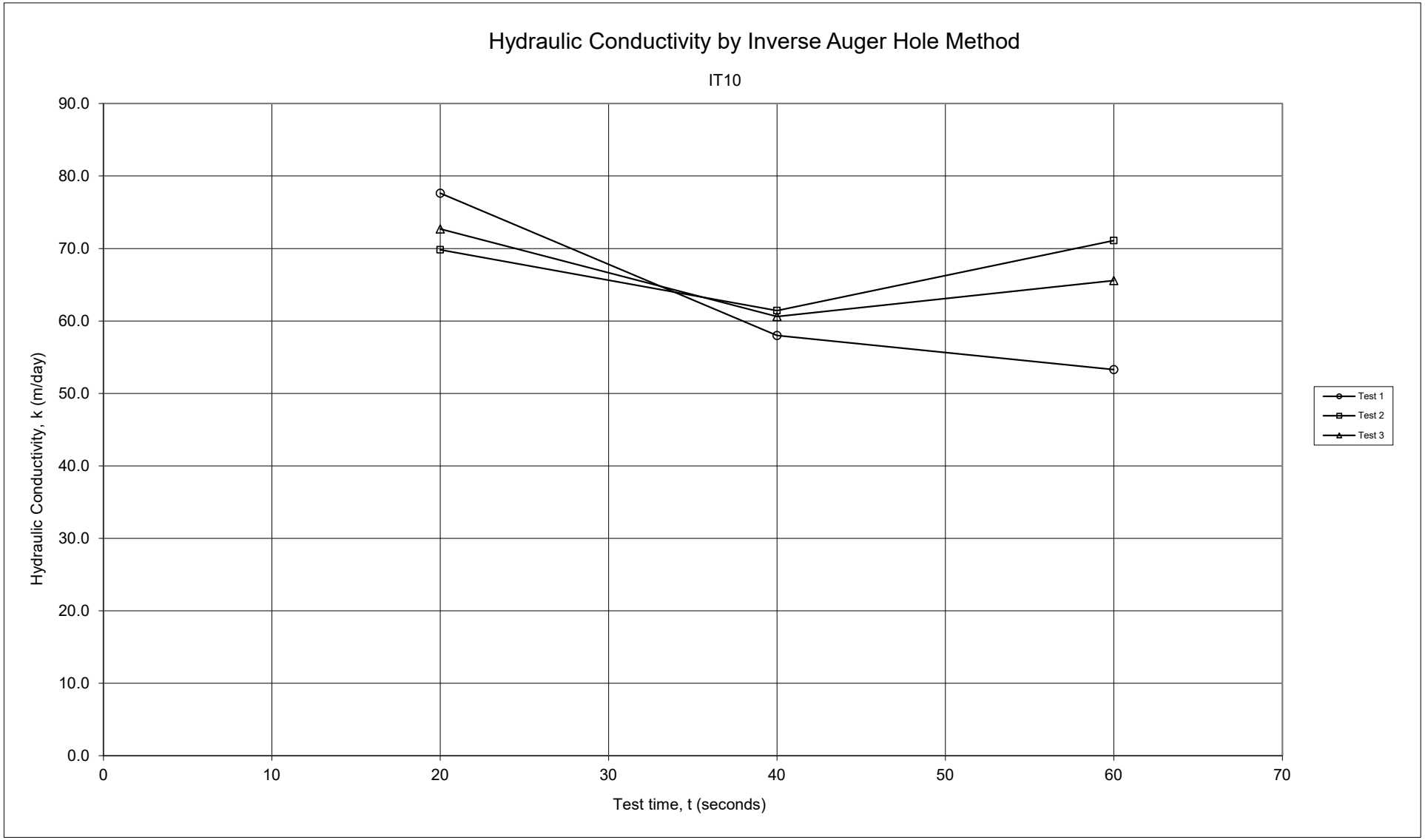
t (s)	d_w (m)	h_t (m)	K (m/s)	K (m/day)
0	0.57	0.25		
20	0.72	0.1	9.0E-04	77.6
40	0.76	0.06	6.7E-04	58.0
60	0.79	0.03	6.2E-04	53.3
		AVERAGE	7.3E-04	63.0

Test 2

t (s)	d_w (m)	h_t (m)	K (m/s)	K (m/day)
0	0.55	0.27		
20	0.7	0.12	8.1E-04	69.8
40	0.76	0.06	7.1E-04	61.4
60	0.81	0.01	8.2E-04	71.1
		AVERAGE	7.8E-04	67.5

Test 3

t (s)	d_w (m)	h_t (m)	K (m/s)	K (m/day)
0	0.52	0.3		
20	0.69	0.13	8.4E-04	72.7
40	0.75	0.07	7.0E-04	60.6
60	0.8	0.02	7.6E-04	65.6
		AVERAGE	7.7E-04	66.3


Hydraulic Conductivity by Inverse Auger Hole Method
IT10
Hydraulic Conductivity, k (m/day)
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
0
10
20
30
40
50
60
70
Test time, t (seconds)
Test 1
Test 2
Test 3

Hydraulic Conductivity Calculation - Inverse Auger Hole Method

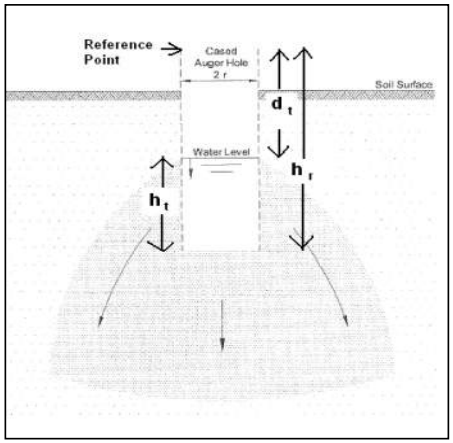
Galt Geotechnics

Job No:	WAE230106
Client:	Qube
Project:	Proposed Subdivision
Location:	Wattleup Road
	Hammond Park
BH Name:	IT11
Test Depth:	0.53 m

Spreadsheet author:	ORW	17-Oct-09

$$K = 1.15r \frac{\log_{10}(h_0 + \frac{1}{2}r) - \log_{10}(h_t + \frac{1}{2}r)}{t - t_0}$$

REFERENCE: Cocks, G. *Disposal of Stormwater Runoff by Soakage in Perth Western Australia*, Journal and News of the Australian Geomechanics Society, Volume 42 No 3 September 2007, pp101-114



Spreadsheet Legend	
	Required input
	Calculated field
	Comment field
	Field not used
	Fixed field

Parameter	Description	Value	Units
K	Hydraulic Conductivity		m/s
r	radius of test hole	0.045	m
t	time since start of measurement		s
h_r	reference point height above base	0.58	m
d_t	depth from reference point to water at time t		m
h_t	Water column height at time t		m
Sup	reference point stickup from ground level	0.05	m
h_0	h_t at t=0		m

Test 1

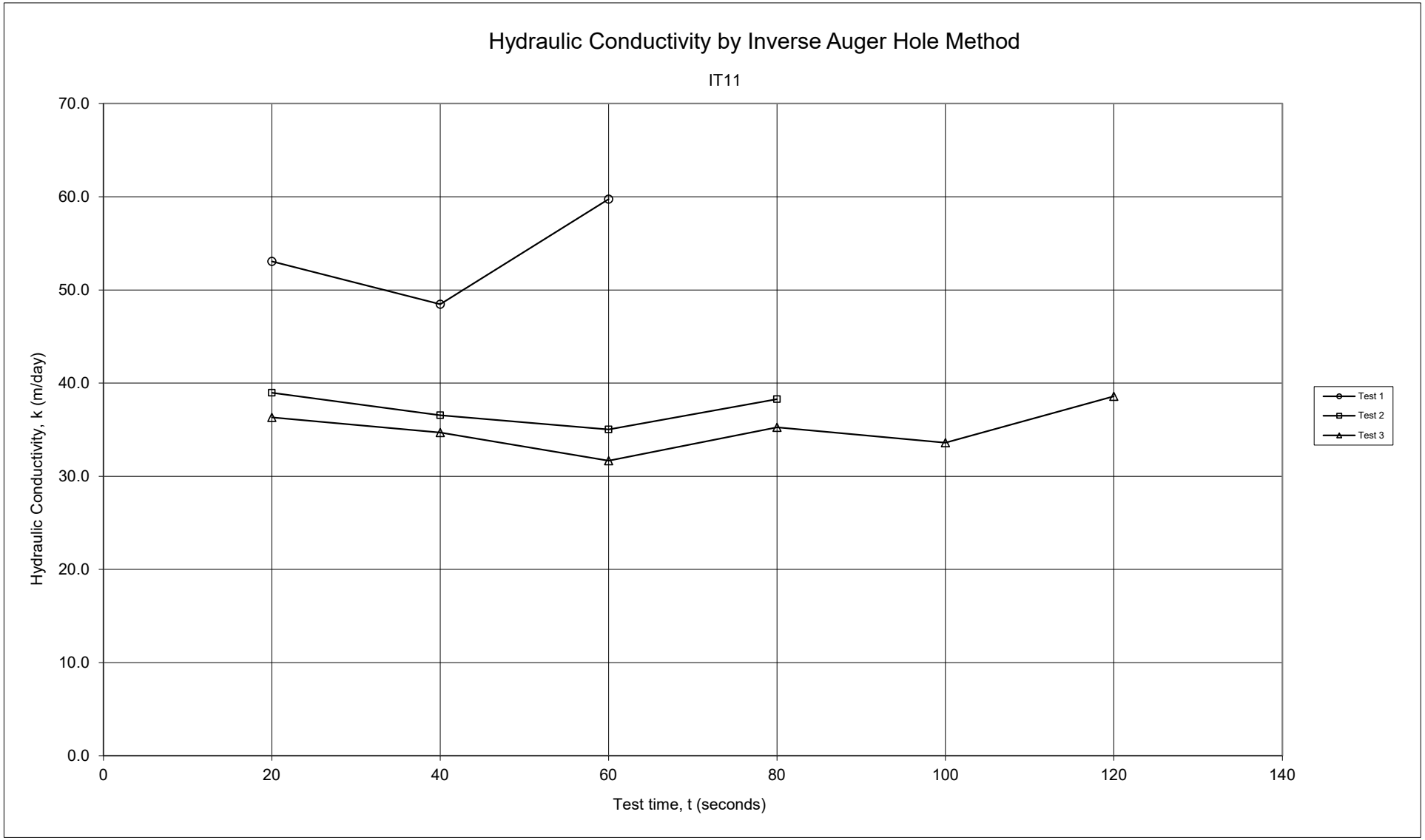
t (s)	d_w (m)	h_t (m)	K (m/s)	K (m/day)
0	0.46	0.12		
20	0.52	0.06	6.1E-04	53.1
40	0.55	0.03	5.6E-04	48.5
60	0.58	0	6.9E-04	59.7
		AVERAGE	6.2E-04	53.8

Test 2

t (s)	d_w (m)	h_t (m)	K (m/s)	K (m/day)
0	0.3	0.28		
20	0.4	0.18	4.5E-04	39.0
40	0.46	0.12	4.2E-04	36.5
60	0.5	0.08	4.1E-04	35.0
80	0.54	0.04	4.4E-04	38.3
		AVERAGE	4.3E-04	37.2

Test 3

t (s)	d_w (m)	h_t (m)	K (m/s)	K (m/day)
0	0.25	0.33		
20	0.36	0.22	4.2E-04	36.3
40	0.43	0.15	4.0E-04	34.7
60	0.47	0.11	3.7E-04	31.7
80	0.52	0.06	4.1E-04	35.3
100	0.54	0.04	3.9E-04	33.6
120	0.57	0.01	4.5E-04	38.6
		AVERAGE	4.1E-04	35.0


Hydraulic Conductivity by Inverse Auger Hole Method
IT11
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
Hydraulic Conductivity, k (m/day)
0
20
40
60
80
100
120
140
Test time, t (seconds)
Test 1
Test 2
Test 3

Hydraulic Conductivity Calculation - Inverse Auger Hole Method

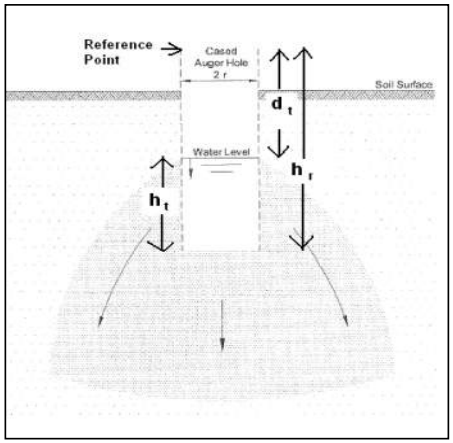
Galt Geotechnics

Job No:	WAE230106
Client:	Qube
Project:	Proposed Subdivision
Location:	Wattleup Road
	Hammond Park
BH Name:	IT12
Test Depth:	0.55 m

Spreadsheet author:	ORW	17-Oct-09

$$K = 1.15r \frac{\log_{10}(h_0 + \frac{1}{2}r) - \log_{10}(h_t + \frac{1}{2}r)}{t - t_0}$$

REFERENCE: Cocks, G. *Disposal of Stormwater Runoff by Soakage in Perth Western Australia*, Journal and News of the Australian Geomechanics Society, Volume 42 No 3 September 2007, pp101-114



Spreadsheet Legend	
	Required input
	Calculated field
	Comment field
	Field not used
	Fixed field

Parameter	Description	Value	Units
K	Hydraulic Conductivity		m/s
r	radius of test hole	0.045	m
t	time since start of measurement		s
h_r	reference point height above base	0.85	m
d_t	depth from reference point to water at time t		m
h_t	Water column height at time t		m
Sup	reference point stickup from ground level	0.3	m
h_0	h_t at t=0		m

Test 1

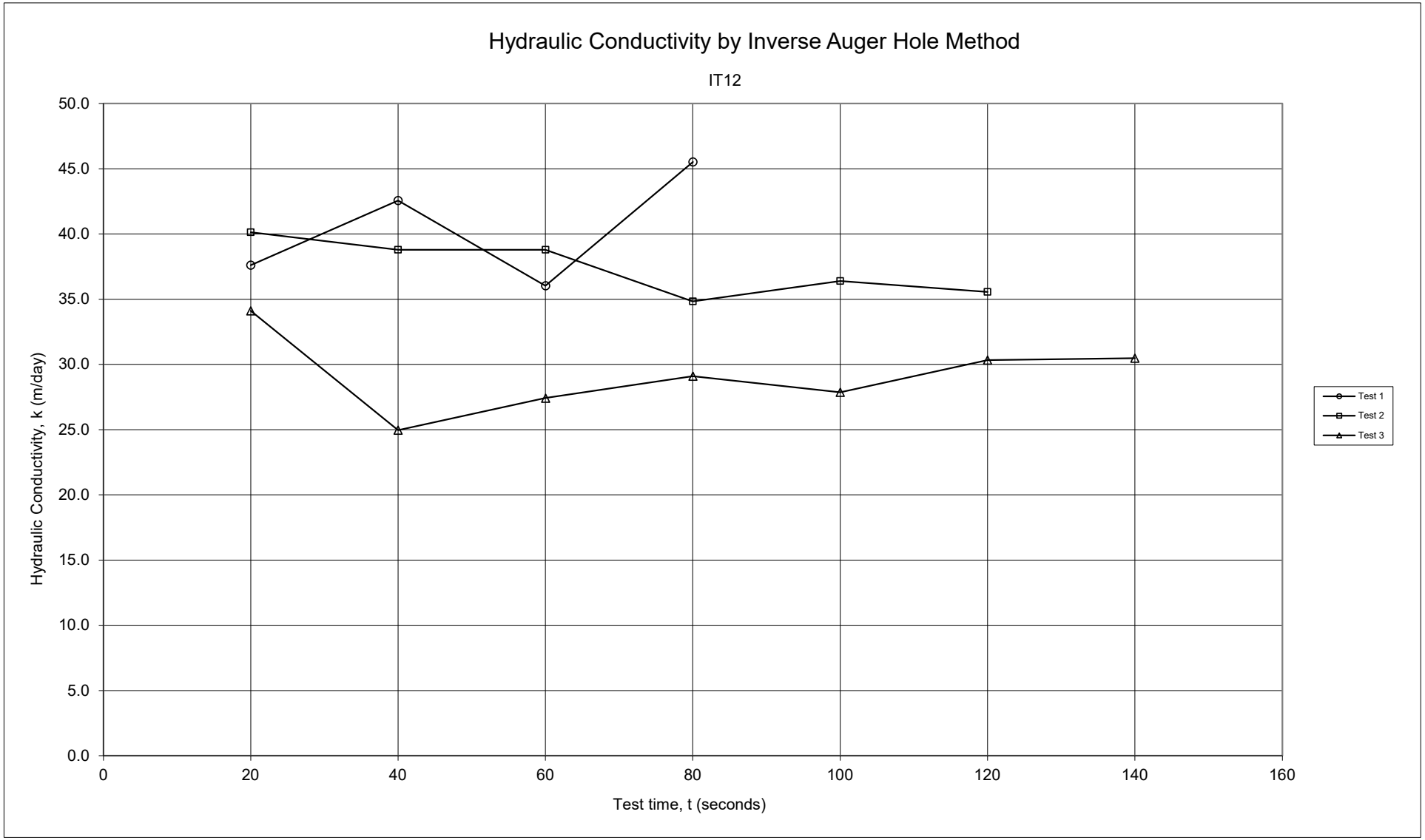
t (s)	d_w (m)	h_t (m)	K (m/s)	K (m/day)
0	0.53	0.32		
20	0.64	0.21	4.4E-04	37.6
40	0.73	0.12	4.9E-04	42.6
60	0.76	0.09	4.2E-04	36.0
80	0.82	0.03	5.3E-04	45.5
		AVERAGE	4.7E-04	40.4

Test 2

t (s)	d_w (m)	h_t (m)	K (m/s)	K (m/day)
0	0.4	0.45		
20	0.56	0.29	4.6E-04	40.1
40	0.66	0.19	4.5E-04	38.8
60	0.73	0.12	4.5E-04	38.8
80	0.76	0.09	4.0E-04	34.8
100	0.8	0.05	4.2E-04	36.4
120	0.82	0.03	4.1E-04	35.6
		AVERAGE	4.3E-04	37.4

Test 3

t (s)	d_w (m)	h_t (m)	K (m/s)	K (m/day)
0	0.4	0.45		
20	0.54	0.31	3.9E-04	34.1
40	0.59	0.26	2.9E-04	25.0
60	0.67	0.18	3.2E-04	27.4
80	0.73	0.12	3.4E-04	29.1
100	0.76	0.09	3.2E-04	27.9
120	0.8	0.05	3.5E-04	30.3
140	0.82	0.03	3.5E-04	30.5
		AVERAGE	3.4E-04	29.2


Hydraulic Conductivity by Inverse Auger Hole Method
IT12
Hydraulic Conductivity, k (m/day)
50.0
45.0
40.0
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0.0
0
20
40
60
80
100
120
140
160
Test time, t (seconds)
Test 1
Test 2
Test 3

Appendix E: Groundwater Monitoring Well Borehole Reports

www.galtenv.com.au
50 Edward Street OSBORNE PARK WA 6017
ABN: 96 520 810 622

METHOD OF SOIL DESCRIPTION
BOREHOLE AND TEST PIT REPORTS

GRAPHIC LOG & SOIL CLASSIFICATION SYMBOLS

Graphic	USCS	Soil Name
		FILL (various types)
		COBBLES / BOULDERS
	GP	GRAVEL (poorly graded)
	GW	GRAVEL (well graded)
	GC	Clayey GRAVEL
	GM	Silty GRAVEL
	SP	SAND (poorly graded)
	SW	SAND (well graded)
	SC	Clayey SAND

Graphic	USCS	Soil Name
	SM	Silty SAND
	ML	SILT (low liquid limit)
	MH	SILT (high liquid limit)
	CL	CLAY (low plasticity)
	CI	CLAY (medium plasticity)
	CH	CLAY (high plasticity)
	OL	Organic SILT (low liquid limit)
	OH	Organic SILT (high liquid limit)
	Pt	PEAT

NOTE: Dual classification given for soils with a fines content between 5% and 12%.

SOIL CLASSIFICATION AND INFERRED STRATIGRAPHY

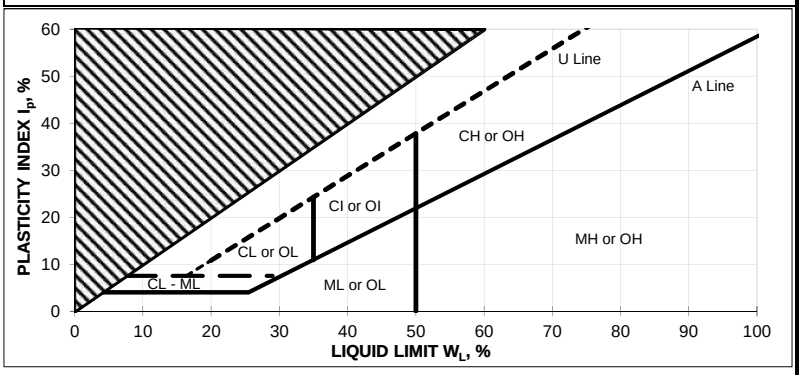
Soil descriptions are based on AS1726-2017. Material properties are assessed in the field by visual/tactile methods in combination with field and laboratory testing techniques (where used).

NOTE: AS 1726-2017 defines a fine grained soil where the total dry mass of fine fractions (<0.075 mm particle size) exceeds 35%.

PARTICLE SIZE

Soil Name		Particle Size (mm)
BOULDERS		>200
COBBLES		63 to 200
GRAVEL	Coarse	19 to 63
	Medium	6.7 to 19
	Fine	2.3 to 6.7
SAND	Coarse	0.6 to 2.36
	Medium	0.21 to 0.6
	Fine	0.075 to 0.21
FINES	SILT	0.002 to 0.075
	CLAY	<0.002

PLASTICITY - MODIFIED CASAGRANDE CHART - AS1726-2017



RESISTANCE TO EXCAVATION

Symbol	Term	Description
VE	Very easy	All resistances are relative to the selected method of excavation
E	Easy	
F	Firm	
H	Hard	
VH	Very hard	

MOISTURE CONDITION

Symbol	Term
D	Dry
M	Moist
W	Wet

CEMENTATION

Cementation	Description
Weakly cemented	Soil may be easily disaggregated by hand in air or water
Moderately cemented	Effort is required to disaggregate the soil by hand in air or water

CONSISTENCY

Symbol	Term	Undrained Shear Strength (kPa)
VS	Very Soft	0 to 12
S	Soft	12 to 25
F	Firm	25 to 50
St	Stiff	50 to 100
VSt	Very Stiff	100 to 200
H	Hard	>200

ORGANIC SOILS

Material	Organic Content % of dry mass
Inorganic soil	<2%
Organic soil	2% to 25%
Peat	>25%

DENSITY

Symbol	Term	Density Index (%)
VL	Very Loose	<15
L	Loose	15 to 35
MD	Medium Dense	35 to 65
D	Dense	65 to 85
VD	Very Dense	>85

EXPLANATORY NOTES TO BE READ WITH BOREHOLE AND TEST PIT REPORTS

METHOD OF DRILLING OR EXCAVATION

AC	Air Core	E	Excavator	PQ3	PQ3 Core Barrel
AD/T	Auger Drilling with TC-Bit	EH	Excavator with Hammer	PT	Push Tube
AD/V	Auger Drilling with V-Bit	HA	Hand Auger	R	Ripper
AT	Air Track	HMLC	HMLC Core Barrel	RR	Rock Roller
B	Bulldozer Blade	HQ3	HQ3 Core Barrel	SON	Sonic Rig
BH	Backhoe Bucket	N	Natural Exposure	SPT	Driven SPT
CT	Cable Tool	NMLC	NMLC Core Barrel	WB	Washbore
DT	Diatube	PP	Push Probe	X	Existing Excavation

SUPPORT

T	Timbering

PENETRATION EFFORT (RELATIVE TO THE EQUIPMENT USED)

VE	Very Easy	E	Easy	F	Firm
H	Hard	VH	Very Hard		

WATER

►	Water Inflow	▼	Water Level
◄	Water Loss (complete)		
◁	Water Loss (partial)		

SAMPLING AND TESTING

B	Bulk Disturbed Sample	P	Piston Sample
BLK	Block Sample	PBT	Plate Bearing Test
C	Core Sample	U	Undisturbed Push-in Sample
CBR	CBR Mould Sample		U50: 50 mm diameter
D	Small Disturbed Sample	SPT	Standard Penetration Test
ES	Environmental Soil Sample		Example: 3, 4, 5 N=9
EW	Environmental Water Sample		3,4,5: Blows per 150 mm
G	Gas Sample		N=9: Blows per 300 mm after
HP	Hand Penetrometer		150 mm seating interval
LB	Large Bulk Disturbed Sample	VS	Vane Shear; P = Peak
M	Mazier Type Sample		R = Remoulded (kPa)
MC	Moisture Content Sample	W	Water Sample

ACID SULFATE SOILS

NASS	Non acid sulfate soils
PASS	Potential acid sulfate soils
AASS	Actual acid sulfate soils
pH_F	pH of soil:water
pH_{FOX}	pH of soil:water following reaction with hydrogen sulfide
Net Acidity	Chromium Reduciable Sulfur + Titratable actual acidity

BOREHOLE: MW01

Job Number:	WAE230106-01	**Contractor:**	Galt	**Date:**	07/11/2023
Client:	Qube Property	**Drill Rig:**	AMS Powerprobe	**Logged:**	SC
Project:	Due Dilligence Assessment	**Inclination:**	-90°	**Checked Date:**	06/12/2023
Location:	343-361 Wattleup Road, Wattleup			**Checked By:**	BP

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	*DEPTH* RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
HA			0					SP	Gravelly SAND: fine to medium grained, sub-angular to sub-rounded, pale grey, fine to coarse grained gravel			
			1									
PT			2					SP	SAND: fine to medium grained, sub-angular to sub-rounded, yellow/brown, trace fine to medium grained gravel	D		
			3									
			4									
			5									
			6									
			7						Becomes coarse grained, pale grey			

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

GALT LIB 1.01.GLB Log GG_EXCAVATION WAE230106-01.GPJ <<DrawingFile>> 06/12/2023 08:14 10.02.00.04 Datgel DGD, CPT, Photo, Monitoring Tools | Lib: GALT 1.01 2013-02-21 Prj: GALT 1.01 2013-02-21

BOREHOLE: MW01

Job Number:	WAE230106-01	**Contractor:**	Galt	**Date:**	07/11/2023
Client:	Qube Property	**Drill Rig:**	AMS Powerprobe	**Logged:**	SC
Project:	Due Dilligence Assessment	**Inclination:**	-90°	**Checked Date:**	06/12/2023
Location:	343-361 Wattleup Road, Wattleup			**Checked By:**	BP

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	*DEPTH* RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
PT		▼	7					SP		D		
			8									
			9							M		
			10									
			11							W		
			12						Hole terminated at 12.00 m Target depth Groundwater encountered at 10.2 m			
			13									
			14									

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

GALT LIB 1.01.GLB Log GG_EXCAVATION WAE230106-01.GPJ <<DrawingFile>> 06/12/2023 08:14 10.02.00.04 Datgel DGD, CPT, Photo, Monitoring Tools | Lib: GALT 1.01 2013-02-21 Prj: GALT 1.01 2013-02-21

BOREHOLE: MW02

Job Number:	WAE230106-01	**Contractor:**	Galt	**Date:**	07/11/2023
Client:	Qube Property	**Drill Rig:**	AMS Powerprobe	**Logged:**	SC
Project:	Due Dilligence Assessment	**Inclination:**	-90°	**Checked Date:**	06/12/2023
Location:	343-361 Wattleup Road, Wattleup			**Checked By:**	BP

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	*DEPTH* RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
HA			0					SP	Gravelly SAND: fine to medium grained, sub-angular to rounded, pale brown/grey, fine to coarse grained, rounded to sub-rounded gravel, trace organics/roots			
			1					SP	SAND: fine to medium grained, sub-angular to sub-rounded, pale grey	D		
PT			2						As above with COFFEE ROCK nodules, weakly cemented, dark brown			
		▼	3							M W		
			4					SP	SAND: fine to coarse grained, sub-angular to sub-rounded, pale brown			
			5									
			6						Hole terminated at 6.00 m Target depth Groundwater encountered at 3.5 m			
			7									

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

GALT LIB 1.01.GLB Log GG_EXCAVATION WAE230106-01.GPJ <<DrawingFile>> 06/12/2023 08:14 10.02.00.04 Datgel DGD, CPT, Photo, Monitoring Tools | Lib: GALT 1.01 2013-02-21 Prj: GALT 1.01 2013-02-21

BOREHOLE: MW03

Job Number:	WAE230106-01	**Contractor:**	Galt	**Date:**	07/11/2023
Client:	Qube Property	**Drill Rig:**	AMS Powerprobe	**Logged:**	SC
Project:	Due Dilligence Assessment	**Inclination:**	-90°	**Checked Date:**	06/12/2023
Location:	343-361 Wattleup Road, Wattleup			**Checked By:**	BP

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	*DEPTH* RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	SOIL CLASS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
HA			0					SP	SAND: fine to medium grained, sub-angular to sub-rounded, dark grey, trace fine to medium grained gravel, trace organics			
			1					SP	SAND: fine to medium grained, sub-angular to sub-rounded, pale grey	D		
PT			2						COFFEE ROCK layer, weak to medium cemented, dark brown			
			3					SP	SAND: fine to coarse grained, sub-angular to sub-rounded, pale brown, weakly cemented	M		
			4							W		
			5									
			6						Hole terminated at 6.00 m Target depth Groundwater encountered at 3.4 m			
			7									

Sketch & Other Observations

Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

GALT LIB 1.01.GLB Log GG_EXCAVATION WAE230106-01.GPJ <<DrawingFile>> 06/12/2023 08:14 10.02.00.04 Datgel DGD, CPT, Photo, Monitoring Tools | Lib: GALT 1.01 2013-02-21 Prj: GALT 1.01 2013-02-21

Appendix F: Groundwater Monitoring Well Construction Reports

www.galtenv.com.au
50 Edward Street OSBORNE PARK WA 6017
ABN: 96 520 810 622

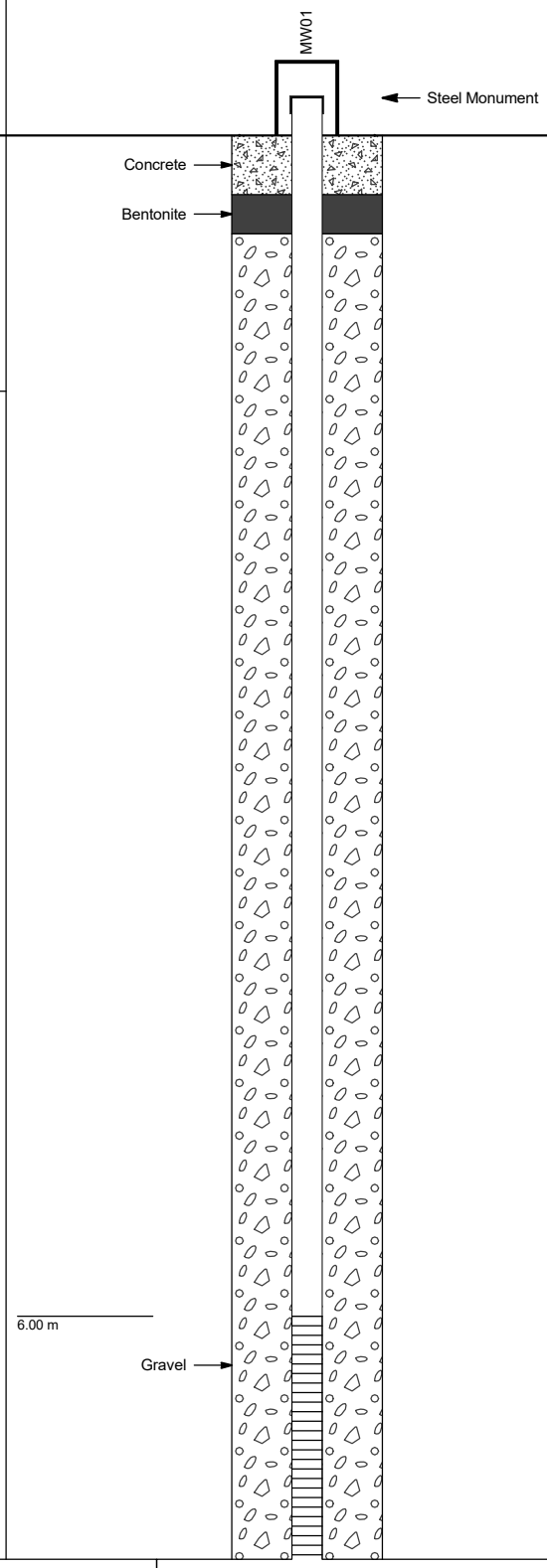
GROUNDWATER MONITORING BORE: MW01

Job Number:	WAE230106-01	**Contractor:**	Galt	**Date:**	07/11/2023
Client:	Qube Property	**Drill Rig:**	AMS Powerprobe	**Logged:**	SC
Project:	Due Dilligence Assessment	**Inclination:**	-90°	**Checked Date:**	06/12/2023
Location:	343-361 Wattleup Road, Wattleup			**Checked By:**	BP

Method	Ground Water	Depth (m)	Elevation (m AHD)	Graphic Log	Soil / Rock Description
HA		0			Gravelly SAND: fine to medium grained, sub-angular to sub-rounded, pale grey, fine to coarse grained gravel
		1			
PT					SAND: fine to medium grained, sub-angular to sub-rounded, yellow/brown, trace fine to medium grained gravel
		2			
		3			
		4			
		5			
		6			
					Becomes coarse grained, pale grey
		7			

WELL INSTALLATION DETAILS

ID:	MW01	**Stick Up & RL:**	0.59 m
Type:	Standpipe	**Tip Depth & RL:**	12.00 m
Installation Date:	07/11/2023	**Static Water Level:**	10.20 m



Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

GALT LIB 1.01.GLB Log G_MON_INSTALL WAE230106-01.GPJ <<DrawingFile>> 06/12/2023 08:15 10.02.00.04 Datgel DGD, CPT, Photo, Monitoring Tools | Lib: GALT 1.01 2013-02-21 Prj: GALT 1.01 2013-02-21

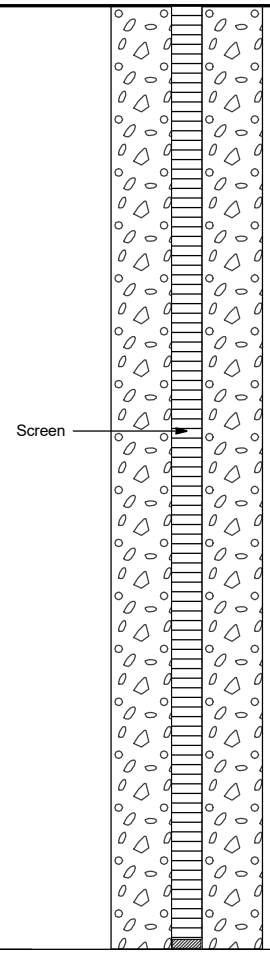
GROUNDWATER MONITORING BORE: MW01

Job Number:	WAE230106-01	**Contractor:**	Galt	**Date:**	07/11/2023
Client:	Qube Property	**Drill Rig:**	AMS Powerprobe	**Logged:**	SC
Project:	Due Dilligence Assessment	**Inclination:**	-90°	**Checked Date:**	06/12/2023
Location:	343-361 Wattleup Road, Wattleup			**Checked By:**	BP

Method	Ground Water	Depth (m)	Elevation (m AHD)	Graphic Log	Soil / Rock Description
PT		8, 9, 10, 11, 12			
		12			Hole terminated at 12.00 m Target depth Groundwater encountered at 10.2 m
		13, 14, 15			

WELL INSTALLATION DETAILS

ID:	MW01	**Stick Up & RL:**	0.59 m
Type:	Standpipe	**Tip Depth & RL:**	12.00 m
Installation Date:	07/11/2023	**Static Water Level:**	10.20 m



Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

GALT LIB 1.01.GLB Log G_MON_INSTALL WAE230106-01.GPJ <<DrawingFile>> 06/12/2023 08:15 10.02.00.04 Datgel DGD, CPT, Photo, Monitoring Tools | Lib: GALT 1.01 2013-02-21 Prj: GALT 1.01 2013-02-21

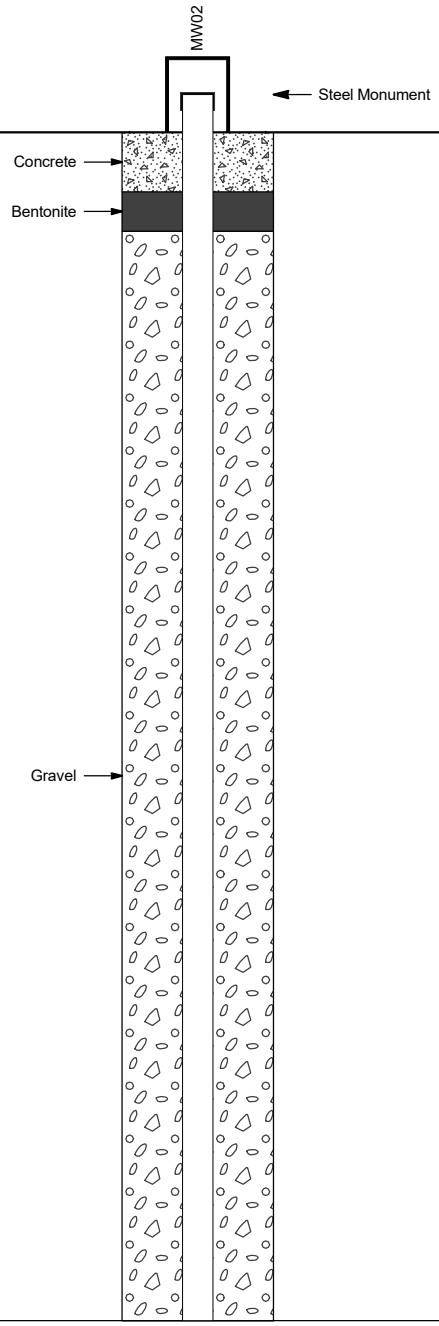
GROUNDWATER MONITORING BORE: MW02

Job Number:	WAE230106-01	**Contractor:**	Galt	**Date:**	07/11/2023
Client:	Qube Property	**Drill Rig:**	AMS Powerprobe	**Logged:**	SC
Project:	Due Dilligence Assessment	**Inclination:**	-90°	**Checked Date:**	06/12/2023
Location:	343-361 Wattleup Road, Wattleup			**Checked By:**	BP

Method	Ground Water	Depth (m)	Elevation (m AHD)	Graphic Log	Soil / Rock Description
HA		0			Gravelly SAND: fine to medium grained, sub-angular to rounded, pale brown/grey, fine to coarse grained, rounded to sub-rounded gravel, trace organics/roots
					SAND: fine to medium grained, sub-angular to sub-rounded, pale grey
		1			
PT		2			
					As above with COFFEE ROCK nodules, weakly cemented, dark brown
		3			
					SAND: fine to coarse grained, sub-angular to sub-rounded, pale brown
		4			
		5			
		6			Hole terminated at 6.00 m Target depth Groundwater encountered at 3.5 m
		7			

WELL INSTALLATION DETAILS

ID:	MW02	**Stick Up & RL:**	0.61 m
Type:	Standpipe	**Tip Depth & RL:**	6.00 m
Installation Date:	07/11/2023	**Static Water Level:**	3.50 m



Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

GALT LIB 1.01.GLB Log G_MON_INSTALL WAE230106-01.GPJ <<DrawingFile>> 06/12/2023 08:15 10.02.00.04 Datgel DGD, CPT, Photo, Monitoring Tools | Lib: GALT 1.01 2013-02-21 Prj: GALT 1.01 2013-02-21

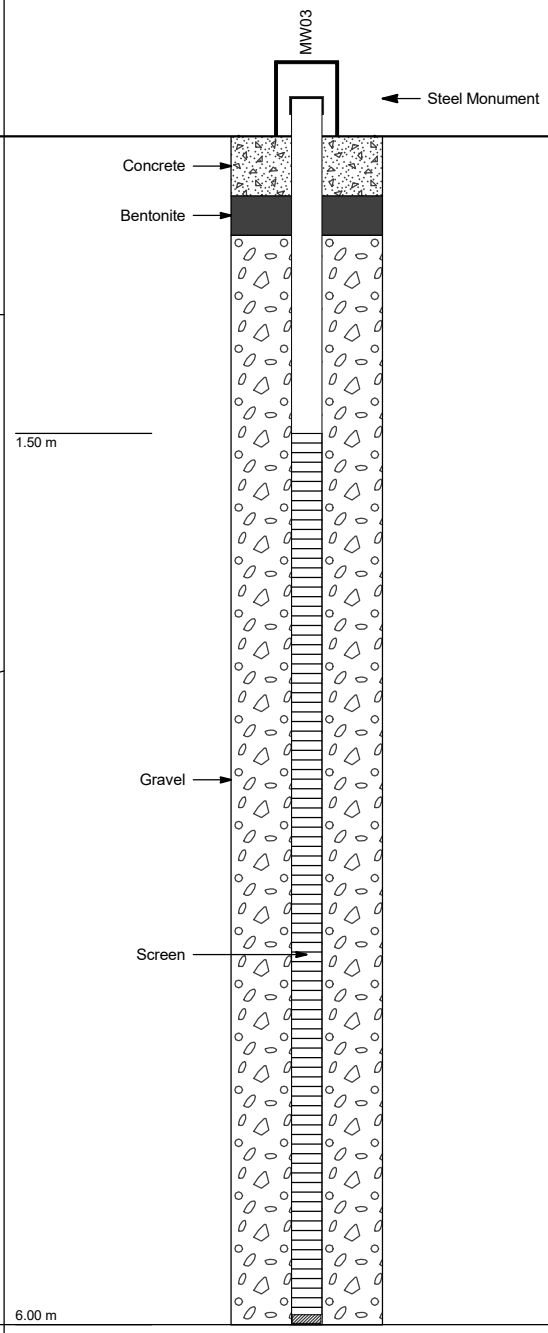
GROUNDWATER MONITORING BORE: MW03

Job Number:	WAE230106-01	**Contractor:**	Galt	**Date:**	07/11/2023
Client:	Qube Property	**Drill Rig:**	AMS Powerprobe	**Logged:**	SC
Project:	Due Dilligence Assessment	**Inclination:**	-90°	**Checked Date:**	06/12/2023
Location:	343-361 Wattleup Road, Wattleup			**Checked By:**	BP

Method	Ground Water	Depth (m)	Elevation (m AHD)	Graphic Log	Soil / Rock Description
HA		0			SAND: fine to medium grained, sub-angular to sub-rounded, dark grey, trace fine to medium grained gravel, trace organics
		1			SAND: fine to medium grained, sub-angular to sub-rounded, pale grey
PT		2			COFFEE ROCK layer, weak to medium cemented, dark brown
		3			SAND: fine to coarse grained, sub-angular to sub-rounded, pale brown, weakly cemented
		4			
		5			
		6			Hole terminated at 6.00 m Target depth Groundwater encountered at 3.4 m
		7			

WELL INSTALLATION DETAILS

ID:	MW03	**Stick Up & RL:**	0.60 m
Type:	Standpipe	**Tip Depth & RL:**	6.00 m
Installation Date:	07/11/2023	**Static Water Level:**	3.40 m



Comments:

See Explanatory Notes and Method of Soil Description sheets for details of abbreviations and basis of descriptions

GALT LIB 1.01.GLB Log G_MON_INSTALL WAE230106-01.GPJ <<DrawingFile>> 06/12/2023 08:15 10.02.00.04 Datgel DGD, CPT, Photo, Monitoring Tools | Lib: GALT 1.01 2013-02-21 Prj: GALT 1.01 2013-02-21

Appendix G: Calibration Certificate

CERTIFICATE OF CALIBRATION

Galt ENVIRONMENTAL

Instrument Description: Water Quality Meter Multi-Parameter **Calibration Date:** 15/11/23

Model Number: YSI Professional Plus Quatro – 1m **Calibrated by:** TG

Serial Number: 11K100514

Item	Test	Pass	Comments
Battery	Condition	✓	Voltage reading above 5.8V
	Auto Power off	✓	Automatically turns off after 10mins if not used
Keypad	Operational	✓	All keys operate adequately
Unit and Display	Screen	✓	Minor scratches, numbers clear and legible
	Seals and O rings	✓	Seals in good condition (YSI unit and flowcell)
Connections	Condition	✓	Good condition
Cable	Condition	✓	No signs of wear or damage
Sensors	Temperature	✓	°C
	pH	✓	pH
	Redox or ORP	✓	mV
	Electrical Conductivity	✓	µs/cm
	Dissolved Oxygen	✓	ppm
Software	Version		Up to date

This is to certify that the above instrument has been calibrated to the following specifications:

Parameter	Standards	Reference Number	Calibration Points	Instrument Reading
Temperature			Temperature (°C)	21.4°c
pH	pH 7.00	3566	pH 7.00	7.0
pH	pH 4.00	3433	pH 4.00	4.0
Conductivity	1413 µs/cm at 25°C	2323	1413 µs/cm	1381 @21.4°
ORP	Zobell A and Zobell B	23210	240mV at 25°C	213 mV
100% Dissolved Oxygen	100% air saturation	Air	Dissolved Oxygen 100%	100 %

Appendix H: Chain of Custody Documentation

www.galtenv.com.au
50 Edward Street OSBORNE PARK WA 6017
ABN: 96 520 810 622

CHAIN OF CUSTODY RECORD

Eurofins | Environment Testing ABN 50 005 085 521

☐ Sydney Laboratory
Unit F3 Bld F 16 Mars Road Lane Cove West NSW 2066
02 9900 8400 EnviroSampleNSW@eurofins.com

☐ Brisbane Laboratory
Unit 1 21 Smallwood Place Murarrie QLD 4172
07 3902 4600 EnviroSampleQLD@eurofins.com

☐ Perth Laboratory
Unit 2 9 Leach Highway Kewdale WA 6105
08 9251 9900 EnviroSampleWA@eurofins.com

☐ Melbourne Laboratory
6 Monterey Road Dandenong South VIC 3175
03 8564 5000 EnviroSampleVic@eurofins.com

Company	Galt Environment P/L	Project №	WAE230106	Project Manager	Sarah Carter
Address	50 Edward Street, Osborne Park	Project Name	Wattleup	EDD Format (Esdat, EQuIS etc)	esdat
Contact Name	Brad Palmer			Facility Code	
Phone №	(08) 6272 0200				
Special Directions	sarah - 0423 958 546				
Purchase Order	WAE230106				
Quote ID №	180801GAL				

Sampler(s)	Sarah Carter
Handed over by	Sarah Carter
Email for Invoice	accounts@galtenv.com.au
Email for Results	lab.results@galtenv.com.au; galtenv@esdat.com

Analyses — Where available pre-populated Analyte Groups "Total" or "Filtered" BLITE codes must be used to avoid SUPE pricing

Containers — Change container type & size if necessary

Required Turnaround Time (TAT) — Default will be 5 days if not ticked

☐ Overnight (reporting by 9am)♦
☐ Same day♦ ☐ 1 day♦
☐ 2 days♦ ☐ 3 days♦
☑ 5 days (Standard)
☐ Other( )

♦Surcharge will apply

№	Client Sample ID	Sampled Date/Time dd/mm/yy hh:mm	Matrix Soil (S) Water (W)	B19A	M8 (inc lechacate)	OC pesticides	OP pesticides	Carbamate pesticides	500mL Plastic	250mL Plastic	125mL Plastic	200mL Amber Glass	40mL VOA vial	500mL PFAS Bottle	Jar (Glass or HDPE)	Other (Asbestos AS4964, WA Guidelines)	Sample Comments / Dangerous Goods Hazard Warning
1	TP01/0.0	1/11/23	Soil	X	X	X											
2	TP03/0.0	1/11/23	Soil	X	X	X	X	X									
3	TP04/0.0	1/11/23	Soil	X	X	X											
4	TP08/0.0	1/11/23	Soil	X	X	X											
5	TP09/0.0	1/11/23	Soil	X	X	X											
6	TP11/0.0	1/11/23	Soil	X	X	X	X	X									
7	TP14/0.0	1/11/23	Soil	X	X	X											
8	TP15/0.0	1/11/23	Soil	X	X	X											
9	TP19/0.0	1/11/23	Soil	X	X	X	X	X									
10	TP20/0.0	1/11/23	Soil	X	X	X											
11	QC01	1/11/23	Soil	X	X	X	X	X									
12	QC02	1/11/23	Water	X	X	X	X	X									
13	QC03	1/11/23	Water	X	X	X	X	X									
14	TP21/0.0	2/11/23	Soil	X	X	X	X	X									
15	TP23/0.0	2/11/23	Soil	X	X	X											
16	TP25/0.0	2/11/23	Soil	X	X	X											

17	TP26/0.0	2/11/23	Soil	X	X	X	X	X
18	TP29/0.0	2/11/23	Soil	X	X	X		
19	TP30/0.0	2/11/23	Soil	X	X	X		
20	TP34/0.0	2/11/23	Soil	X	X	X	X	X
21	TP35/0.0	2/11/23	Soil	X	X	X		
22	TP38/0.0	2/11/23	Soil	X	X	X		
23	TP39/0.0	2/11/23	Soil	X	X	X		
24	QC10	2/11/23	Soil	X	X	X	X	X
25	QC11	2/11/23	Water	X	X	X	X	X
26	TP41/0.0	3/11/23	Soil	X	X	X		
27	TP42/0.0	3/11/23	Soil	X	X	X		
28	TP45/0.0	3/11/23	Soil	X	X	X	X	X
29	TP48/0.0	3/11/23	Soil	X	X	X		
30	TP51/0.0	3/11/23	Soil	X	X	X		
31	TP53/0.0	3/11/23	Soil	X	X	X	X	X
32	TP54/0.0	3/11/23	Soil	X	X	X		
33	TP56/0.0	3/11/23	Soil	X	X	X		
34	TP58/0.0	3/11/23	Soil	X	X	X		
35	TP59/0.0	3/11/23	Soil	X	X	X	X	X
36	QC13	3/11/23	Soil	X	X	X	X	X
37	QC15	3/11/23	Water	X	X	X	X	X
	Add Rows		Total Counts	37	37	37	16	16

Method of Shipment	☑ Courier (#)	☐ Hand Delivered	☐ Postal	Name		Signature		Date	9/11/2023	Time	16:00:52		
Laboratory Use Only	Received By	Hayley	SYD | BNE | MEL | PER | ADL | NTL | DRW	Signature		Date	9/11/23	Time	14:00	Temperature	19.4		
	Received By		SYD | BNE | MEL | PER | ADL | NTL | DRW	Signature		Date		Time		Report №	1043004		

Submission of samples to the laboratory will be deemed as acceptance of Eurofins | mgt Standard Terms and Conditions unless agreed otherwise. A copy of Eurofins | mgt Standard Terms and Conditions is available on request.

CHAIN OF CUSTODY RECORD

Eurofins | Environment Testing ABN 50 005 085 521

☐ Sydney Laboratory
Unit F3 Bld F 16 Mars Road Lane Cove West NSW 2066
02 9900 8400 EnviroSampleNSW@eurofins.com

☐ Brisbane Laboratory
Unit 1 21 Smallwood Place Murarrie QLD 4172
07 3902 4600 EnviroSampleQLD@eurofins.com

☐ Perth Laboratory
Unit 2 91 Leach Highway Kewdale WA 6105
08 9251 9600 EnviroSampleWA@eurofins.com

☐ Melbourne Laboratory
6 Monterey Road Dandenong South VIC 3175
03 8564 5000 EnviroSampleVic@eurofins.com

Company	Galt Environment P/L	Project №	WAE230106	Project Manager		Sampler(s)	
Address	50 Edward Street, Osborne Park	Project Name	Wattleup	EDD Format (Esdat, EQuIS etc)	Esdat	Facility Code		Handed over by	
Contact Name	Brad Palmer							Email for Invoice	accounts@galtenv.com.au
Phone №	(08) 6272 0200							Email for Results	lab.results@galtenv.com.au; galtenv@estdat.com.au
Special Directions	Sarah - 0423 958 546								
Purchase Order	WAE230106								
Quote ID №	180801GAL								

Analyses — Where metals are requested, please specify "Total" or "Filtered". SUITE code must be used to attract SUITE pricing

Containers — Change container type & size if necessary

Required Turnaround Time (TAT) — Default will be 5 days if not ticked.

☐ Overnight (reporting by 9am)♦ (♦Surcharge will apply)
☐ Same day♦ ☐ 1 day♦
☐ 2 days♦ ☐ 3 days♦
☑ 5 days (Standard)
☐ Other( )

№	Client Sample ID	Sampled Date/Time dd/mm/yy hh:mm	Matrix Solid (S) Water (W)	B19A	M8	OC Pesticides	OP Pesticides	Carbamate Pesticides	500mL Plastic	250mL Plastic	125mL Plastic	200mL Amber Glass	40mL VOA vial	500mL PFAS Bottle	Jar (Glass or HDPE)	Other (Asbestos AS4964, WA Guidelines)	Sample Comments / Dangerous Goods Hazard Warning
1	MW01	15/11/23	Water	X	X	X	X	X									Please filter MW01 'dissolved metals' bottle in lab
2	MW02	15/11/23	Water	X	X	X	X	X									
3	MW03	15/11/23	Water	X	X	X	X	X									
4	QC19	15/11/23	Water	X	X	X	X	X									
5	QC20	15/11/23	Water	X	X	X	X	X									
6	QC21	15/11/23	Water	X	X	X	X	X									
7																	
8																	
9																	
10																	
	Add Rows		Total Counts	6	6	6	6	6									

Method of Shipment	☑ Courier (#)	☐ Hand Delivered	☐ Postal	Name		Signature		Date	17/11/2023	Time	12:42:00

Laboratory Use Only	Received By	Hayley	SYD | BNE | MEL | PER | ADL | NTL | DRW	Signature		Date	17/11/23	Time	12:34	Temperature	23.8
	Received By		SYD | BNE | MEL | PER | ADL | NTL | DRW	Signature		Date		Time		Report №	1045303

Submission of samples to the laboratory will be deemed as acceptance of Eurofins | mgt Standard Terms and Conditions unless agreed otherwise. A copy of Eurofins | mgt Standard Terms and Conditions is available on request.

CHAIN OF CUSTODY FORM - Client

[Copyright and Confidential]

ENVIROLAB GROUP
National phone number 1300 424 344

Sydney Lab - Envirolab Services
12 Ashley St, Chatswood, NSW 2067
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Perth Lab - MPL Laboratories
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08 9317 2505 | lab@mpl.com.au

Melbourne Lab - Envirolab Services
25 Research Drive, Croydon South, VIC 3136
03 9763 2500 | melbourne@envirolab.com.au

Adelaide Office - Envirolab Services
7a The Parade, Norwood, SA 5067
08 7087 6800 | adelaide@envirolab.com.au

Brisbane Office - Envirolab Services
20a, 10-20 Depot St, Banyo, QLD 4014
07 3266 9532 | brisbane@envirolab.com.au

Darwin Office - Envirolab Services
Unit 20/119 Reichardt Road, Winnellie, NT 0820
08 8967 1201 | darwin@envirolab.com.au

Company:	Galt Environmental	Client Project Name/Number/Site etc (ie report title):	Wattleup - WAE230106
Contact Person:	Sarah Carter		
Project Mgr:	Sarah Carter	PO No. (if applicable):	
Sampler:	Sarah Carter	Envirolab Quote No. :	
Address:		Date results required: Or choose: ☑ Standard ☐ Same Day ☐ 1 day ☐ 2 day ☐ 3 day	
Phone:	Mob: 0423 958 546	*Note: Inform lab in advance if urgent turnaround is required - surcharges apply*	
Email Results to:	lab.results@galtenv.com.au galtenv@esdat.com.au	Additional report format: ☑ Esdat ☐ Equis	
Email Invoice to:	accounts@galtgeo.com.au	Lab Comments: std 8metals, 01 water leachate Instructions rec'd 9/11/23. 15:10 GM	

Sample information					Tests Required																	Comments
Envirolab Sample ID (Lab use only)	Client Sample ID or Information	Depth	Date Sampled	Type of Sample	Total N	Total P	TKN	NOX	Ground 1 metals (inc leachate)	OC + OP pesticides	Carbamate pesticides											Provide as much information about the sample as you can
1	QC04	N/A	1/11/2023	Soil	X	X	X	X	X	X	X											
2	QC14	N/A	2/11/2023	Soil	X	X	X	X	X	X	X											
3	QC12	N/A	1/11/2023	Soil	X	X	X	X	X	X	X											
			SM 9/11																			

☐ *Please tick the box if observed settled sediment present in water samples is to be included in the extraction and/or analysis*

Relinquished by (Company):	Galt ENV	Received by (Company):	MPL	Lab Use Only	
Print Name:	Sarah Carter	Print Name:	GM	Job number:	23EK0053
Date & Time:	9/11/2023 0:00	Date & Time:	9/11/23. 15:10	Temperature:	18
Signature:	SCarter	Signature:		TAT Req - SAME day / 1 / 2 / 3 / 4 / STD	
				Cooling: Ice / Ice pack / None	
				Security seal: Intact / Broken / None	

samples rec'd 13:50

CHAIN OF CUSTODY FORM - Client

[Copyright and Confidential]

ENVIROLAB GROUP
National phone number 1300 424 344

Sydney Lab - Envirolab Services
12 Ashley St, Chatswood, NSW 2067
02 9910 6200 | sydney@envirolab.com.au

Perth Lab - MPL Laboratories
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08 9317 2505 | lab@mpl.com.au

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03 9763 2500 | melbourne@envirolab.com.au

Adelaide Office - Envirolab Services
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07 3266 9532 | brisbane@envirolab.com.au

Darwin Office - Envirolab Services
Unit 20/119 Reichardt Road, Winnellie, NT 0820
08 8967 1201 | darwin@envirolab.com.au

Company:	Galt Environmental	Client Project Name/Number/Site etc (ie report title):	Wattleup - WAE230106
Contact Person:	Sarah Carter		
Project Mgr:	Sarah Carter	PO No. (if applicable):	
Sampler:	Sarah Carter	Envirolab Quote No. :	
Address:		Date results required: Or choose: ☑ Standard ☐ Same Day ☐ 1 day ☐ 2 day ☐ 3 day	
Phone:	Mob: 0423 958 546	*Note: Inform lab in advance if urgent turnaround is required - surcharges apply*	
Email Results to:	lab.results@galtenv.com.au galtenv@esdat.com.au	Additional report format:	☑ Esdat ☐ Equis
Email Invoice to:	accounts@galtgeo.com.au	Lab Comments:	

Sample information					Tests Required																	Comments
Envirolab Sample ID (Lab use only)	Client Sample ID or Information	Depth	Date Sampled	Type of Sample	Total N	Total P	TKN	NOX	Group 1 metals	OC + OP pesticides	Carbamate pesticides											Provide as much information about the sample as you can
1	QC18	N/A	15/11/2023	~~Soil~~	X	X	X	X	X	X	X											
				Water.																		

☐ *Please tick the box if observed settled sediment present in water samples is to be included in the extraction and/or analysis*

Relinquished by (Company):	Galt ENV	Received by (Company): MPL		Lab Use Only	
Print Name:	Sarah Carter	Print Name: Gm		Job number: 9EK1344.	Cooling: Ice / Ice pack / None
Date & Time:	17/11/2023 0:00	Date & Time: 17/11/23 14:25		Temperature: 20°	Security seal: Intact / Broken / None
Signature:	SCarter	Signature:		TAT Req - SAME day / 1 / 2 / 3 / 4 / STD	

Appendix I: Laboratory Certificates of Analysis

www.galtenv.com.au
50 Edward Street OSBORNE PARK WA 6017
ABN: 96 520 810 622

Galt Environment P/L
50 Edward Street
Osborne Park
WA 6017

NATA Accredited
Accreditation Number 2377
Site Number 2370

Accredited for compliance with ISO/IEC 17025 – Testing
NATA is a signatory to the ILAC Mutual Recognition Arrangement for the mutual recognition of the equivalence of testing, medical testing, calibration, inspection, proficiency testing scheme providers and reference materials producers reports and certificates.

Attention: **- ALL SRA/Results**

Report **1043004-S**
Project name WATTLEUP
Project ID WAE230106
Received Date Nov 09, 2023

Client Sample ID			**TP01/0.0**	**TP03/0.0**	**TP04/0.0**	**TP08/0.0**
Sample Matrix			**Soil**	**Soil**	**Soil**	**Soil**
Eurofins Sample No.			**L23-No0024721**	**L23-No0024722**	**L23-No0024723**	**L23-No0024724**
Date Sampled			**Nov 01, 2023**	**Nov 01, 2023**	**Nov 01, 2023**	**Nov 01, 2023**
Test/Reference	LOR	Unit				
Organochlorine Pesticides						
Chlordanes - Total	0.1	mg/kg	< 0.1	-	< 0.1	< 0.1
4.4'-DDD	0.05	mg/kg	< 0.05	-	< 0.05	< 0.05
4.4'-DDE	0.05	mg/kg	< 0.05	-	< 0.05	< 0.05
4.4'-DDT	0.05	mg/kg	< 0.05	-	< 0.05	< 0.05
a-HCH	0.05	mg/kg	< 0.05	-	< 0.05	< 0.05
Aldrin	0.05	mg/kg	< 0.05	-	< 0.05	< 0.05
b-HCH	0.05	mg/kg	< 0.05	-	< 0.05	< 0.05
d-HCH	0.05	mg/kg	< 0.05	-	< 0.05	< 0.05
Dieldrin	0.05	mg/kg	< 0.05	-	< 0.05	< 0.05
Endosulfan I	0.05	mg/kg	< 0.05	-	< 0.05	< 0.05
Endosulfan II	0.05	mg/kg	< 0.05	-	< 0.05	< 0.05
Endosulfan sulphate	0.05	mg/kg	< 0.05	-	< 0.05	< 0.05
Endrin	0.05	mg/kg	< 0.05	-	< 0.05	< 0.05
Endrin aldehyde	0.05	mg/kg	< 0.05	-	< 0.05	< 0.05
Endrin ketone	0.05	mg/kg	< 0.05	-	< 0.05	< 0.05
g-HCH (Lindane)	0.05	mg/kg	< 0.05	-	< 0.05	< 0.05
Heptachlor	0.05	mg/kg	< 0.05	-	< 0.05	< 0.05
Heptachlor epoxide	0.05	mg/kg	< 0.05	-	< 0.05	< 0.05
Hexachlorobenzene	0.05	mg/kg	< 0.05	-	< 0.05	< 0.05
Methoxychlor	0.05	mg/kg	< 0.05	-	< 0.05	< 0.05
Toxaphene	0.5	mg/kg	< 0.5	-	< 0.5	< 0.5
Aldrin and Dieldrin (Total)*	0.05	mg/kg	< 0.05	-	< 0.05	< 0.05
DDT + DDE + DDD (Total)*	0.05	mg/kg	< 0.05	-	< 0.05	< 0.05
Vic EPA IWRG 621 OCP (Total)*	0.1	mg/kg	< 0.1	-	< 0.1	< 0.1
Vic EPA IWRG 621 Other OCP (Total)*	0.1	mg/kg	< 0.1	-	< 0.1	< 0.1
Dibutylchlorendate (surr.)	1	%	117	-	60	84
Tetrachloro-m-xylene (surr.)	1	%	88	-	113	129
NOx-N	1	mg/kg	3.6	2.3	2.6	1.2
Total Kjeldahl Nitrogen	10	mg/kg	460	280	300	160
Total Nitrogen	10	mg/kg	460	280	300	160
Phosphorus	1	mg/kg	280	400	280	400

Client Sample ID			TP01/0.0	TP03/0.0	TP04/0.0	TP08/0.0
Sample Matrix			Soil	Soil	Soil	Soil
Eurofins Sample No.			L23-No0024721	L23-No0024722	L23-No0024723	L23-No0024724
Date Sampled			Nov 01, 2023	Nov 01, 2023	Nov 01, 2023	Nov 01, 2023
Test/Reference	LOR	Unit				
Heavy Metals						
Arsenic	2	mg/kg	< 2	< 2	< 2	< 2
Cadmium	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1
Chromium	1	mg/kg	2.4	2.3	1.2	1.6
Copper	1	mg/kg	6.2	3.5	4.0	4.5
Lead	1	mg/kg	1.6	1.4	< 1	< 1
Mercury	0.02	mg/kg	< 0.02	< 0.02	0.02	< 0.02
Nickel	1	mg/kg	< 1	< 1	< 1	< 1
Zinc	5	mg/kg	7.2	12	10	13
Sample Properties						
% Moisture	1	%	< 1	< 1	< 1	< 1
OCOP in Soil						
Aldrin	0.01	mg/kg	-	< 0.01	-	-
alpha-BHC (HCH)	0.01	mg/kg	-	< 0.01	-	-
beta-BHC (HCH)	0.01	mg/kg	-	< 0.01	-	-
delta-BHC (HCH)	0.01	mg/kg	-	< 0.01	-	-
Bifenthrin	0.2	mg/kg	-	< 0.2	-	-
Bromophos Ethyl	0.05	mg/kg	-	< 0.05	-	-
Chlordane	0.01	mg/kg	-	< 0.01	-	-
Chlorpyrifos	0.02	mg/kg	-	< 0.02	-	-
Dieldrin	0.01	mg/kg	-	< 0.01	-	-
p.p-DDD	0.01	mg/kg	-	< 0.01	-	-
p.p-DDE	0.01	mg/kg	-	< 0.01	-	-
p.p-DDT	0.01	mg/kg	-	< 0.01	-	-
o.p-DDT	0.01	mg/kg	-	< 0.01	-	-
Endosulfan I	0.01	mg/kg	-	< 0.01	-	-
Endosulfan II	0.01	mg/kg	-	< 0.01	-	-
Endosulfan Sulfate	0.01	mg/kg	-	< 0.01	-	-
Endrin	0.01	mg/kg	-	< 0.01	-	-
Heptachlor	0.01	mg/kg	-	< 0.01	-	-
Heptachlor Epoxide	0.01	mg/kg	-	< 0.01	-	-
Hexachlorobenzene (HCB)	0.01	mg/kg	-	< 0.01	-	-
Lindane	0.01	mg/kg	-	< 0.01	-	-
Methoxychlor	0.2	mg/kg	-	< 0.2	-	-
Oxychlordane	0.01	mg/kg	-	< 0.01	-	-
Diazinon	0.2	mg/kg	-	< 0.2	-	-
Ethion	0.05	mg/kg	-	< 0.05	-	-
Fenitrothion	0.1	mg/kg	-	< 0.1	-	-
Malathion	0.1	mg/kg	-	< 0.1	-	-
Trifluralin	0.2	mg/kg	-	< 0.2	-	-
Carbamates in Soil						
Aminocarb	0.04	mg/kg	-	< 0.04	-	-
Aldicarb Sulfoxide	0.004	mg/kg	-	< 0.004	-	-
Carbendazim	0.04	mg/kg	-	< 0.04	-	-
Oxamyl	0.04	mg/kg	-	< 0.04	-	-
Aldicarb Sulfone	0.02	mg/kg	-	< 0.02	-	-
Methomyl	0.04	mg/kg	-	< 0.04	-	-
Fenuron/Fenuron TCA	0.005	mg/kg	-	< 0.005	-	-
Thidiazuron	0.04	mg/kg	-	< 0.04	-	-
Aldicarb	0.004	mg/kg	-	< 0.004	-	-

Client Sample ID			TP01/0.0	TP03/0.0	TP04/0.0	TP08/0.0
Sample Matrix			Soil	Soil	Soil	Soil
Eurofins Sample No.			L23-No0024721	L23-No0024722	L23-No0024723	L23-No0024724
Date Sampled			Nov 01, 2023	Nov 01, 2023	Nov 01, 2023	Nov 01, 2023
Test/Reference	LOR	Unit				
Carbamates in Soil						
Bromacil	0.04	mg/kg	-	< 0.04	-	-
Mexacarbate	0.02	mg/kg	-	< 0.02	-	-
Monuron/Monuron TCA	0.04	mg/kg	-	< 0.04	-	-
Propoxur	0.004	mg/kg	-	< 0.004	-	-
Carbofuran	0.04	mg/kg	-	< 0.04	-	-
Fluometuron	0.02	mg/kg	-	< 0.02	-	-
Carbaryl	0.05	mg/kg	-	< 0.05	-	-
Diuron	0.04	mg/kg	-	< 0.04	-	-
Propachlor	0.02	mg/kg	-	< 0.02	-	-
Siduron	0.02	mg/kg	-	< 0.02	-	-
Methiocarb	0.04	mg/kg	-	< 0.04	-	-
Linuron	0.04	mg/kg	-	< 0.04	-	-
Neburon	0.04	mg/kg	-	< 0.04	-	-

Client Sample ID			TP09/0.0	TP11/0.0	TP14/0.0	TP15/0.0
Sample Matrix			Soil	Soil	Soil	Soil
Eurofins Sample No.			L23-No0024725	L23-No0024726	L23-No0024727	L23-No0024728
Date Sampled			Nov 01, 2023	Nov 01, 2023	Nov 01, 2023	Nov 01, 2023
Test/Reference	LOR	Unit				
Organochlorine Pesticides						
Chlordanes - Total	0.1	mg/kg	< 0.1	-	< 0.1	< 0.1
4.4'-DDD	0.05	mg/kg	< 0.05	-	< 0.05	< 0.05
4.4'-DDE	0.05	mg/kg	< 0.05	-	< 0.05	< 0.05
4.4'-DDT	0.05	mg/kg	< 0.05	-	< 0.05	< 0.05
a-HCH	0.05	mg/kg	< 0.05	-	< 0.05	< 0.05
Aldrin	0.05	mg/kg	< 0.05	-	< 0.05	< 0.05
b-HCH	0.05	mg/kg	< 0.05	-	< 0.05	< 0.05
d-HCH	0.05	mg/kg	< 0.05	-	< 0.05	< 0.05
Dieldrin	0.05	mg/kg	< 0.05	-	< 0.05	< 0.05
Endosulfan I	0.05	mg/kg	< 0.05	-	< 0.05	< 0.05
Endosulfan II	0.05	mg/kg	< 0.05	-	< 0.05	< 0.05
Endosulfan sulphate	0.05	mg/kg	< 0.05	-	< 0.05	< 0.05
Endrin	0.05	mg/kg	< 0.05	-	< 0.05	< 0.05
Endrin aldehyde	0.05	mg/kg	< 0.05	-	< 0.05	< 0.05
Endrin ketone	0.05	mg/kg	< 0.05	-	< 0.05	< 0.05
g-HCH (Lindane)	0.05	mg/kg	< 0.05	-	< 0.05	< 0.05
Heptachlor	0.05	mg/kg	< 0.05	-	< 0.05	< 0.05
Heptachlor epoxide	0.05	mg/kg	< 0.05	-	< 0.05	< 0.05
Hexachlorobenzene	0.05	mg/kg	< 0.05	-	< 0.05	< 0.05
Methoxychlor	0.05	mg/kg	< 0.05	-	< 0.05	< 0.05
Toxaphene	0.5	mg/kg	< 0.5	-	< 0.5	< 0.5
Aldrin and Dieldrin (Total)*	0.05	mg/kg	< 0.05	-	< 0.05	< 0.05
DDT + DDE + DDD (Total)*	0.05	mg/kg	< 0.05	-	< 0.05	< 0.05
Vic EPA IWRG 621 OCP (Total)*	0.1	mg/kg	< 0.1	-	< 0.1	< 0.1
Vic EPA IWRG 621 Other OCP (Total)*	0.1	mg/kg	< 0.1	-	< 0.1	< 0.1
Dibutylchlorendate (surr.)	1	%	60	-	100	66
Tetrachloro-m-xylene (surr.)	1	%	77	-	105	99

Client Sample ID			TP09/0.0	TP11/0.0	TP14/0.0	TP15/0.0
Sample Matrix			Soil	Soil	Soil	Soil
Eurofins Sample No.			L23-No0024725	L23-No0024726	L23-No0024727	L23-No0024728
Date Sampled			Nov 01, 2023	Nov 01, 2023	Nov 01, 2023	Nov 01, 2023
Test/Reference	LOR	Unit				
NOx-N	1	mg/kg	1.9	1.5	2.2	2.4
Total Kjeldahl Nitrogen	10	mg/kg	230	180	310	200
Total Nitrogen	10	mg/kg	230	180	310	200
Phosphorus	1	mg/kg	570	400	350	280
Heavy Metals						
Arsenic	2	mg/kg	< 2	< 2	< 2	< 2
Cadmium	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1
Chromium	1	mg/kg	2.2	2.1	3.2	2.8
Copper	1	mg/kg	7.3	6.2	8.9	2.9
Lead	1	mg/kg	< 1	< 1	< 1	< 1
Mercury	0.02	mg/kg	< 0.02	< 0.02	< 0.02	< 0.02
Nickel	1	mg/kg	< 1	< 1	< 1	< 1
Zinc	5	mg/kg	16	9.9	10	5.1
Sample Properties						
% Moisture	1	%	< 1	< 1	< 1	< 1
OCOP in Soil						
Aldrin	0.01	mg/kg	-	< 0.01	-	-
alpha-BHC (HCH)	0.01	mg/kg	-	< 0.01	-	-
beta-BHC (HCH)	0.01	mg/kg	-	< 0.01	-	-
delta-BHC (HCH)	0.01	mg/kg	-	< 0.01	-	-
Bifenthrin	0.2	mg/kg	-	< 0.2	-	-
Bromophos Ethyl	0.05	mg/kg	-	< 0.05	-	-
Chlordane	0.01	mg/kg	-	< 0.01	-	-
Chlorpyrifos	0.02	mg/kg	-	< 0.02	-	-
Dieldrin	0.01	mg/kg	-	< 0.01	-	-
p.p-DDD	0.01	mg/kg	-	< 0.01	-	-
p.p-DDE	0.01	mg/kg	-	< 0.01	-	-
p.p-DDT	0.01	mg/kg	-	< 0.01	-	-
o.p-DDT	0.01	mg/kg	-	< 0.01	-	-
Endosulfan I	0.01	mg/kg	-	< 0.01	-	-
Endosulfan II	0.01	mg/kg	-	< 0.01	-	-
Endosulfan Sulfate	0.01	mg/kg	-	< 0.01	-	-
Endrin	0.01	mg/kg	-	< 0.01	-	-
Heptachlor	0.01	mg/kg	-	< 0.01	-	-
Heptachlor Epoxide	0.01	mg/kg	-	< 0.01	-	-
Hexachlorobenzene (HCB)	0.01	mg/kg	-	< 0.01	-	-
Lindane	0.01	mg/kg	-	< 0.01	-	-
Methoxychlor	0.2	mg/kg	-	< 0.2	-	-
Oxychlordane	0.01	mg/kg	-	< 0.01	-	-
Diazinon	0.2	mg/kg	-	< 0.2	-	-
Ethion	0.05	mg/kg	-	< 0.05	-	-
Fenitrothion	0.1	mg/kg	-	< 0.1	-	-
Malathion	0.1	mg/kg	-	< 0.1	-	-
Trifluralin	0.2	mg/kg	-	< 0.2	-	-

Client Sample ID			TP09/0.0	TP11/0.0	TP14/0.0	TP15/0.0
Sample Matrix			Soil	Soil	Soil	Soil
Eurofins Sample No.			L23-No0024725	L23-No0024726	L23-No0024727	L23-No0024728
Date Sampled			Nov 01, 2023	Nov 01, 2023	Nov 01, 2023	Nov 01, 2023
Test/Reference	LOR	Unit				
Carbamates in Soil						
Aminocarb	0.04	mg/kg	-	< 0.04	-	-
Aldicarb Sulfoxide	0.004	mg/kg	-	< 0.004	-	-
Carbendazim	0.04	mg/kg	-	< 0.04	-	-
Oxamyl	0.04	mg/kg	-	< 0.04	-	-
Aldicarb Sulfone	0.02	mg/kg	-	< 0.02	-	-
Methomyl	0.04	mg/kg	-	< 0.04	-	-
Fenuron/Fenuron TCA	0.005	mg/kg	-	< 0.005	-	-
Thidiazuron	0.04	mg/kg	-	< 0.04	-	-
Aldicarb	0.004	mg/kg	-	< 0.004	-	-
Bromacil	0.04	mg/kg	-	< 0.04	-	-
Mexacarbate	0.02	mg/kg	-	< 0.02	-	-
Monuron/Monuron TCA	0.04	mg/kg	-	< 0.04	-	-
Propoxur	0.004	mg/kg	-	< 0.004	-	-
Carbofuran	0.04	mg/kg	-	< 0.04	-	-
Fluometuron	0.02	mg/kg	-	< 0.02	-	-
Carbaryl	0.05	mg/kg	-	< 0.05	-	-
Diuron	0.04	mg/kg	-	< 0.04	-	-
Propachlor	0.02	mg/kg	-	< 0.02	-	-
Siduron	0.02	mg/kg	-	< 0.02	-	-
Methiocarb	0.04	mg/kg	-	< 0.04	-	-
Linuron	0.04	mg/kg	-	< 0.04	-	-
Neburon	0.04	mg/kg	-	< 0.04	-	-

Client Sample ID			TP19/0.0	TP20/0.0	QC03	TP21/0.0
Sample Matrix			Soil	Soil	Soil	Soil
Eurofins Sample No.			L23-No0024729	L23-No0024730	L23-No0024733	L23-No0024734
Date Sampled			Nov 01, 2023	Nov 01, 2023	Nov 01, 2023	Nov 02, 2023
Test/Reference	LOR	Unit				
Organochlorine Pesticides						
Chlordanes - Total	0.1	mg/kg	-	< 0.1	-	-
4.4'-DDD	0.05	mg/kg	-	< 0.05	-	-
4.4'-DDE	0.05	mg/kg	-	< 0.05	-	-
4.4'-DDT	0.05	mg/kg	-	< 0.05	-	-
a-HCH	0.05	mg/kg	-	< 0.05	-	-
Aldrin	0.05	mg/kg	-	< 0.05	-	-
b-HCH	0.05	mg/kg	-	< 0.05	-	-
d-HCH	0.05	mg/kg	-	< 0.05	-	-
Dieldrin	0.05	mg/kg	-	< 0.05	-	-
Endosulfan I	0.05	mg/kg	-	< 0.05	-	-
Endosulfan II	0.05	mg/kg	-	< 0.05	-	-
Endosulfan sulphate	0.05	mg/kg	-	< 0.05	-	-
Endrin	0.05	mg/kg	-	< 0.05	-	-
Endrin aldehyde	0.05	mg/kg	-	< 0.05	-	-
Endrin ketone	0.05	mg/kg	-	< 0.05	-	-
g-HCH (Lindane)	0.05	mg/kg	-	< 0.05	-	-
Heptachlor	0.05	mg/kg	-	< 0.05	-	-
Heptachlor epoxide	0.05	mg/kg	-	< 0.05	-	-

Client Sample ID			TP19/0.0	TP20/0.0	QC03	TP21/0.0
Sample Matrix			Soil	Soil	Soil	Soil
Eurofins Sample No.			L23-No0024729	L23-No0024730	L23-No0024733	L23-No0024734
Date Sampled			Nov 01, 2023	Nov 01, 2023	Nov 01, 2023	Nov 02, 2023
Test/Reference	LOR	Unit				
Organochlorine Pesticides						
Hexachlorobenzene	0.05	mg/kg	-	< 0.05	-	-
Methoxychlor	0.05	mg/kg	-	< 0.05	-	-
Toxaphene	0.5	mg/kg	-	< 0.5	-	-
Aldrin and Dieldrin (Total)*	0.05	mg/kg	-	< 0.05	-	-
DDT + DDE + DDD (Total)*	0.05	mg/kg	-	< 0.05	-	-
Vic EPA IWRG 621 OCP (Total)*	0.1	mg/kg	-	< 0.1	-	-
Vic EPA IWRG 621 Other OCP (Total)*	0.1	mg/kg	-	< 0.1	-	-
Dibutylchlorendate (surr.)	1	%	-	100	-	-
Tetrachloro-m-xylene (surr.)	1	%	-	99	-	-
NOx-N	1	mg/kg	1.5	2.9	< 1	2.1
Total Kjeldahl Nitrogen	10	mg/kg	150	200	170	390
Total Nitrogen	10	mg/kg	150	200	170	390
Phosphorus	1	mg/kg	170	120	160	64
Heavy Metals						
Arsenic	2	mg/kg	3.4	3.4	3.6	2.7
Cadmium	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1
Chromium	1	mg/kg	8.3	10	8.1	6.6
Copper	1	mg/kg	3.4	2.0	4.4	< 1
Lead	1	mg/kg	1.0	1.1	1.7	1.8
Mercury	0.02	mg/kg	< 0.02	< 0.02	< 0.02	< 0.02
Nickel	1	mg/kg	< 1	< 1	< 1	< 1
Zinc	5	mg/kg	< 5	< 5	< 5	< 5
Sample Properties						
% Moisture	1	%	1.2	1.1	1.1	< 1
OCOP in Soil						
Aldrin	0.01	mg/kg	< 0.01	-	< 0.01	< 0.01
alpha-BHC (HCH)	0.01	mg/kg	< 0.01	-	< 0.01	< 0.01
beta-BHC (HCH)	0.01	mg/kg	< 0.01	-	< 0.01	< 0.01
delta-BHC (HCH)	0.01	mg/kg	< 0.01	-	< 0.01	< 0.01
Bifenthrin	0.2	mg/kg	< 0.2	-	< 0.2	< 0.2
Bromophos Ethyl	0.05	mg/kg	< 0.05	-	< 0.05	< 0.05
Chlordane	0.01	mg/kg	< 0.01	-	< 0.01	< 0.01
Chlorpyrifos	0.02	mg/kg	< 0.02	-	< 0.02	< 0.02
Dieldrin	0.01	mg/kg	< 0.01	-	< 0.01	< 0.01
p.p-DDD	0.01	mg/kg	< 0.01	-	< 0.01	< 0.01
p.p-DDE	0.01	mg/kg	< 0.01	-	< 0.01	< 0.01
p.p-DDT	0.01	mg/kg	< 0.01	-	< 0.01	< 0.01
o.p-DDT	0.01	mg/kg	< 0.01	-	< 0.01	< 0.01
Endosulfan I	0.01	mg/kg	< 0.01	-	< 0.01	< 0.01
Endosulfan II	0.01	mg/kg	< 0.01	-	< 0.01	< 0.01
Endosulfan Sulfate	0.01	mg/kg	< 0.01	-	< 0.01	< 0.01
Endrin	0.01	mg/kg	< 0.01	-	< 0.01	< 0.01
Heptachlor	0.01	mg/kg	< 0.01	-	< 0.01	< 0.01
Heptachlor Epoxide	0.01	mg/kg	< 0.01	-	< 0.01	< 0.01
Hexachlorobenzene (HCB)	0.01	mg/kg	< 0.01	-	< 0.01	< 0.01
Lindane	0.01	mg/kg	< 0.01	-	< 0.01	< 0.01
Methoxychlor	0.2	mg/kg	< 0.2	-	< 0.2	< 0.2

Client Sample ID			TP19/0.0	TP20/0.0	QC03	TP21/0.0
Sample Matrix			Soil	Soil	Soil	Soil
Eurofins Sample No.			L23-No0024729	L23-No0024730	L23-No0024733	L23-No0024734
Date Sampled			Nov 01, 2023	Nov 01, 2023	Nov 01, 2023	Nov 02, 2023
Test/Reference	LOR	Unit				
OCOP in Soil						
Oxychlordane	0.01	mg/kg	< 0.01	-	< 0.01	< 0.01
Diazinon	0.2	mg/kg	< 0.2	-	< 0.2	< 0.2
Ethion	0.05	mg/kg	< 0.05	-	< 0.05	< 0.05
Fenitrothion	0.1	mg/kg	< 0.1	-	< 0.1	< 0.1
Malathion	0.1	mg/kg	< 0.1	-	< 0.1	< 0.1
Trifluralin	0.2	mg/kg	< 0.2	-	< 0.2	< 0.2
Carbamates in Soil						
Aminocarb	0.04	mg/kg	< 0.04	-	< 0.04	< 0.04
Aldicarb Sulfoxide	0.004	mg/kg	< 0.004	-	< 0.004	< 0.004
Carbendazim	0.04	mg/kg	< 0.04	-	< 0.04	< 0.04
Oxamyl	0.04	mg/kg	< 0.04	-	< 0.04	< 0.04
Aldicarb Sulfone	0.02	mg/kg	< 0.02	-	< 0.02	< 0.02
Methomyl	0.04	mg/kg	< 0.04	-	< 0.04	< 0.04
Fenuron/Fenuron TCA	0.005	mg/kg	< 0.005	-	< 0.005	< 0.005
Thidiazuron	0.04	mg/kg	< 0.04	-	< 0.04	< 0.04
Aldicarb	0.004	mg/kg	< 0.004	-	< 0.004	< 0.004
Bromacil	0.04	mg/kg	< 0.04	-	< 0.04	< 0.04
Mexacarbate	0.02	mg/kg	< 0.02	-	< 0.02	< 0.02
Monuron/Monuron TCA	0.04	mg/kg	< 0.04	-	< 0.04	< 0.04
Propoxur	0.004	mg/kg	< 0.004	-	< 0.004	< 0.004
Carbofuran	0.04	mg/kg	< 0.04	-	< 0.04	< 0.04
Fluometuron	0.02	mg/kg	< 0.02	-	< 0.02	< 0.02
Carbaryl	0.05	mg/kg	< 0.05	-	< 0.05	< 0.05
Diuron	0.04	mg/kg	< 0.04	-	< 0.04	< 0.04
Propachlor	0.02	mg/kg	< 0.02	-	< 0.02	< 0.02
Siduron	0.02	mg/kg	< 0.02	-	< 0.02	< 0.02
Methiocarb	0.04	mg/kg	< 0.04	-	< 0.04	< 0.04
Linuron	0.04	mg/kg	< 0.04	-	< 0.04	< 0.04
Neburon	0.04	mg/kg	< 0.04	-	< 0.04	< 0.04

Client Sample ID			TP23/0.0	TP25/0.0	TP26/0.0	TP29/0.0
Sample Matrix			Soil	Soil	Soil	Soil
Eurofins Sample No.			L23-No0024735	L23-No0024736	L23-No0024737	L23-No0024738
Date Sampled			Nov 02, 2023	Nov 02, 2023	Nov 02, 2023	Nov 02, 2023
Test/Reference	LOR	Unit				
Organochlorine Pesticides						
Chlordanes - Total	0.1	mg/kg	< 0.1	< 0.1	-	< 0.1
4.4'-DDD	0.05	mg/kg	< 0.05	< 0.05	-	< 0.05
4.4'-DDE	0.05	mg/kg	< 0.05	< 0.05	-	< 0.05
4.4'-DDT	0.05	mg/kg	< 0.05	< 0.05	-	< 0.05
a-HCH	0.05	mg/kg	< 0.05	< 0.05	-	< 0.05
Aldrin	0.05	mg/kg	< 0.05	< 0.05	-	< 0.05
b-HCH	0.05	mg/kg	< 0.05	< 0.05	-	< 0.05
d-HCH	0.05	mg/kg	< 0.05	< 0.05	-	< 0.05
Dieldrin	0.05	mg/kg	< 0.05	< 0.05	-	< 0.05
Endosulfan I	0.05	mg/kg	< 0.05	< 0.05	-	< 0.05
Endosulfan II	0.05	mg/kg	< 0.05	< 0.05	-	< 0.05

Client Sample ID			TP23/0.0	TP25/0.0	TP26/0.0	TP29/0.0
Sample Matrix			Soil	Soil	Soil	Soil
Eurofins Sample No.			L23-No0024735	L23-No0024736	L23-No0024737	L23-No0024738
Date Sampled			Nov 02, 2023	Nov 02, 2023	Nov 02, 2023	Nov 02, 2023
Test/Reference	LOR	Unit				
Organochlorine Pesticides						
Endosulfan sulphate	0.05	mg/kg	< 0.05	< 0.05	-	< 0.05
Endrin	0.05	mg/kg	< 0.05	< 0.05	-	< 0.05
Endrin aldehyde	0.05	mg/kg	< 0.05	< 0.05	-	< 0.05
Endrin ketone	0.05	mg/kg	< 0.05	< 0.05	-	< 0.05
g-HCH (Lindane)	0.05	mg/kg	< 0.05	< 0.05	-	< 0.05
Heptachlor	0.05	mg/kg	< 0.05	< 0.05	-	< 0.05
Heptachlor epoxide	0.05	mg/kg	< 0.05	< 0.05	-	< 0.05
Hexachlorobenzene	0.05	mg/kg	< 0.05	< 0.05	-	< 0.05
Methoxychlor	0.05	mg/kg	< 0.05	< 0.05	-	< 0.05
Toxaphene	0.5	mg/kg	< 0.5	< 0.5	-	< 0.5
Aldrin and Dieldrin (Total)*	0.05	mg/kg	< 0.05	< 0.05	-	< 0.05
DDT + DDE + DDD (Total)*	0.05	mg/kg	< 0.05	< 0.05	-	< 0.05
Vic EPA IWRG 621 OCP (Total)*	0.1	mg/kg	< 0.1	< 0.1	-	< 0.1
Vic EPA IWRG 621 Other OCP (Total)*	0.1	mg/kg	< 0.1	< 0.1	-	< 0.1
Dibutylchlorendate (surr.)	1	%	87	76	-	78
Tetrachloro-m-xylene (surr.)	1	%	116	87	-	133
NOx-N	1	mg/kg	< 1	1.2	2.1	1.6
Total Kjeldahl Nitrogen	10	mg/kg	440	410	250	350
Total Nitrogen	10	mg/kg	440	410	250	350
Phosphorus	1	mg/kg	51	44	43	30
Heavy Metals						
Arsenic	2	mg/kg	2.1	< 2	< 2	< 2
Cadmium	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1
Chromium	1	mg/kg	5.8	4.3	3.3	< 1
Copper	1	mg/kg	< 1	< 1	< 1	< 1
Lead	1	mg/kg	1.3	1.5	1.2	1.1
Mercury	0.02	mg/kg	< 0.02	< 0.02	< 0.02	< 0.02
Nickel	1	mg/kg	< 1	< 1	< 1	< 1
Zinc	5	mg/kg	< 5	< 5	< 5	< 5
Sample Properties						
% Moisture	1	%	< 1	< 1	< 1	< 1
OCOP in Soil						
Aldrin	0.01	mg/kg	-	-	< 0.01	-
alpha-BHC (HCH)	0.01	mg/kg	-	-	< 0.01	-
beta-BHC (HCH)	0.01	mg/kg	-	-	< 0.01	-
delta-BHC (HCH)	0.01	mg/kg	-	-	< 0.01	-
Bifenthrin	0.2	mg/kg	-	-	< 0.2	-
Bromophos Ethyl	0.05	mg/kg	-	-	< 0.05	-
Chlordane	0.01	mg/kg	-	-	< 0.01	-
Chlorpyrifos	0.02	mg/kg	-	-	< 0.02	-
Dieldrin	0.01	mg/kg	-	-	< 0.01	-
p.p-DDD	0.01	mg/kg	-	-	< 0.01	-
p.p-DDE	0.01	mg/kg	-	-	< 0.01	-
p.p-DDT	0.01	mg/kg	-	-	< 0.01	-
o.p-DDT	0.01	mg/kg	-	-	< 0.01	-
Endosulfan I	0.01	mg/kg	-	-	< 0.01	-
Endosulfan II	0.01	mg/kg	-	-	< 0.01	-

Client Sample ID			TP23/0.0	TP25/0.0	TP26/0.0	TP29/0.0
Sample Matrix			Soil	Soil	Soil	Soil
Eurofins Sample No.			L23-No0024735	L23-No0024736	L23-No0024737	L23-No0024738
Date Sampled			Nov 02, 2023	Nov 02, 2023	Nov 02, 2023	Nov 02, 2023
Test/Reference	LOR	Unit				
OCOP in Soil						
Endosulfan Sulfate	0.01	mg/kg	-	-	< 0.01	-
Endrin	0.01	mg/kg	-	-	< 0.01	-
Heptachlor	0.01	mg/kg	-	-	< 0.01	-
Heptachlor Epoxide	0.01	mg/kg	-	-	< 0.01	-
Hexachlorobenzene (HCB)	0.01	mg/kg	-	-	< 0.01	-
Lindane	0.01	mg/kg	-	-	< 0.01	-
Methoxychlor	0.2	mg/kg	-	-	< 0.2	-
Oxychlordane	0.01	mg/kg	-	-	< 0.01	-
Diazinon	0.2	mg/kg	-	-	< 0.2	-
Ethion	0.05	mg/kg	-	-	< 0.05	-
Fenitrothion	0.1	mg/kg	-	-	< 0.1	-
Malathion	0.1	mg/kg	-	-	< 0.1	-
Trifluralin	0.2	mg/kg	-	-	< 0.2	-
Carbamates in Soil						
Aminocarb	0.04	mg/kg	-	-	< 0.04	-
Aldicarb Sulfoxide	0.004	mg/kg	-	-	< 0.004	-
Carbendazim	0.04	mg/kg	-	-	< 0.04	-
Oxamyl	0.04	mg/kg	-	-	< 0.04	-
Aldicarb Sulfone	0.02	mg/kg	-	-	< 0.02	-
Methomyl	0.04	mg/kg	-	-	< 0.04	-
Fenuron/Fenuron TCA	0.005	mg/kg	-	-	< 0.005	-
Thidiazuron	0.04	mg/kg	-	-	< 0.04	-
Aldicarb	0.004	mg/kg	-	-	< 0.004	-
Bromacil	0.04	mg/kg	-	-	< 0.04	-
Mexacarbate	0.02	mg/kg	-	-	< 0.02	-
Monuron/Monuron TCA	0.04	mg/kg	-	-	< 0.04	-
Propoxur	0.004	mg/kg	-	-	< 0.004	-
Carbofuran	0.04	mg/kg	-	-	< 0.04	-
Fluometuron	0.02	mg/kg	-	-	< 0.02	-
Carbaryl	0.05	mg/kg	-	-	< 0.05	-
Diuron	0.04	mg/kg	-	-	< 0.04	-
Propachlor	0.02	mg/kg	-	-	< 0.02	-
Siduron	0.02	mg/kg	-	-	< 0.02	-
Methiocarb	0.04	mg/kg	-	-	< 0.04	-
Linuron	0.04	mg/kg	-	-	< 0.04	-
Neburon	0.04	mg/kg	-	-	< 0.04	-

Client Sample ID			TP30/0.0	TP34/0.0	TP35/0.0	TP38/0.0
Sample Matrix			Soil	Soil	Soil	Soil
Eurofins Sample No.			L23-No0024739	L23-No0024740	L23-No0024741	L23-No0024742
Date Sampled			Nov 02, 2023	Nov 02, 2023	Nov 02, 2023	Nov 02, 2023
Test/Reference	LOR	Unit				
Organochlorine Pesticides						
Chlordanes - Total	0.1	mg/kg	< 0.1	-	< 0.1	< 0.1
4.4'-DDD	0.05	mg/kg	< 0.05	-	< 0.05	< 0.05
4.4'-DDE	0.05	mg/kg	< 0.05	-	< 0.05	< 0.05
4.4'-DDT	0.05	mg/kg	< 0.05	-	< 0.05	< 0.05
a-HCH	0.05	mg/kg	< 0.05	-	< 0.05	< 0.05
Aldrin	0.05	mg/kg	< 0.05	-	< 0.05	< 0.05
b-HCH	0.05	mg/kg	< 0.05	-	< 0.05	< 0.05
d-HCH	0.05	mg/kg	< 0.05	-	< 0.05	< 0.05
Dieldrin	0.05	mg/kg	< 0.05	-	< 0.05	< 0.05
Endosulfan I	0.05	mg/kg	< 0.05	-	< 0.05	< 0.05
Endosulfan II	0.05	mg/kg	< 0.05	-	< 0.05	< 0.05
Endosulfan sulphate	0.05	mg/kg	< 0.05	-	< 0.05	< 0.05
Endrin	0.05	mg/kg	< 0.05	-	< 0.05	< 0.05
Endrin aldehyde	0.05	mg/kg	< 0.05	-	< 0.05	< 0.05
Endrin ketone	0.05	mg/kg	< 0.05	-	< 0.05	< 0.05
g-HCH (Lindane)	0.05	mg/kg	< 0.05	-	< 0.05	< 0.05
Heptachlor	0.05	mg/kg	< 0.05	-	< 0.05	< 0.05
Heptachlor epoxide	0.05	mg/kg	< 0.05	-	< 0.05	< 0.05
Hexachlorobenzene	0.05	mg/kg	< 0.05	-	< 0.05	< 0.05
Methoxychlor	0.05	mg/kg	< 0.05	-	< 0.05	< 0.05
Toxaphene	0.5	mg/kg	< 0.5	-	< 0.5	< 0.5
Aldrin and Dieldrin (Total)*	0.05	mg/kg	< 0.05	-	< 0.05	< 0.05
DDT + DDE + DDD (Total)*	0.05	mg/kg	< 0.05	-	< 0.05	< 0.05
Vic EPA IWRG 621 OCP (Total)*	0.1	mg/kg	< 0.1	-	< 0.1	< 0.1
Vic EPA IWRG 621 Other OCP (Total)*	0.1	mg/kg	< 0.1	-	< 0.1	< 0.1
Dibutylchlorendate (surr.)	1	%	88	-	85	91
Tetrachloro-m-xylene (surr.)	1	%	105	-	87	87
NOx-N	1	mg/kg	1.0	< 1	< 1	2.1
Total Kjeldahl Nitrogen	10	mg/kg	460	250	170	200
Total Nitrogen	10	mg/kg	460	250	170	200
Phosphorus	1	mg/kg	69	19	180	9.4
Heavy Metals						
Arsenic	2	mg/kg	< 2	< 2	3.1	< 2
Cadmium	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1
Chromium	1	mg/kg	2.2	< 1	10	< 1
Copper	1	mg/kg	1.9	< 1	< 1	< 1
Lead	1	mg/kg	2.1	< 1	< 1	< 1
Mercury	0.02	mg/kg	< 0.02	< 0.02	< 0.02	< 0.02
Nickel	1	mg/kg	< 1	< 1	< 1	< 1
Zinc	5	mg/kg	< 5	< 5	7.1	< 5
Sample Properties						
% Moisture	1	%	< 1	< 1	< 1	< 1
OCOP in Soil						
Aldrin	0.01	mg/kg	-	< 0.01	-	-
alpha-BHC (HCH)	0.01	mg/kg	-	< 0.01	-	-
beta-BHC (HCH)	0.01	mg/kg	-	< 0.01	-	-
delta-BHC (HCH)	0.01	mg/kg	-	< 0.01	-	-

Client Sample ID			TP30/0.0	TP34/0.0	TP35/0.0	TP38/0.0
Sample Matrix			Soil	Soil	Soil	Soil
Eurofins Sample No.			L23-No0024739	L23-No0024740	L23-No0024741	L23-No0024742
Date Sampled			Nov 02, 2023	Nov 02, 2023	Nov 02, 2023	Nov 02, 2023
Test/Reference	LOR	Unit				
OCOP in Soil						
Bifenthrin	0.2	mg/kg	-	< 0.2	-	-
Bromophos Ethyl	0.05	mg/kg	-	< 0.05	-	-
Chlordane	0.01	mg/kg	-	< 0.01	-	-
Chlorpyrifos	0.02	mg/kg	-	< 0.02	-	-
Dieldrin	0.01	mg/kg	-	< 0.01	-	-
p.p-DDD	0.01	mg/kg	-	< 0.01	-	-
p.p-DDE	0.01	mg/kg	-	< 0.01	-	-
p.p-DDT	0.01	mg/kg	-	< 0.01	-	-
o.p-DDT	0.01	mg/kg	-	< 0.01	-	-
Endosulfan I	0.01	mg/kg	-	< 0.01	-	-
Endosulfan II	0.01	mg/kg	-	< 0.01	-	-
Endosulfan Sulfate	0.01	mg/kg	-	< 0.01	-	-
Endrin	0.01	mg/kg	-	< 0.01	-	-
Heptachlor	0.01	mg/kg	-	< 0.01	-	-
Heptachlor Epoxide	0.01	mg/kg	-	< 0.01	-	-
Hexachlorobenzene (HCB)	0.01	mg/kg	-	< 0.01	-	-
Lindane	0.01	mg/kg	-	< 0.01	-	-
Methoxychlor	0.2	mg/kg	-	< 0.2	-	-
Oxychlordane	0.01	mg/kg	-	< 0.01	-	-
Diazinon	0.2	mg/kg	-	< 0.2	-	-
Ethion	0.05	mg/kg	-	< 0.05	-	-
Fenitrothion	0.1	mg/kg	-	< 0.1	-	-
Malathion	0.1	mg/kg	-	< 0.1	-	-
Trifluralin	0.2	mg/kg	-	< 0.2	-	-
Carbamates in Soil						
Aminocarb	0.04	mg/kg	-	< 0.04	-	-
Aldicarb Sulfoxide	0.004	mg/kg	-	< 0.004	-	-
Carbendazim	0.04	mg/kg	-	< 0.04	-	-
Oxamyl	0.04	mg/kg	-	< 0.04	-	-
Aldicarb Sulfone	0.02	mg/kg	-	< 0.02	-	-
Methomyl	0.04	mg/kg	-	< 0.04	-	-
Fenuron/Fenuron TCA	0.005	mg/kg	-	< 0.005	-	-
Thidiazuron	0.04	mg/kg	-	< 0.04	-	-
Aldicarb	0.004	mg/kg	-	< 0.004	-	-
Bromacil	0.04	mg/kg	-	< 0.04	-	-
Mexacarbate	0.02	mg/kg	-	< 0.02	-	-
Monuron/Monuron TCA	0.04	mg/kg	-	< 0.04	-	-
Propoxur	0.004	mg/kg	-	< 0.004	-	-
Carbofuran	0.04	mg/kg	-	< 0.04	-	-
Fluometuron	0.02	mg/kg	-	< 0.02	-	-
Carbaryl	0.05	mg/kg	-	< 0.05	-	-
Diuron	0.04	mg/kg	-	< 0.04	-	-
Propachlor	0.02	mg/kg	-	< 0.02	-	-
Siduron	0.02	mg/kg	-	< 0.02	-	-
Methiocarb	0.04	mg/kg	-	< 0.04	-	-
Linuron	0.04	mg/kg	-	< 0.04	-	-
Neburon	0.04	mg/kg	-	< 0.04	-	-

Client Sample ID			TP39/0.0	QC11	TP41/0.0	TP42/0.0
Sample Matrix			Soil	Soil	Soil	Soil
Eurofins Sample No.			L23-No0024743	L23-No0024745	L23-No0024746	L23-No0024747
Date Sampled			Nov 02, 2023	Nov 02, 2023	Nov 03, 2023	Nov 03, 2023
Test/Reference	LOR	Unit				
Organochlorine Pesticides						
Chlordanes - Total	0.1	mg/kg	< 0.1	-	< 0.1	< 0.1
4.4'-DDD	0.05	mg/kg	< 0.05	-	< 0.05	< 0.05
4.4'-DDE	0.05	mg/kg	< 0.05	-	< 0.05	< 0.05
4.4'-DDT	0.05	mg/kg	< 0.05	-	< 0.05	< 0.05
a-HCH	0.05	mg/kg	< 0.05	-	< 0.05	< 0.05
Aldrin	0.05	mg/kg	< 0.05	-	< 0.05	< 0.05
b-HCH	0.05	mg/kg	< 0.05	-	< 0.05	< 0.05
d-HCH	0.05	mg/kg	< 0.05	-	< 0.05	< 0.05
Dieldrin	0.05	mg/kg	< 0.05	-	< 0.05	< 0.05
Endosulfan I	0.05	mg/kg	< 0.05	-	< 0.05	< 0.05
Endosulfan II	0.05	mg/kg	< 0.05	-	< 0.05	< 0.05
Endosulfan sulphate	0.05	mg/kg	< 0.05	-	< 0.05	< 0.05
Endrin	0.05	mg/kg	< 0.05	-	< 0.05	< 0.05
Endrin aldehyde	0.05	mg/kg	< 0.05	-	< 0.05	< 0.05
Endrin ketone	0.05	mg/kg	< 0.05	-	< 0.05	< 0.05
g-HCH (Lindane)	0.05	mg/kg	< 0.05	-	< 0.05	< 0.05
Heptachlor	0.05	mg/kg	< 0.05	-	< 0.05	< 0.05
Heptachlor epoxide	0.05	mg/kg	< 0.05	-	< 0.05	< 0.05
Hexachlorobenzene	0.05	mg/kg	< 0.05	-	< 0.05	< 0.05
Methoxychlor	0.05	mg/kg	< 0.05	-	< 0.05	< 0.05
Toxaphene	0.5	mg/kg	< 0.5	-	< 0.5	< 0.5
Aldrin and Dieldrin (Total)*	0.05	mg/kg	< 0.05	-	< 0.05	< 0.05
DDT + DDE + DDD (Total)*	0.05	mg/kg	< 0.05	-	< 0.05	< 0.05
Vic EPA IWRG 621 OCP (Total)*	0.1	mg/kg	< 0.1	-	< 0.1	< 0.1
Vic EPA IWRG 621 Other OCP (Total)*	0.1	mg/kg	< 0.1	-	< 0.1	< 0.1
Dibutylchlorendate (surr.)	1	%	69	-	76	84
Tetrachloro-m-xylene (surr.)	1	%	84	-	87	129
NOx-N	1	mg/kg	< 1	1.5	1.2	< 1
Total Kjeldahl Nitrogen	10	mg/kg	250	230	580	350
Total Nitrogen	10	mg/kg	250	230	580	350
Phosphorus	1	mg/kg	33	470	310	240
Heavy Metals						
Arsenic	2	mg/kg	< 2	< 2	< 2	< 2
Cadmium	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1
Chromium	1	mg/kg	1.4	1.5	1.0	< 1
Copper	1	mg/kg	< 1	440	130	81
Lead	1	mg/kg	1.5	1.5	1.3	1.7
Mercury	0.02	mg/kg	< 0.02	< 0.02	< 0.02	< 0.02
Nickel	1	mg/kg	< 1	1.7	< 1	< 1
Zinc	5	mg/kg	< 5	27	9.7	19
Sample Properties						
% Moisture	1	%	< 1	3.0	< 1	< 1
OCOP in Soil						
Aldrin	0.01	mg/kg	-	< 0.01	-	-
alpha-BHC (HCH)	0.01	mg/kg	-	< 0.01	-	-
beta-BHC (HCH)	0.01	mg/kg	-	< 0.01	-	-
delta-BHC (HCH)	0.01	mg/kg	-	< 0.01	-	-

Client Sample ID			TP39/0.0	QC11	TP41/0.0	TP42/0.0
Sample Matrix			Soil	Soil	Soil	Soil
Eurofins Sample No.			L23-No0024743	L23-No0024745	L23-No0024746	L23-No0024747
Date Sampled			Nov 02, 2023	Nov 02, 2023	Nov 03, 2023	Nov 03, 2023
Test/Reference	LOR	Unit				
OCOP in Soil						
Bifenthrin	0.2	mg/kg	-	< 0.2	-	-
Bromophos Ethyl	0.05	mg/kg	-	< 0.05	-	-
Chlordane	0.01	mg/kg	-	< 0.01	-	-
Chlorpyrifos	0.02	mg/kg	-	< 0.02	-	-
Dieldrin	0.01	mg/kg	-	0.02	-	-
p.p-DDD	0.01	mg/kg	-	< 0.01	-	-
p.p-DDE	0.01	mg/kg	-	< 0.01	-	-
p.p-DDT	0.01	mg/kg	-	< 0.01	-	-
o.p-DDT	0.01	mg/kg	-	< 0.01	-	-
Endosulfan I	0.01	mg/kg	-	< 0.01	-	-
Endosulfan II	0.01	mg/kg	-	< 0.01	-	-
Endosulfan Sulfate	0.01	mg/kg	-	< 0.01	-	-
Endrin	0.01	mg/kg	-	< 0.01	-	-
Heptachlor	0.01	mg/kg	-	< 0.01	-	-
Heptachlor Epoxide	0.01	mg/kg	-	< 0.01	-	-
Hexachlorobenzene (HCB)	0.01	mg/kg	-	< 0.01	-	-
Lindane	0.01	mg/kg	-	< 0.01	-	-
Methoxychlor	0.2	mg/kg	-	< 0.2	-	-
Oxychlordane	0.01	mg/kg	-	< 0.01	-	-
Diazinon	0.2	mg/kg	-	< 0.2	-	-
Ethion	0.05	mg/kg	-	< 0.05	-	-
Fenitrothion	0.1	mg/kg	-	< 0.1	-	-
Malathion	0.1	mg/kg	-	< 0.1	-	-
Trifluralin	0.2	mg/kg	-	< 0.2	-	-
Carbamates in Soil						
Aminocarb	0.04	mg/kg	-	< 0.04	-	-
Aldicarb Sulfoxide	0.004	mg/kg	-	< 0.004	-	-
Carbendazim	0.04	mg/kg	-	< 0.04	-	-
Oxamyl	0.04	mg/kg	-	< 0.04	-	-
Aldicarb Sulfone	0.02	mg/kg	-	< 0.02	-	-
Methomyl	0.04	mg/kg	-	< 0.04	-	-
Fenuron/Fenuron TCA	0.005	mg/kg	-	< 0.005	-	-
Thidiazuron	0.04	mg/kg	-	< 0.04	-	-
Aldicarb	0.004	mg/kg	-	< 0.004	-	-
Bromacil	0.04	mg/kg	-	< 0.04	-	-
Mexacarbate	0.02	mg/kg	-	< 0.02	-	-
Monuron/Monuron TCA	0.04	mg/kg	-	< 0.04	-	-
Propoxur	0.004	mg/kg	-	< 0.004	-	-
Carbofuran	0.04	mg/kg	-	< 0.04	-	-
Fluometuron	0.02	mg/kg	-	< 0.02	-	-
Carbaryl	0.05	mg/kg	-	< 0.05	-	-
Diuron	0.04	mg/kg	-	< 0.04	-	-
Propachlor	0.02	mg/kg	-	< 0.02	-	-
Siduron	0.02	mg/kg	-	< 0.02	-	-
Methiocarb	0.04	mg/kg	-	< 0.04	-	-
Linuron	0.04	mg/kg	-	< 0.04	-	-
Neburon	0.04	mg/kg	-	< 0.04	-	-

Client Sample ID			TP45/0.0	TP48/0.0	TP51/0.0	TP53/0.0
Sample Matrix			Soil	Soil	Soil	Soil
Eurofins Sample No.			L23-No0024748	L23-No0024749	L23-No0024750	L23-No0024751
Date Sampled			Nov 03, 2023	Nov 03, 2023	Nov 03, 2023	Nov 03, 2023
Test/Reference	LOR	Unit				
Organochlorine Pesticides						
Chlordanes - Total	0.1	mg/kg	-	< 0.1	< 0.1	-
4.4'-DDD	0.05	mg/kg	-	< 0.05	< 0.05	-
4.4'-DDE	0.05	mg/kg	-	< 0.05	< 0.05	-
4.4'-DDT	0.05	mg/kg	-	< 0.05	< 0.05	-
a-HCH	0.05	mg/kg	-	< 0.05	< 0.05	-
Aldrin	0.05	mg/kg	-	< 0.05	< 0.05	-
b-HCH	0.05	mg/kg	-	< 0.05	< 0.05	-
d-HCH	0.05	mg/kg	-	< 0.05	< 0.05	-
Dieldrin	0.05	mg/kg	-	< 0.05	< 0.05	-
Endosulfan I	0.05	mg/kg	-	< 0.05	< 0.05	-
Endosulfan II	0.05	mg/kg	-	< 0.05	< 0.05	-
Endosulfan sulphate	0.05	mg/kg	-	< 0.05	< 0.05	-
Endrin	0.05	mg/kg	-	< 0.05	< 0.05	-
Endrin aldehyde	0.05	mg/kg	-	< 0.05	< 0.05	-
Endrin ketone	0.05	mg/kg	-	< 0.05	< 0.05	-
g-HCH (Lindane)	0.05	mg/kg	-	< 0.05	< 0.05	-
Heptachlor	0.05	mg/kg	-	< 0.05	< 0.05	-
Heptachlor epoxide	0.05	mg/kg	-	< 0.05	< 0.05	-
Hexachlorobenzene	0.05	mg/kg	-	< 0.05	< 0.05	-
Methoxychlor	0.05	mg/kg	-	< 0.05	< 0.05	-
Toxaphene	0.5	mg/kg	-	< 0.5	< 0.5	-
Aldrin and Dieldrin (Total)*	0.05	mg/kg	-	< 0.05	< 0.05	-
DDT + DDE + DDD (Total)*	0.05	mg/kg	-	< 0.05	< 0.05	-
Vic EPA IWRG 621 OCP (Total)*	0.1	mg/kg	-	< 0.1	< 0.1	-
Vic EPA IWRG 621 Other OCP (Total)*	0.1	mg/kg	-	< 0.1	< 0.1	-
Dibutylchlorendate (surr.)	1	%	-	60	84	-
Tetrachloro-m-xylene (surr.)	1	%	-	77	129	-
NOx-N	1	mg/kg	2.0	1.8	2.1	2.1
Total Kjeldahl Nitrogen	10	mg/kg	310	470	370	450
Total Nitrogen	10	mg/kg	310	470	370	450
Phosphorus	1	mg/kg	64	330	120	130
Heavy Metals						
Arsenic	2	mg/kg	< 2	< 2	< 2	< 2
Cadmium	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1
Chromium	1	mg/kg	< 1	2.3	2.6	2.8
Copper	1	mg/kg	62	6.5	3.0	3.7
Lead	1	mg/kg	1.2	1.7	1.7	1.5
Mercury	0.02	mg/kg	< 0.02	< 0.02	< 0.02	< 0.02
Nickel	1	mg/kg	< 1	< 1	< 1	< 1
Zinc	5	mg/kg	5.4	14	5.4	< 5
Sample Properties						
% Moisture	1	%	< 1	< 1	< 1	1.0
OCOP in Soil						
Aldrin	0.01	mg/kg	< 0.01	-	-	< 0.01
alpha-BHC (HCH)	0.01	mg/kg	< 0.01	-	-	< 0.01
beta-BHC (HCH)	0.01	mg/kg	< 0.01	-	-	< 0.01
delta-BHC (HCH)	0.01	mg/kg	< 0.01	-	-	< 0.01

Client Sample ID			TP45/0.0	TP48/0.0	TP51/0.0	TP53/0.0
Sample Matrix			Soil	Soil	Soil	Soil
Eurofins Sample No.			L23-No0024748	L23-No0024749	L23-No0024750	L23-No0024751
Date Sampled			Nov 03, 2023	Nov 03, 2023	Nov 03, 2023	Nov 03, 2023
Test/Reference	LOR	Unit				
OCOP in Soil						
Bifenthrin	0.2	mg/kg	< 0.2	-	-	< 0.2
Bromophos Ethyl	0.05	mg/kg	< 0.05	-	-	< 0.05
Chlordane	0.01	mg/kg	< 0.01	-	-	< 0.01
Chlorpyrifos	0.02	mg/kg	< 0.02	-	-	< 0.02
Dieldrin	0.01	mg/kg	< 0.01	-	-	< 0.01
p.p-DDD	0.01	mg/kg	< 0.01	-	-	< 0.01
p.p-DDE	0.01	mg/kg	< 0.01	-	-	< 0.01
p.p-DDT	0.01	mg/kg	< 0.01	-	-	< 0.01
o.p-DDT	0.01	mg/kg	< 0.01	-	-	< 0.01
Endosulfan I	0.01	mg/kg	< 0.01	-	-	< 0.01
Endosulfan II	0.01	mg/kg	< 0.01	-	-	< 0.01
Endosulfan Sulfate	0.01	mg/kg	< 0.01	-	-	< 0.01
Endrin	0.01	mg/kg	< 0.01	-	-	< 0.01
Heptachlor	0.01	mg/kg	< 0.01	-	-	< 0.01
Heptachlor Epoxide	0.01	mg/kg	< 0.01	-	-	< 0.01
Hexachlorobenzene (HCB)	0.01	mg/kg	< 0.01	-	-	< 0.01
Lindane	0.01	mg/kg	< 0.01	-	-	< 0.01
Methoxychlor	0.2	mg/kg	< 0.2	-	-	< 0.2
Oxychlordane	0.01	mg/kg	< 0.01	-	-	< 0.01
Diazinon	0.2	mg/kg	< 0.2	-	-	< 0.2
Ethion	0.05	mg/kg	< 0.05	-	-	< 0.05
Fenitrothion	0.1	mg/kg	< 0.1	-	-	< 0.1
Malathion	0.1	mg/kg	< 0.1	-	-	< 0.1
Trifluralin	0.2	mg/kg	< 0.2	-	-	< 0.2
Carbamates in Soil						
Aminocarb	0.04	mg/kg	< 0.04	-	-	< 0.04
Aldicarb Sulfoxide	0.004	mg/kg	< 0.004	-	-	< 0.004
Carbendazim	0.04	mg/kg	< 0.04	-	-	< 0.04
Oxamyl	0.04	mg/kg	< 0.04	-	-	< 0.04
Aldicarb Sulfone	0.02	mg/kg	< 0.02	-	-	< 0.02
Methomyl	0.04	mg/kg	< 0.04	-	-	< 0.04
Fenuron/Fenuron TCA	0.005	mg/kg	< 0.005	-	-	< 0.005
Thidiazuron	0.04	mg/kg	< 0.04	-	-	< 0.04
Aldicarb	0.004	mg/kg	< 0.004	-	-	< 0.004
Bromacil	0.04	mg/kg	< 0.04	-	-	< 0.04
Mexacarbate	0.02	mg/kg	< 0.02	-	-	< 0.02
Monuron/Monuron TCA	0.04	mg/kg	< 0.04	-	-	< 0.04
Propoxur	0.004	mg/kg	< 0.004	-	-	< 0.004
Carbofuran	0.04	mg/kg	< 0.04	-	-	< 0.04
Fluometuron	0.02	mg/kg	< 0.02	-	-	< 0.02
Carbaryl	0.05	mg/kg	< 0.05	-	-	< 0.05
Diuron	0.04	mg/kg	< 0.04	-	-	< 0.04
Propachlor	0.02	mg/kg	< 0.02	-	-	< 0.02
Siduron	0.02	mg/kg	< 0.02	-	-	< 0.02
Methiocarb	0.04	mg/kg	< 0.04	-	-	< 0.04
Linuron	0.04	mg/kg	< 0.04	-	-	< 0.04
Neburon	0.04	mg/kg	< 0.04	-	-	< 0.04

Client Sample ID			TP56/0.0	TP58/0.0	TP59/0.0	QC13
Sample Matrix			Soil	Soil	Soil	Soil
Eurofins Sample No.			L23-No0024752	L23-No0024753	L23-No0024754	L23-No0024755
Date Sampled			Nov 03, 2023	Nov 03, 2023	Nov 03, 2023	Nov 03, 2023
Test/Reference	LOR	Unit				
Organochlorine Pesticides						
Chlordanes - Total	0.1	mg/kg	< 0.1	< 0.1	-	-
4.4'-DDD	0.05	mg/kg	< 0.05	< 0.05	-	-
4.4'-DDE	0.05	mg/kg	< 0.05	< 0.05	-	-
4.4'-DDT	0.05	mg/kg	< 0.05	< 0.05	-	-
a-HCH	0.05	mg/kg	< 0.05	< 0.05	-	-
Aldrin	0.05	mg/kg	< 0.05	< 0.05	-	-
b-HCH	0.05	mg/kg	< 0.05	< 0.05	-	-
d-HCH	0.05	mg/kg	< 0.05	< 0.05	-	-
Dieldrin	0.05	mg/kg	< 0.05	< 0.05	-	-
Endosulfan I	0.05	mg/kg	< 0.05	< 0.05	-	-
Endosulfan II	0.05	mg/kg	< 0.05	< 0.05	-	-
Endosulfan sulphate	0.05	mg/kg	< 0.05	< 0.05	-	-
Endrin	0.05	mg/kg	< 0.05	< 0.05	-	-
Endrin aldehyde	0.05	mg/kg	< 0.05	< 0.05	-	-
Endrin ketone	0.05	mg/kg	< 0.05	< 0.05	-	-
g-HCH (Lindane)	0.05	mg/kg	< 0.05	< 0.05	-	-
Heptachlor	0.05	mg/kg	< 0.05	< 0.05	-	-
Heptachlor epoxide	0.05	mg/kg	< 0.05	< 0.05	-	-
Hexachlorobenzene	0.05	mg/kg	< 0.05	< 0.05	-	-
Methoxychlor	0.05	mg/kg	< 0.05	< 0.05	-	-
Toxaphene	0.5	mg/kg	< 0.5	< 0.5	-	-
Aldrin and Dieldrin (Total)*	0.05	mg/kg	< 0.05	< 0.05	-	-
DDT + DDE + DDD (Total)*	0.05	mg/kg	< 0.05	< 0.05	-	-
Vic EPA IWRG 621 OCP (Total)*	0.1	mg/kg	< 0.1	< 0.1	-	-
Vic EPA IWRG 621 Other OCP (Total)*	0.1	mg/kg	< 0.1	< 0.1	-	-
Dibutylchlorendate (surr.)	1	%	60	100	-	-
Tetrachloro-m-xylene (surr.)	1	%	77	105	-	-
NOx-N	1	mg/kg	1.2	2.9	3.1	3.3
Total Kjeldahl Nitrogen	10	mg/kg	170	970	760	400
Total Nitrogen	10	mg/kg	170	970	760	400
Phosphorus	1	mg/kg	130	450	430	90
Heavy Metals						
Arsenic	2	mg/kg	3.2	4.1	3.8	< 2
Cadmium	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1
Chromium	1	mg/kg	8.4	12	10	< 1
Copper	1	mg/kg	< 1	8.2	7.3	4.0
Lead	1	mg/kg	2.2	2.9	2.9	1.3
Mercury	0.02	mg/kg	< 0.02	< 0.02	< 0.02	< 0.02
Nickel	1	mg/kg	< 1	< 1	< 1	< 1
Zinc	5	mg/kg	9.9	20	8.9	6.3
Sample Properties						
% Moisture	1	%	< 1	2.2	1.6	1.6
OCOP in Soil						
Aldrin	0.01	mg/kg	-	-	< 0.01	< 0.01
alpha-BHC (HCH)	0.01	mg/kg	-	-	< 0.01	< 0.01
beta-BHC (HCH)	0.01	mg/kg	-	-	< 0.01	< 0.01
delta-BHC (HCH)	0.01	mg/kg	-	-	< 0.01	< 0.01

Client Sample ID			TP56/0.0	TP58/0.0	TP59/0.0	QC13
Sample Matrix			Soil	Soil	Soil	Soil
Eurofins Sample No.			L23-No0024752	L23-No0024753	L23-No0024754	L23-No0024755
Date Sampled			Nov 03, 2023	Nov 03, 2023	Nov 03, 2023	Nov 03, 2023
Test/Reference	LOR	Unit				
OCOP in Soil						
Bifenthrin	0.2	mg/kg	-	-	< 0.2	< 0.2
Bromophos Ethyl	0.05	mg/kg	-	-	< 0.05	< 0.05
Chlordane	0.01	mg/kg	-	-	< 0.01	< 0.01
Chlorpyrifos	0.02	mg/kg	-	-	< 0.02	< 0.02
Dieldrin	0.01	mg/kg	-	-	< 0.01	< 0.01
p.p-DDD	0.01	mg/kg	-	-	< 0.01	< 0.01
p.p-DDE	0.01	mg/kg	-	-	< 0.01	< 0.01
p.p-DDT	0.01	mg/kg	-	-	< 0.01	< 0.01
o.p-DDT	0.01	mg/kg	-	-	< 0.01	< 0.01
Endosulfan I	0.01	mg/kg	-	-	< 0.01	< 0.01
Endosulfan II	0.01	mg/kg	-	-	< 0.01	< 0.01
Endosulfan Sulfate	0.01	mg/kg	-	-	< 0.01	< 0.01
Endrin	0.01	mg/kg	-	-	< 0.01	< 0.01
Heptachlor	0.01	mg/kg	-	-	< 0.01	< 0.01
Heptachlor Epoxide	0.01	mg/kg	-	-	< 0.01	< 0.01
Hexachlorobenzene (HCB)	0.01	mg/kg	-	-	< 0.01	< 0.01
Lindane	0.01	mg/kg	-	-	< 0.01	< 0.01
Methoxychlor	0.2	mg/kg	-	-	< 0.2	< 0.2
Oxychlordane	0.01	mg/kg	-	-	< 0.01	< 0.01
Diazinon	0.2	mg/kg	-	-	< 0.2	< 0.2
Ethion	0.05	mg/kg	-	-	< 0.05	< 0.05
Fenitrothion	0.1	mg/kg	-	-	< 0.1	< 0.1
Malathion	0.1	mg/kg	-	-	< 0.1	< 0.1
Trifluralin	0.2	mg/kg	-	-	< 0.2	< 0.2
Carbamates in Soil						
Aminocarb	0.04	mg/kg	-	-	< 0.04	< 0.04
Aldicarb Sulfoxide	0.004	mg/kg	-	-	< 0.004	< 0.004
Carbendazim	0.04	mg/kg	-	-	< 0.04	< 0.04
Oxamyl	0.04	mg/kg	-	-	< 0.04	< 0.04
Aldicarb Sulfone	0.02	mg/kg	-	-	< 0.02	< 0.02
Methomyl	0.04	mg/kg	-	-	< 0.04	< 0.04
Fenuron/Fenuron TCA	0.005	mg/kg	-	-	< 0.005	< 0.005
Thidiazuron	0.04	mg/kg	-	-	< 0.04	< 0.04
Aldicarb	0.004	mg/kg	-	-	< 0.004	< 0.004
Bromacil	0.04	mg/kg	-	-	< 0.04	< 0.04
Mexacarbate	0.02	mg/kg	-	-	< 0.02	< 0.02
Monuron/Monuron TCA	0.04	mg/kg	-	-	< 0.04	< 0.04
Propoxur	0.004	mg/kg	-	-	< 0.004	< 0.004
Carbofuran	0.04	mg/kg	-	-	< 0.04	< 0.04
Fluometuron	0.02	mg/kg	-	-	< 0.02	< 0.02
Carbaryl	0.05	mg/kg	-	-	< 0.05	< 0.05
Diuron	0.04	mg/kg	-	-	< 0.04	< 0.04
Propachlor	0.02	mg/kg	-	-	< 0.02	< 0.02
Siduron	0.02	mg/kg	-	-	< 0.02	< 0.02
Methiocarb	0.04	mg/kg	-	-	< 0.04	< 0.04
Linuron	0.04	mg/kg	-	-	< 0.04	< 0.04
Neburon	0.04	mg/kg	-	-	< 0.04	< 0.04

Sample History

Where samples are submitted/analysed over several days, the last date of extraction is reported.

If the date and time of sampling are not provided, the Laboratory will not be responsible for compromised results should testing be performed outside the recommended holding time.

Description	Testing Site	Extracted	Holding Time
Organochlorine Pesticides	Welshpool	Nov 14, 2023	14 Days
- Method: LTM-ORG-2220 OCP & PCB in Soil and Water			
Phosphorus	Welshpool	Nov 16, 2023	7 Days
- Method: ARL401/403 - Metals in Soil and Sediment by ICPOES/MS			
Metals M8	Welshpool	Nov 14, 2023	28 Days
- Method: LTM-MET-3040 Metals in Waters, Soils & Sediments by ICP-MS			
OCOP in Soil	Welshpool	Nov 16, 2023	14 Days
- Method: ARL003 - OCOP and PCB in Soil			
Carbamates in Soil	Welshpool	Nov 16, 2023	14 Days
- Method: ARL504 - Carbamates in Soil			
NOx-N	Welshpool	Nov 16, 2023	7 Days
- Method: ARL314 - NOx in Soil and Sediment by Discrete Analyser			
Total Kjeldahl Nitrogen	Welshpool	Nov 16, 2023	7 Days
- Method: ARL118 - Total Phosphorus and TKN in Soil and Biosolids			
Total Nitrogen	Welshpool	Nov 10, 2023	7 Days
- Method: ARL No. 330 - Persulfate Method for Simultaneous Determination of TN & TP			
% Moisture	Welshpool	Nov 10, 2023	14 Days
- Method: ARL135 Moisture in Solids			

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Company Name: Galt Environment P/L
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Project Name: WATTLEUP
Project ID: WAE230106

Order No.: WAE230106
Report #: 1043004
Phone: 08 6272 0200
Fax: 08 9285 8444

Received: Nov 9, 2023 2:00 PM
Due: Nov 16, 2023
Priority: 5 Day
Contact Name: - ALL SRA/Results

Eurofins Analytical Services Manager : Natalie Hill

Sample Detail						HOLD	Phosphorus	Organochlorine Pesticides	AUS Leaching Procedure	Metals M8	Moisture Set	OCOP in Soil	OCOP in Water	Carbamates in Soil	Total Nitrogen	Carbamates	Eurofins Suite B19A
Perth Laboratory - NATA # 2377 Site # 2370						X	X	X	X	X	X	X	X	X	X	X	X
External Laboratory																	
No	**Sample ID**	**Sample Date**	**Sampling Time**	**Matrix**	**LAB ID**												
1	TP01/0.0	Nov 01, 2023		Soil	L23-No0024721		X	X		X	X				X		
2	TP03/0.0	Nov 01, 2023		Soil	L23-No0024722		X			X	X	X		X	X		
3	TP04/0.0	Nov 01, 2023		Soil	L23-No0024723		X	X		X	X				X		
4	TP08/0.0	Nov 01, 2023		Soil	L23-No0024724		X	X		X	X				X		
5	TP09/0.0	Nov 01, 2023		Soil	L23-No0024725		X	X		X	X				X		
6	TP11/0.0	Nov 01, 2023		Soil	L23-No0024726		X			X	X	X		X	X		
7	TP14/0.0	Nov 01, 2023		Soil	L23-No0024727		X	X		X	X				X		
8	TP15/0.0	Nov 01, 2023		Soil	L23-No0024728		X	X		X	X				X		
9	TP19/0.0	Nov 01, 2023		Soil	L23-No0024729		X			X	X	X		X	X		
10	TP20/0.0	Nov 01, 2023		Soil	L23-No0024730		X	X		X	X				X		
11	QC01	Nov 01, 2023		Water	L23-No0024731					X			X			X	X
12	QC02	Nov 01, 2023		Water	L23-No0024732					X			X			X	X
13	QC03	Nov 01, 2023		Soil	L23-No0024733		X			X	X	X		X	X		

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Perth Laboratory - NATA # 2377 Site # 2370						X	X	X	X	X	X	X	X	X	X	X	X
External Laboratory																	
14	TP21/0.0	Nov 02, 2023		Soil	L23-No0024734		X			X	X	X		X	X		
15	TP23/0.0	Nov 02, 2023		Soil	L23-No0024735		X	X		X	X				X		
16	TP25/0.0	Nov 02, 2023		Soil	L23-No0024736		X	X		X	X				X		
17	TP26/0.0	Nov 02, 2023		Soil	L23-No0024737		X			X	X	X		X	X		
18	TP29/0.0	Nov 02, 2023		Soil	L23-No0024738		X	X		X	X				X		
19	TP30/0.0	Nov 02, 2023		Soil	L23-No0024739		X	X		X	X				X		
20	TP34/0.0	Nov 02, 2023		Soil	L23-No0024740		X			X	X	X		X	X		
21	TP35/0.0	Nov 02, 2023		Soil	L23-No0024741		X	X		X	X				X		
22	TP38/0.0	Nov 02, 2023		Soil	L23-No0024742		X	X		X	X				X		
23	TP39/0.0	Nov 02, 2023		Soil	L23-No0024743		X	X		X	X				X		
24	QC10	Nov 02, 2023		Water	L23-No0024744					X			X			X	X
25	QC11	Nov 02, 2023		Soil	L23-No0024745		X			X	X	X		X	X		
26	TP41/0.0	Nov 03, 2023		Soil	L23-No0024746		X	X		X	X				X		
27	TP42/0.0	Nov 03, 2023		Soil	L23-No0024747		X	X		X	X				X		
28	TP45/0.0	Nov 03, 2023		Soil	L23-No0024748		X			X	X	X		X	X		

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Eurofins Analytical Services Manager : Natalie Hill

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Perth Laboratory - NATA # 2377 Site # 2370						X	X	X	X	X	X	X	X	X	X	X	X
External Laboratory																	
29	TP48/0.0	Nov 03, 2023		Soil	L23-No0024749		X	X		X	X				X		
30	TP51/0.0	Nov 03, 2023		Soil	L23-No0024750		X	X		X	X				X		
31	TP53/0.0	Nov 03, 2023		Soil	L23-No0024751		X			X	X	X		X	X		
32	TP56/0.0	Nov 03, 2023		Soil	L23-No0024752		X	X		X	X				X		
33	TP58/0.0	Nov 03, 2023		Soil	L23-No0024753		X	X		X	X				X		
34	TP59/0.0	Nov 03, 2023		Soil	L23-No0024754		X			X	X	X		X	X		
35	QC13	Nov 03, 2023		Soil	L23-No0024755		X			X	X	X		X	X		
36	QC15	Nov 03, 2023		Water	L23-No0024756					X			X			X	X
37	TP01/0.0	Nov 01, 2023		AUS Leachate - pH 5.0	L23-No0024757				X	X							
38	TP03/0.0	Nov 01, 2023		AUS Leachate - pH 5.0	L23-No0024758				X	X							
39	TP04/0.0	Nov 01, 2023		AUS Leachate - pH 5.0	L23-No0024759				X	X							
40	TP08/0.0	Nov 01, 2023		AUS Leachate - pH 5.0	L23-No0024760				X	X							

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Perth Laboratory - NATA # 2377 Site # 2370						X	X	X	X	X	X	X	X	X	X	X	X
External Laboratory																	
41	TP09/0.0	Nov 01, 2023		AUS Leachate - pH 5.0	L23-No0024761				X	X							
42	TP11/0.0	Nov 01, 2023		AUS Leachate - pH 5.0	L23-No0024762				X	X							
43	TP14/0.0	Nov 01, 2023		AUS Leachate - pH 5.0	L23-No0024763				X	X							
44	TP15/0.0	Nov 01, 2023		AUS Leachate - pH 5.0	L23-No0024764				X	X							
45	TP19/0.0	Nov 01, 2023		AUS Leachate - pH 5.0	L23-No0024765				X	X							
46	TP20/0.0	Nov 01, 2023		AUS Leachate - pH 5.0	L23-No0024766				X	X							
47	QC03	Nov 01, 2023		AUS Leachate - pH 5.0	L23-No0024767				X	X							
48	TP21/0.0	Nov 02, 2023		AUS Leachate - pH 5.0	L23-No0024768				X	X							
49	TP23/0.0	Nov 02, 2023		AUS Leachate - pH 5.0	L23-No0024769				X	X							

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Perth Laboratory - NATA # 2377 Site # 2370						X	X	X	X	X	X	X	X	X	X	X	X
External Laboratory																	
50	TP25/0.0	Nov 02, 2023		AUS Leachate - pH 5.0	L23-No0024770				X	X							
51	TP26/0.0	Nov 02, 2023		AUS Leachate - pH 5.0	L23-No0024771				X	X							
52	TP29/0.0	Nov 02, 2023		AUS Leachate - pH 5.0	L23-No0024772				X	X							
53	TP30/0.0	Nov 02, 2023		AUS Leachate - pH 5.0	L23-No0024773				X	X							
54	TP34/0.0	Nov 02, 2023		AUS Leachate - pH 5.0	L23-No0024774				X	X							
55	TP35/0.0	Nov 02, 2023		AUS Leachate - pH 5.0	L23-No0024775				X	X							
56	TP38/0.0	Nov 02, 2023		AUS Leachate - pH 5.0	L23-No0024776				X	X							
57	TP39/0.0	Nov 02, 2023		AUS Leachate - pH 5.0	L23-No0024777				X	X							
58	QC11	Nov 02, 2023		AUS Leachate - pH 5.0	L23-No0024778				X	X							

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Perth Laboratory - NATA # 2377 Site # 2370						X	X	X	X	X	X	X	X	X	X	X	X
External Laboratory																	
59	TP41/0.0	Nov 03, 2023		AUS Leachate - pH 5.0	L23-No0024779				X	X							
60	TP42/0.0	Nov 03, 2023		AUS Leachate - pH 5.0	L23-No0024780				X	X							
61	TP45/0.0	Nov 03, 2023		AUS Leachate - pH 5.0	L23-No0024781				X	X							
62	TP48/0.0	Nov 03, 2023		AUS Leachate - pH 5.0	L23-No0024782				X	X							
63	TP51/0.0	Nov 03, 2023		AUS Leachate - pH 5.0	L23-No0024783				X	X							
64	TP53/0.0	Nov 03, 2023		AUS Leachate - pH 5.0	L23-No0024784				X	X							
65	TP56/0.0	Nov 03, 2023		AUS Leachate - pH 5.0	L23-No0024785				X	X							
66	TP58/0.0	Nov 03, 2023		AUS Leachate - pH 5.0	L23-No0024786				X	X							
67	TP59/0.0	Nov 03, 2023		AUS Leachate - pH 5.0	L23-No0024787				X	X							

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Company Name:	Galt Environment P/L	**Order No.:**	WAE230106	**Received:**	Nov 9, 2023 2:00 PM
Address:	50 Edward Street Osborne Park WA 6017	**Report #:**	1043004	**Due:**	Nov 16, 2023
		Phone:	08 6272 0200	**Priority:**	5 Day
		Fax:	08 9285 8444	**Contact Name:**	- ALL SRA/Results
Project Name:	WATTLEUP				
Project ID:	WAE230106				

Eurofins Analytical Services Manager : Natalie Hill

Sample Detail						HOLD	Phosphorus	Organochlorine Pesticides	AUS Leaching Procedure	Metals M8	Moisture Set	OCOP in Soil	OCOP in Water	Carbamates in Soil	Total Nitrogen	Carbamates	Eurofins Suite B19A
Perth Laboratory - NATA # 2377 Site # 2370						X	X	X	X	X	X	X	X	X	X	X	X
External Laboratory																	
68	QC13	Nov 03, 2023		AUS Leachate - pH 5.0	L23-No0024788				X	X							
69	TP57/0.0	Not Provided		Soil	L23-No0024789	X											
Test Counts						1	32	20	32	68	32	12	4	13	32	4	4

Internal Quality Control Review and Glossary

General

1. Laboratory QC results for Method Blanks, Duplicates, Matrix Spikes, and Laboratory Control Samples follow guidelines delineated in the National Environment Protection (Assessment of Site Contamination) Measure 1999, as amended May 2013. They are included in this QC report where applicable. Additional QC data may be available on request.
2. All soil/sediment/solid results are reported on a dry weight basis unless otherwise stated.
3. All biota/food results are reported on a wet weight basis on the edible portion unless otherwise stated.
4. For CEC results where the sample's origin is unknown or environmentally contaminated, the results should be used advisedly.
5. Actual LORs are matrix dependent. Quoted LORs may be raised where sample extracts are diluted due to interferences.
6. Results are uncorrected for matrix spikes or surrogate recoveries except for PFAS compounds.
7. SVOC analysis on waters is performed on homogenised, unfiltered samples unless noted otherwise.
8. Samples were analysed on an 'as received' basis.
9. Information identified in this report with blue colour indicates data provided by customers that may have an impact on the results.
10. This report replaces any interim results previously issued.

Holding Times

Please refer to the 'Sample Preservation and Container Guide' for holding times (QS3001).

For samples received on the last day of holding time, notification of testing requirements should have been received at least 6 hours before sample receipt deadlines as stated on the SRA.

If the Laboratory did not receive the information in the required timeframe, and despite any other integrity issues, suitably qualified results may still be reported.

Holding times apply from the date of sampling; therefore, compliance with these may be outside the laboratory's control.

For VOCs containing vinyl chloride, styrene and 2-chloroethyl vinyl ether, the holding time is 7 days; however, for all other VOCs, such as BTEX or C6-10 TRH, the holding time is 14 days.

Units

mg/kg: milligrams per kilogram
mg/L: milligrams per litre
µg/L: micrograms per litre
ppm: parts per million
ppb: parts per billion
%: Percentage
org/100 mL: Organisms per 100 millilitres
NTU: Nephelometric Turbidity Units
MPN/100 mL: Most Probable Number of organisms per 100 millilitres
CFU: Colony forming unit

Terms

APHA	American Public Health Association
CEC	Cation Exchange Capacity
COC	Chain of Custody
CP	Client Parent - QC was performed on samples pertaining to this report
CRM	Certified Reference Material (ISO17034) - reported as percent recovery.
Dry	Where moisture has been determined on a solid sample, the result is expressed on a dry weight basis.
Duplicate	A second piece of analysis from the same sample and reported in the same units as the result to show comparison.
LOR	Limit of Reporting.
LCS	Laboratory Control Sample - reported as percent recovery.
Method Blank	In the case of solid samples, these are performed on laboratory-certified clean sands and in the case of water samples, these are performed on de-ionised water.
NCP	Non-Client Parent - QC performed on samples not pertaining to this report, QC represents the sequence or batch that client samples were analysed within.
RPD	Relative Percent Difference between two Duplicate pieces of analysis.
SPIKE	Addition of the analyte to the sample and reported as percentage recovery.
SRA	Sample Receipt Advice
Surr - Surrogate	The addition of a like compound to the analyte target and reported as percentage recovery.
TBTO	Tributyltin oxide (*bis*-tributyltin oxide) - individual tributyltin compounds cannot be identified separately in the environment; however free tributyltin was measured, and its values were converted stoichiometrically into tributyltin oxide for comparison with regulatory limits.
TCLP	Toxicity Characteristic Leaching Procedure
TEQ	Toxic Equivalency Quotient or Total Equivalence
QSM	US Department of Defense Quality Systems Manual Version 5.4
US EPA	United States Environmental Protection Agency
WA DWER	Sum of PFBA, PFPeA, PFHxA, PFHpA, PFOA, PFBS, PFHxS, PFOS, 6:2 FTSA, 8:2 FTSA

QC - Acceptance Criteria

The acceptance criteria should be used as a guide only and may be different when site-specific Sampling Analysis and Quality Plan (SAQP) have been implemented.

RPD Duplicates: Global RPD Duplicates Acceptance Criteria is 30%; however the following acceptance guidelines are equally applicable: Results <10 times the LOR: No Limit

Results between 10-20 times the LOR: RPD must lie between 0-50%

Results >20 times the LOR: RPD must lie between 0-30%

NOTE: pH duplicates are reported as a range, not as RPD

Surrogate Recoveries: Recoveries must lie between 20-130% for Speciated Phenols & 50-150% for PFAS. SVOCs recoveries 20 – 150%

PFAS field samples that contain surrogate recoveries above the QC limit designated in QSM 5.4, where no positive PFAS results have been reported, have been reviewed, and no data was affected.

QC Data General Comments

1. Where a result is reported as less than (<), higher than the nominated LOR, this is due to either matrix interference, extract dilution required due to interferences or contaminant levels within the sample, high moisture content or insufficient sample provided.
2. Duplicate data shown within this report that states the word "BATCH" is a Batch Duplicate from outside of your sample batch but within the laboratory sample batch at a 1:10 ratio. The Parent and Duplicate data shown are not data from your samples.
3. pH and Free Chlorine analysed in the laboratory - Analysis on this test must begin within 30 minutes of sampling. Therefore, laboratory analysis is unlikely to be completed within holding time.Analysis will begin as soon as possible after sample receipt.
4. Recovery Data (Spikes & Surrogates) - where chromatographic interference does not allow the determination of recovery, the term "INT" appears against that analyte.
5. For Matrix Spikes and LCS results, a dash "-" in the report means that the specific analyte was not added to the QC sample.
6. Duplicate RPDs are calculated from raw analytical data; thus, it is possible to have two sets of data.

Quality Control Results

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Method Blank							
Organochlorine Pesticides							
Chlordanes - Total	mg/kg	< 0.1			0.1	Pass	
4.4'-DDD	mg/kg	< 0.05			0.05	Pass	
4.4'-DDE	mg/kg	< 0.05			0.05	Pass	
4.4'-DDT	mg/kg	< 0.05			0.05	Pass	
a-HCH	mg/kg	< 0.05			0.05	Pass	
Aldrin	mg/kg	< 0.05			0.05	Pass	
b-HCH	mg/kg	< 0.05			0.05	Pass	
d-HCH	mg/kg	< 0.05			0.05	Pass	
Dieldrin	mg/kg	< 0.05			0.05	Pass	
Endosulfan I	mg/kg	< 0.05			0.05	Pass	
Endosulfan II	mg/kg	< 0.05			0.05	Pass	
Endosulfan sulphate	mg/kg	< 0.05			0.05	Pass	
Endrin	mg/kg	< 0.05			0.05	Pass	
Endrin aldehyde	mg/kg	< 0.05			0.05	Pass	
Endrin ketone	mg/kg	< 0.05			0.05	Pass	
g-HCH (Lindane)	mg/kg	< 0.05			0.05	Pass	
Heptachlor	mg/kg	< 0.05			0.05	Pass	
Heptachlor epoxide	mg/kg	< 0.05			0.05	Pass	
Hexachlorobenzene	mg/kg	< 0.05			0.05	Pass	
Methoxychlor	mg/kg	< 0.05			0.05	Pass	
Aldrin and Dieldrin (Total)*	mg/kg	< 0.05			0.05	Pass	
Method Blank							
NOx-N	mg/kg	< 1			1	Pass	
Total Kjeldahl Nitrogen	mg/kg	< 10			10	Pass	
Phosphorus	mg/kg	< 1			1	Pass	
Method Blank							
Heavy Metals							
Arsenic	mg/kg	< 2			2	Pass	
Cadmium	mg/kg	< 0.1			0.1	Pass	
Chromium	mg/kg	< 1			1	Pass	
Copper	mg/kg	< 1			1	Pass	
Lead	mg/kg	< 1			1	Pass	
Mercury	mg/kg	< 0.02			0.02	Pass	
Nickel	mg/kg	< 1			1	Pass	
Zinc	mg/kg	< 5			5	Pass	
Method Blank							
OCOP in Soil							
Aldrin	mg/kg	< 0.01			0.01	Pass	
alpha-BHC (HCH)	mg/kg	< 0.01			0.01	Pass	
beta-BHC (HCH)	mg/kg	< 0.01			0.01	Pass	
delta-BHC (HCH)	mg/kg	< 0.01			0.01	Pass	
Bifenthrin	mg/kg	< 0.2			0.2	Pass	
Bromophos Ethyl	mg/kg	< 0.05			0.05	Pass	
Chlordane	mg/kg	< 0.01			0.01	Pass	
Chlorpyrifos	mg/kg	< 0.02			0.02	Pass	
Dieldrin	mg/kg	< 0.01			0.01	Pass	
p.p-DDD	mg/kg	< 0.01			0.01	Pass	
p.p-DDE	mg/kg	< 0.01			0.01	Pass	
p.p-DDT	mg/kg	< 0.01			0.01	Pass	
o.p-DDT	mg/kg	< 0.01			0.01	Pass	

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Endosulfan I	mg/kg	< 0.01			0.01	Pass	
Endosulfan II	mg/kg	< 0.01			0.01	Pass	
Endosulfan Sulfate	mg/kg	< 0.01			0.01	Pass	
Endrin	mg/kg	< 0.01			0.01	Pass	
Heptachlor	mg/kg	< 0.01			0.01	Pass	
Heptachlor Epoxide	mg/kg	< 0.01			0.01	Pass	
Hexachlorobenzene (HCB)	mg/kg	< 0.01			0.01	Pass	
Lindane	mg/kg	< 0.01			0.01	Pass	
Methoxychlor	mg/kg	< 0.2			0.2	Pass	
Oxychlordane	mg/kg	< 0.01			0.01	Pass	
Diazinon	mg/kg	< 0.2			0.2	Pass	
Ethion	mg/kg	< 0.05			0.05	Pass	
Fenitrothion	mg/kg	< 0.1			0.1	Pass	
Malathion	mg/kg	< 0.1			0.1	Pass	
Trifluralin	mg/kg	< 0.2			0.2	Pass	
Method Blank							
Carbamates in Soil							
Aminocarb	mg/kg	< 0.04			0.04	Pass	
Aldicarb Sulfoxide	mg/kg	< 0.004			0.004	Pass	
Carbendazim	mg/kg	< 0.04			0.04	Pass	
Oxamyl	mg/kg	< 0.04			0.04	Pass	
Aldicarb Sulfone	mg/kg	< 0.02			0.02	Pass	
Methomyl	mg/kg	< 0.04			0.04	Pass	
Fenuron/Fenuron TCA	mg/kg	< 0.005			0.005	Pass	
Thidiazuron	mg/kg	< 0.04			0.04	Pass	
Aldicarb	mg/kg	< 0.004			0.004	Pass	
Bromacil	mg/kg	< 0.04			0.04	Pass	
Mexacarbate	mg/kg	< 0.02			0.02	Pass	
Monuron/Monuron TCA	mg/kg	< 0.04			0.04	Pass	
Propoxur	mg/kg	< 0.004			0.004	Pass	
Carbofuran	mg/kg	< 0.04			0.04	Pass	
Fluometuron	mg/kg	< 0.02			0.02	Pass	
Carbaryl	mg/kg	< 0.05			0.05	Pass	
Diuron	mg/kg	< 0.04			0.04	Pass	
Propachlor	mg/kg	< 0.02			0.02	Pass	
Siduron	mg/kg	< 0.02			0.02	Pass	
Methiocarb	mg/kg	< 0.04			0.04	Pass	
Linuron	mg/kg	< 0.04			0.04	Pass	
Neburon	mg/kg	< 0.04			0.04	Pass	
LCS - % Recovery							
Organochlorine Pesticides							
Chlordanes - Total	%	104			70-130	Pass	
4.4'-DDD	%	110			70-130	Pass	
4.4'-DDE	%	104			70-130	Pass	
4.4'-DDT	%	91			70-130	Pass	
a-HCH	%	97			70-130	Pass	
Aldrin	%	89			70-130	Pass	
b-HCH	%	99			70-130	Pass	
d-HCH	%	88			70-130	Pass	
Dieldrin	%	91			70-130	Pass	
Endosulfan I	%	94			70-130	Pass	
Endosulfan II	%	105			70-130	Pass	
Endosulfan sulphate	%	83			70-130	Pass	
Endrin	%	87			70-130	Pass	

Test			Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Endrin aldehyde			%	103			70-130	Pass	
Endrin ketone			%	110			70-130	Pass	
g-HCH (Lindane)			%	107			70-130	Pass	
Heptachlor			%	84			70-130	Pass	
Heptachlor epoxide			%	95			70-130	Pass	
Hexachlorobenzene			%	92			70-130	Pass	
Methoxychlor			%	94			70-130	Pass	
LCS - % Recovery									
Phosphorus			%	117			80-120	Pass	
LCS - % Recovery									
Heavy Metals									
Arsenic			%	100			80-120	Pass	
Cadmium			%	92			80-120	Pass	
Chromium			%	91			80-120	Pass	
Copper			%	87			80-120	Pass	
Lead			%	89			80-120	Pass	
Mercury			%	91			80-120	Pass	
Nickel			%	89			80-120	Pass	
Zinc			%	87			80-120	Pass	
LCS - % Recovery									
OCOP in Soil									
Bifenthrin			%	78			60-120	Pass	
o.p-DDT			%	74			60-120	Pass	
Endosulfan I			%	79			60-120	Pass	
Malathion			%	81			60-120	Pass	
Trifluralin			%	100			60-120	Pass	
Test	**Lab Sample ID**	**QA Source**	**Units**	**Result 1**			**Acceptance Limits**	**Pass Limits**	**Qualifying Code**
Spike - % Recovery									
Heavy Metals				Result 1					
Arsenic	L23-No0024722	CP	%	97			75-125	Pass	
Cadmium	L23-No0024722	CP	%	96			75-125	Pass	
Chromium	L23-No0024722	CP	%	99			75-125	Pass	
Copper	L23-No0024722	CP	%	98			75-125	Pass	
Mercury	L23-No0024722	CP	%	96			75-125	Pass	
Nickel	L23-No0024722	CP	%	98			75-125	Pass	
Zinc	L23-No0024722	CP	%	99			75-125	Pass	
Spike - % Recovery									
Organochlorine Pesticides				Result 1					
Chlordanes - Total	L23-No0024723	CP	%	103			70-130	Pass	
4.4'-DDD	L23-No0024723	CP	%	108			70-130	Pass	
4.4'-DDE	L23-No0024723	CP	%	105			70-130	Pass	
4.4'-DDT	L23-No0024723	CP	%	100			70-130	Pass	
a-HCH	L23-No0024723	CP	%	90			70-130	Pass	
Aldrin	L23-No0024723	CP	%	100			70-130	Pass	
b-HCH	L23-No0024723	CP	%	100			70-130	Pass	
d-HCH	L23-No0024723	CP	%	97			70-130	Pass	
Dieldrin	L23-No0024723	CP	%	101			70-130	Pass	
Endosulfan I	L23-No0024723	CP	%	93			70-130	Pass	
Endosulfan II	L23-No0024723	CP	%	104			70-130	Pass	
Endosulfan sulphate	L23-No0024723	CP	%	98			70-130	Pass	
Endrin	L23-No0024723	CP	%	98			70-130	Pass	
Endrin aldehyde	L23-No0024723	CP	%	101			70-130	Pass	
Endrin ketone	L23-No0024723	CP	%	96			70-130	Pass	
g-HCH (Lindane)	L23-No0024723	CP	%	105			70-130	Pass	

Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Heptachlor	L23-No0024723	CP	%	95			70-130	Pass	
Heptachlor epoxide	L23-No0024723	CP	%	104			70-130	Pass	
Hexachlorobenzene	L23-No0024723	CP	%	95			70-130	Pass	
Methoxychlor	L23-No0024723	CP	%	81			70-130	Pass	
Spike - % Recovery									
OCOP in Soil				Result 1					
Bifenthrin	L23-No0014560	NCP	%	91			60-120	Pass	
o.p-DDT	L23-No0014560	NCP	%	96			60-120	Pass	
Endosulfan I	L23-No0014560	NCP	%	113			60-120	Pass	
Malathion	L23-No0014560	NCP	%	91			60-120	Pass	
Trifluralin	L23-No0014560	NCP	%	89			60-120	Pass	
Spike - % Recovery									
Carbamates in Soil				Result 1					
Aminocarb	L23-No0024726	CP	%	94			60-120	Pass	
Aldicarb Sulfoxide	L23-No0024726	CP	%	93			60-120	Pass	
Carbendazim	L23-No0024726	CP	%	92			60-120	Pass	
Oxamyl	L23-No0024726	CP	%	88			60-120	Pass	
Aldicarb Sulfone	L23-No0024726	CP	%	96			60-120	Pass	
Methomyl	L23-No0024726	CP	%	96			60-120	Pass	
Fenuron/Fenuron TCA	L23-No0024726	CP	%	99			60-120	Pass	
Thidiazuron	L23-No0024726	CP	%	99			60-120	Pass	
Aldicarb	L23-No0024726	CP	%	90			60-120	Pass	
Bromacil	L23-No0024726	CP	%	111			60-120	Pass	
Mexacarbate	L23-No0024726	CP	%	96			60-120	Pass	
Monuron/Monuron TCA	L23-No0024726	CP	%	102			60-120	Pass	
Propoxur	L23-No0024726	CP	%	103			60-120	Pass	
Carbofuran	L23-No0024726	CP	%	99			60-120	Pass	
Fluometuron	L23-No0024726	CP	%	94			60-120	Pass	
Carbaryl	L23-No0024726	CP	%	87			60-120	Pass	
Diuron	L23-No0024726	CP	%	89			60-120	Pass	
Propachlor	L23-No0024726	CP	%	104			60-120	Pass	
Siduron	L23-No0024726	CP	%	106			60-120	Pass	
Methiocarb	L23-No0024726	CP	%	108			60-120	Pass	
Linuron	L23-No0024726	CP	%	89			60-120	Pass	
Neburon	L23-No0024726	CP	%	98			60-120	Pass	
Spike - % Recovery									
Carbamates in Soil				Result 1					
Aminocarb	L23-No0024755	CP	%	83			60-120	Pass	
Aldicarb Sulfoxide	L23-No0024755	CP	%	84			60-120	Pass	
Carbendazim	L23-No0024755	CP	%	84			60-120	Pass	
Oxamyl	L23-No0024755	CP	%	86			60-120	Pass	
Aldicarb Sulfone	L23-No0024755	CP	%	90			60-120	Pass	
Methomyl	L23-No0024755	CP	%	87			60-120	Pass	
Fenuron/Fenuron TCA	L23-No0024755	CP	%	93			60-120	Pass	
Thidiazuron	L23-No0024755	CP	%	86			60-120	Pass	
Aldicarb	L23-No0024755	CP	%	81			60-120	Pass	
Bromacil	L23-No0024755	CP	%	82			60-120	Pass	
Mexacarbate	L23-No0024755	CP	%	87			60-120	Pass	
Monuron/Monuron TCA	L23-No0024755	CP	%	91			60-120	Pass	
Propoxur	L23-No0024755	CP	%	93			60-120	Pass	
Carbofuran	L23-No0024755	CP	%	85			60-120	Pass	
Fluometuron	L23-No0024755	CP	%	92			60-120	Pass	
Carbaryl	L23-No0024755	CP	%	88			60-120	Pass	
Diuron	L23-No0024755	CP	%	94			60-120	Pass	

Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Propachlor	L23-No0024755	CP	%	91			60-120	Pass	
Siduron	L23-No0024755	CP	%	86			60-120	Pass	
Methiocarb	L23-No0024755	CP	%	102			60-120	Pass	
Linuron	L23-No0024755	CP	%	85			60-120	Pass	
Neburon	L23-No0024755	CP	%	87			60-120	Pass	
Test	**Lab Sample ID**	**QA Source**	**Units**	**Result 1**			**Acceptance Limits**	**Pass Limits**	**Qualifying Code**
Duplicate									
Organochlorine Pesticides				Result 1	Result 2	RPD			
Chlordanes - Total	L23-No0024721	CP	mg/kg	< 0.1	< 0.1	<1	30%	Pass	
4.4'-DDD	L23-No0024721	CP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
4.4'-DDE	L23-No0024721	CP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
4.4'-DDT	L23-No0024721	CP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
a-HCH	L23-No0024721	CP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
Aldrin	L23-No0024721	CP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
b-HCH	L23-No0024721	CP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
d-HCH	L23-No0024721	CP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
Dieldrin	L23-No0024721	CP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
Endosulfan I	L23-No0024721	CP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
Endosulfan II	L23-No0024721	CP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
Endosulfan sulphate	L23-No0024721	CP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
Endrin	L23-No0024721	CP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
Endrin aldehyde	L23-No0024721	CP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
Endrin ketone	L23-No0024721	CP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
g-HCH (Lindane)	L23-No0024721	CP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
Heptachlor	L23-No0024721	CP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
Heptachlor epoxide	L23-No0024721	CP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
Hexachlorobenzene	L23-No0024721	CP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
Methoxychlor	L23-No0024721	CP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
Duplicate									
				Result 1	Result 2	RPD			
Phosphorus	L23-No0024721	CP	mg/kg	280	290	4.6	30%	Pass	
Duplicate									
Heavy Metals				Result 1	Result 2	RPD			
Arsenic	L23-No0024721	CP	mg/kg	< 2	< 2	<1	30%	Pass	
Cadmium	L23-No0024721	CP	mg/kg	< 0.1	< 0.1	<1	30%	Pass	
Chromium	L23-No0024721	CP	mg/kg	2.4	2.3	3.5	30%	Pass	
Copper	L23-No0024721	CP	mg/kg	6.2	5.9	4.7	30%	Pass	
Lead	L23-No0024721	CP	mg/kg	1.6	1.5	6.3	30%	Pass	
Mercury	L23-No0024721	CP	mg/kg	< 0.02	< 0.02	<1	30%	Pass	
Nickel	L23-No0024721	CP	mg/kg	< 1	< 1	<1	30%	Pass	
Zinc	L23-No0024721	CP	mg/kg	7.2	6.8	5.7	30%	Pass	
Duplicate									
Sample Properties				Result 1	Result 2	RPD			
% Moisture	L23-No0024721	CP	%	< 1	< 1	<1	30%	Pass	
Duplicate									
OCOP in Soil				Result 1	Result 2	RPD			
Aldrin	L23-No0022230	NCP	mg/kg	< 0.01	< 0.01	<1	30%	Pass	
alpha-BHC (HCH)	L23-No0022230	NCP	mg/kg	< 0.01	< 0.01	<1	30%	Pass	
beta-BHC (HCH)	L23-No0022230	NCP	mg/kg	< 0.01	< 0.01	<1	30%	Pass	
delta-BHC (HCH)	L23-No0022230	NCP	mg/kg	< 0.01	< 0.01	<1	30%	Pass	
Bifenthrin	L23-No0022230	NCP	mg/kg	< 0.2	< 0.2	<1	30%	Pass	
Bromophos Ethyl	L23-No0022230	NCP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
Chlordane	L23-No0022230	NCP	mg/kg	< 0.01	< 0.01	<1	30%	Pass	
Chlorpyrifos	L23-No0022230	NCP	mg/kg	< 0.02	< 0.02	<1	30%	Pass	

Duplicate									
OCOP in Soil				Result 1	Result 2	RPD			
Dieldrin	L23-No0022230	NCP	mg/kg	< 0.01	< 0.01	<1	30%	Pass	
p.p-DDD	L23-No0022230	NCP	mg/kg	< 0.01	< 0.01	<1	30%	Pass	
p.p-DDE	L23-No0022230	NCP	mg/kg	< 0.01	< 0.01	<1	30%	Pass	
p.p-DDT	L23-No0022230	NCP	mg/kg	< 0.01	< 0.01	<1	30%	Pass	
o.p-DDT	L23-No0022230	NCP	mg/kg	< 0.01	< 0.01	<1	30%	Pass	
Endosulfan I	L23-No0022230	NCP	mg/kg	< 0.01	< 0.01	<1	30%	Pass	
Endosulfan II	L23-No0022230	NCP	mg/kg	< 0.01	< 0.01	<1	30%	Pass	
Endosulfan Sulfate	L23-No0022230	NCP	mg/kg	< 0.01	< 0.01	<1	30%	Pass	
Endrin	L23-No0022230	NCP	mg/kg	< 0.01	< 0.01	<1	30%	Pass	
Heptachlor	L23-No0022230	NCP	mg/kg	< 0.01	< 0.01	<1	30%	Pass	
Heptachlor Epoxide	L23-No0022230	NCP	mg/kg	< 0.01	< 0.01	<1	30%	Pass	
Hexachlorobenzene (HCB)	L23-No0022230	NCP	mg/kg	< 0.01	< 0.01	<1	30%	Pass	
Lindane	L23-No0022230	NCP	mg/kg	< 0.01	< 0.01	<1	30%	Pass	
Methoxychlor	L23-No0022230	NCP	mg/kg	< 0.2	< 0.2	<1	30%	Pass	
Oxychlordane	L23-No0022230	NCP	mg/kg	< 0.01	< 0.01	<1	30%	Pass	
Diazinon	L23-No0022230	NCP	mg/kg	< 0.2	< 0.2	<1	30%	Pass	
Ethion	L23-No0022230	NCP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
Fenitrothion	L23-No0022230	NCP	mg/kg	< 0.1	< 0.1	<1	30%	Pass	
Malathion	L23-No0022230	NCP	mg/kg	< 0.1	< 0.1	<1	30%	Pass	
Trifluralin	L23-No0022230	NCP	mg/kg	< 0.2	< 0.2	<1	30%	Pass	
Duplicate									
Carbamates in Soil				Result 1	Result 2	RPD			
Aminocarb	L23-No0024722	CP	mg/kg	< 0.04	< 0.04	<1	30%	Pass	
Aldicarb Sulfoxide	L23-No0024722	CP	mg/kg	< 0.004	< 0.004	<1	30%	Pass	
Carbendazim	L23-No0024722	CP	mg/kg	< 0.04	< 0.04	<1	30%	Pass	
Oxamyl	L23-No0024722	CP	mg/kg	< 0.04	< 0.04	<1	30%	Pass	
Aldicarb Sulfone	L23-No0024722	CP	mg/kg	< 0.02	< 0.02	<1	30%	Pass	
Methomyl	L23-No0024722	CP	mg/kg	< 0.04	< 0.04	<1	30%	Pass	
Fenuron/Fenuron TCA	L23-No0024722	CP	mg/kg	< 0.005	< 0.005	<1	30%	Pass	
Thidiazuron	L23-No0024722	CP	mg/kg	< 0.04	< 0.04	<1	30%	Pass	
Aldicarb	L23-No0024722	CP	mg/kg	< 0.004	< 0.004	<1	30%	Pass	
Bromacil	L23-No0024722	CP	mg/kg	< 0.04	< 0.04	<1	30%	Pass	
Mexacarbate	L23-No0024722	CP	mg/kg	< 0.02	< 0.02	<1	30%	Pass	
Monuron/Monuron TCA	L23-No0024722	CP	mg/kg	< 0.04	< 0.04	<1	30%	Pass	
Propoxur	L23-No0024722	CP	mg/kg	< 0.004	< 0.004	<1	30%	Pass	
Carbofuran	L23-No0024722	CP	mg/kg	< 0.04	< 0.04	<1	30%	Pass	
Fluometuron	L23-No0024722	CP	mg/kg	< 0.02	< 0.02	<1	30%	Pass	
Carbaryl	L23-No0024722	CP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
Diuron	L23-No0024722	CP	mg/kg	< 0.04	< 0.04	<1	30%	Pass	
Propachlor	L23-No0024722	CP	mg/kg	< 0.02	< 0.02	<1	30%	Pass	
Siduron	L23-No0024722	CP	mg/kg	< 0.02	< 0.02	<1	30%	Pass	
Methiocarb	L23-No0024722	CP	mg/kg	< 0.04	< 0.04	<1	30%	Pass	
Linuron	L23-No0024722	CP	mg/kg	< 0.04	< 0.04	<1	30%	Pass	
Neburon	L23-No0024722	CP	mg/kg	< 0.04	< 0.04	<1	30%	Pass	
Duplicate									
				Result 1	Result 2	RPD			
NOx-N	L23-No0012739	NCP	mg/kg	1.7	1.7	2.1	20%	Pass	
Total Kjeldahl Nitrogen	L23-No0024733	CP	mg/kg	170	150	13	20%	Pass	
Phosphorus	L23-No0024733	CP	mg/kg	160	160	<1	30%	Pass	

Duplicate									
Heavy Metals				Result 1	Result 2	RPD			
Arsenic	L23-No0026778	NCP	mg/kg	3.7	3.9	6.3	30%	Pass	
Cadmium	L23-No0026778	NCP	mg/kg	0.3	0.3	<1	30%	Pass	
Chromium	L23-No0026778	NCP	mg/kg	28	32	14	30%	Pass	
Copper	L23-No0026778	NCP	mg/kg	190	210	7.3	30%	Pass	
Lead	L23-No0026778	NCP	mg/kg	40	43	5.3	30%	Pass	
Mercury	L23-No0026778	NCP	mg/kg	0.11	0.12	8.1	30%	Pass	
Nickel	L23-No0026778	NCP	mg/kg	18	19	6.3	30%	Pass	
Zinc	L23-No0026778	NCP	mg/kg	420	450	7.2	30%	Pass	
Duplicate									
Sample Properties				Result 1	Result 2	RPD			
% Moisture	L23-No0024733	CP	%	1.1	< 1	13	30%	Pass	
Duplicate									
Organochlorine Pesticides				Result 1	Result 2	RPD			
Chlordanes - Total	L23-No0024739	CP	mg/kg	< 0.1	< 0.1	<1	30%	Pass	
4.4'-DDD	L23-No0024739	CP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
4.4'-DDE	L23-No0024739	CP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
4.4'-DDT	L23-No0024739	CP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
a-HCH	L23-No0024739	CP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
Aldrin	L23-No0024739	CP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
b-HCH	L23-No0024739	CP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
d-HCH	L23-No0024739	CP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
Dieldrin	L23-No0024739	CP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
Endosulfan I	L23-No0024739	CP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
Endosulfan II	L23-No0024739	CP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
Endosulfan sulphate	L23-No0024739	CP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
Endrin	L23-No0024739	CP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
Endrin aldehyde	L23-No0024739	CP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
Endrin ketone	L23-No0024739	CP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
g-HCH (Lindane)	L23-No0024739	CP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
Heptachlor	L23-No0024739	CP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
Heptachlor epoxide	L23-No0024739	CP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
Hexachlorobenzene	L23-No0024739	CP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
Methoxychlor	L23-No0024739	CP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
Duplicate									
Sample Properties				Result 1	Result 2	RPD			
% Moisture	L23-No0024743	CP	%	< 1	< 1	<1	30%	Pass	
Duplicate									
				Result 1	Result 2	RPD			
Total Kjeldahl Nitrogen	L23-No0024746	CP	mg/kg	580	500	15	20%	Pass	
Duplicate									
Organochlorine Pesticides				Result 1	Result 2	RPD			
Chlordanes - Total	L23-No0024753	CP	mg/kg	< 0.1	< 0.1	<1	30%	Pass	
4.4'-DDD	L23-No0024753	CP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
4.4'-DDE	L23-No0024753	CP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
4.4'-DDT	L23-No0024753	CP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
a-HCH	L23-No0024753	CP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
Aldrin	L23-No0024753	CP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
b-HCH	L23-No0024753	CP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
d-HCH	L23-No0024753	CP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
Dieldrin	L23-No0024753	CP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
Endosulfan I	L23-No0024753	CP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
Endosulfan II	L23-No0024753	CP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
Endosulfan sulphate	L23-No0024753	CP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
Endrin	L23-No0024753	CP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	

Duplicate									
Organochlorine Pesticides				Result 1	Result 2	RPD			
Endrin aldehyde	L23-No0024753	CP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
Endrin ketone	L23-No0024753	CP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
g-HCH (Lindane)	L23-No0024753	CP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
Heptachlor	L23-No0024753	CP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
Heptachlor epoxide	L23-No0024753	CP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
Hexachlorobenzene	L23-No0024753	CP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
Methoxychlor	L23-No0024753	CP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
Duplicate									
Sample Properties				Result 1	Result 2	RPD			
% Moisture	L23-No0024753	CP	%	2.2	2.2	<1	30%	Pass	
Duplicate									
Sample Properties				Result 1	Result 2	RPD			
% Moisture	L23-No0024754	CP	%	1.6	1.8	11	30%	Pass	
Duplicate									
Carbamates in Soil				Result 1	Result 2	RPD			
Aminocarb	L23-No0024754	CP	mg/kg	< 0.04	< 0.04	<1	30%	Pass	
Aldicarb Sulfoxide	L23-No0024754	CP	mg/kg	< 0.004	< 0.004	<1	30%	Pass	
Carbendazim	L23-No0024754	CP	mg/kg	< 0.04	< 0.04	<1	30%	Pass	
Oxamyl	L23-No0024754	CP	mg/kg	< 0.04	< 0.04	<1	30%	Pass	
Aldicarb Sulfone	L23-No0024754	CP	mg/kg	< 0.02	< 0.02	<1	30%	Pass	
Methomyl	L23-No0024754	CP	mg/kg	< 0.04	< 0.04	<1	30%	Pass	
Fenuron/Fenuron TCA	L23-No0024754	CP	mg/kg	< 0.005	< 0.005	<1	30%	Pass	
Thidiazuron	L23-No0024754	CP	mg/kg	< 0.04	< 0.04	<1	30%	Pass	
Aldicarb	L23-No0024754	CP	mg/kg	< 0.004	< 0.004	<1	30%	Pass	
Bromacil	L23-No0024754	CP	mg/kg	< 0.04	< 0.04	<1	30%	Pass	
Mexacarbate	L23-No0024754	CP	mg/kg	< 0.02	< 0.02	<1	30%	Pass	
Monuron/Monuron TCA	L23-No0024754	CP	mg/kg	< 0.04	< 0.04	<1	30%	Pass	
Propoxur	L23-No0024754	CP	mg/kg	< 0.004	< 0.004	<1	30%	Pass	
Carbofuran	L23-No0024754	CP	mg/kg	< 0.04	< 0.04	<1	30%	Pass	
Fluometuron	L23-No0024754	CP	mg/kg	< 0.02	< 0.02	<1	30%	Pass	
Carbaryl	L23-No0024754	CP	mg/kg	< 0.05	< 0.05	<1	30%	Pass	
Diuron	L23-No0024754	CP	mg/kg	< 0.04	< 0.04	<1	30%	Pass	
Propachlor	L23-No0024754	CP	mg/kg	< 0.02	< 0.02	<1	30%	Pass	
Siduron	L23-No0024754	CP	mg/kg	< 0.02	< 0.02	<1	30%	Pass	
Methiocarb	L23-No0024754	CP	mg/kg	< 0.04	< 0.04	<1	30%	Pass	
Linuron	L23-No0024754	CP	mg/kg	< 0.04	< 0.04	<1	30%	Pass	
Neburon	L23-No0024754	CP	mg/kg	< 0.04	< 0.04	<1	30%	Pass	

Comments

Sample Integrity

Custody Seals Intact (if used)	N/A
Attempt to Chill was evident	Yes
Sample correctly preserved	Yes
Appropriate sample containers have been used	Yes
Sample containers for volatile analysis received with minimal headspace	Yes
Samples received within HoldingTime	N/A
Some samples have been subcontracted	No

Authorised by:

Natalie Hill	Analytical Services Manager
Douglas Todd	Senior Analyst-Metal
Douglas Todd	Senior Analyst-Sample Properties
Kim Rodgers	Senior Analyst-Sample Properties
Patrick Patfield	Senior Analyst-Organic
Paul Nottle	Senior Analyst-Organic
Sam Becker	Senior Analyst-Inorganic
Sean Sangster	Senior Analyst-Metal

Kim Rodgers
General Manager

Final Report – this report replaces any previously issued Report

- Indicates Not Requested

* Indicates NATA accreditation does not cover the performance of this service

Measurement uncertainty of test data is available on request

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Interim Report PEK0653

Client Details

Client	Galt Environmental Pty Ltd (WA)
Contact	Sarah Carter
Address	50 Edward Street, Osborne Park, WA, 6017

Sample Details

Your Reference	Wattleup - WAE230106
Number of Samples	3 Soil
Date Samples Received	09/11/2023
Date Instructions Received	09/11/2023

Analysis Details

Please refer to the following pages for results, methodology summary and quality control data.
Samples were analysed as received from the client. Results relate specifically to the samples as received.
Results are reported on a dry weight basis for solids and on an as received basis for other matrices.

PLEASE NOTE THAT THIS IS A PRELIMINARY REPORT AND THEREFORE DATA & INFORMATION THEREIN MAY BE ALTERED IN THE COMPLETE FINAL REPORT

Report Details

Date Results Requested by	17/11/2023
Date of Issue	17/11/2023

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Accredited for compliance with ISO/IEC 17025. Tests not covered by NATA are denoted with *.

Authorisation Details

Results Approved By	Heram Halim, Operations Manager Lien Tang, Assistant Operations Manager Travis Carey, Organics Supervisor
Laboratory Manager	Michael Kubiak

Interim Report PEK0653

Samples in this Report

Envirolab ID	Sample ID	Matrix	Date Sampled	Date Received
PEK0653-01	QC04	Soil	01/11/2023	09/11/2023
PEK0653-02	QC14	Soil	02/11/2023	09/11/2023
PEK0653-03	QC12	Soil	02/11/2023	09/11/2023

Interim Report PEK0653

Organochlorine Pesticides (Soil)

Envirolab ID	Units	PQL	PEK0653-01	PEK0653-02	PEK0653-03
Your Reference			QC04	QC14	QC12
Date Sampled			01/11/2023	02/11/2023	02/11/2023
alpha-BHC	mg/kg	0.10	<0.10	<0.10	<0.10
Hexachlorobenzene	mg/kg	0.10	<0.10	<0.10	<0.10
beta-BHC	mg/kg	0.10	<0.10	<0.10	<0.10
gamma-BHC	mg/kg	0.10	<0.10	<0.10	<0.10
delta-BHC	mg/kg	0.10	<0.10	<0.10	<0.10
Heptachlor	mg/kg	0.10	<0.10	<0.10	<0.10
Aldrin	mg/kg	0.10	<0.10	<0.10	<0.10
Heptachlor epoxide	mg/kg	0.10	<0.10	<0.10	<0.10
trans-Chlordane	mg/kg	0.10	<0.10	<0.10	<0.10
cis-Chlordane	mg/kg	0.10	<0.10	<0.10	<0.10
Endosulfan I	mg/kg	0.10	<0.10	<0.10	<0.10
4,4'-DDE	mg/kg	0.10	<0.10	<0.10	<0.10
Dieldrin	mg/kg	0.10	<0.10	<0.10	<0.10
Endrin	mg/kg	0.10	<0.10	<0.10	<0.10
4,4'-DDD	mg/kg	0.10	<0.10	<0.10	<0.10
Endosulfan II	mg/kg	0.10	<0.10	<0.10	<0.10
Endrin aldehyde	mg/kg	0.10	<0.10	<0.10	<0.10
4,4'-DDT	mg/kg	0.10	<0.10	<0.10	<0.10
Endosulfan sulfate	mg/kg	0.10	<0.10	<0.10	<0.10
Endrin ketone	mg/kg	0.10	<0.10	<0.10	<0.10
Methoxychlor	mg/kg	0.10	<0.10	<0.10	<0.10
Mirex	mg/kg	0.10	<0.10	<0.10	<0.10
Total +ve OCP	mg/kg	0.10	<0.10	<0.10	<0.10
Surrogate 2-Chlorophenol-D4	%		*89.5*	*96.9*	*95.3*

Organophosphorus Pesticides (Soil)

Envirolab ID	Units	PQL	PEK0653-01	PEK0653-02	PEK0653-03
Your Reference			QC04	QC14	QC12
Date Sampled			01/11/2023	02/11/2023	02/11/2023
Dichlorvos	mg/kg	0.10	<0.10	<0.10	<0.10
Dimethoate	mg/kg	0.10	<0.10	<0.10	<0.10
Diazinon	mg/kg	0.10	<0.10	<0.10	<0.10
Chlorpyrifos-methyl	mg/kg	0.10	<0.10	<0.10	<0.10
Ronnel	mg/kg	0.10	<0.10	<0.10	<0.10
Fenitrothion	mg/kg	0.10	<0.10	<0.10	<0.10
Malathion	mg/kg	0.10	<0.10	<0.10	<0.10
Chlorpyrifos	mg/kg	0.10	<0.10	<0.10	<0.10
Parathion	mg/kg	0.10	<0.10	<0.10	<0.10
Bromophos-ethyl	mg/kg	0.10	<0.10	<0.10	<0.10
Ethion	mg/kg	0.10	<0.10	<0.10	<0.10
Coumaphos	mg/kg	0.10	<0.10	<0.10	<0.10
Disulfoton	mg/kg	0.10	<0.10	<0.10	<0.10
Fenamiphos	mg/kg	0.10	<0.10	<0.10	<0.10
Fenthion	mg/kg	0.10	<0.10	<0.10	<0.10
Methidathion	mg/kg	0.10	<0.10	<0.10	<0.10
Mevinphos	mg/kg	0.10	<0.10	<0.10	<0.10
Parathion-methyl	mg/kg	0.10	<0.10	<0.10	<0.10
Phorate	mg/kg	0.10	<0.10	<0.10	<0.10
Phosalone	mg/kg	0.10	<0.10	<0.10	<0.10
Azinphos-methyl	mg/kg	0.10	<0.10	<0.10	<0.10
Surrogate 2-Chlorophenol-D4	%		*89.5*	*96.9*	*95.3*

Carbamates (Soil)

Envirolab ID	Units	PQL	PEK0653-01	PEK0653-02	PEK0653-03
Your Reference			QC04	QC14	QC12
Date Sampled			01/11/2023	02/11/2023	02/11/2023
Molinate	mg/kg	0.50	<0.50	<0.50	<0.50
Carbofuran	mg/kg	0.50	<0.50	<0.50	<0.50
Carbaryl	mg/kg	0.50	<0.50	<0.50	<0.50
Surrogate p-Terphenyl-D14	%		*85.2*	*97.0*	*97.2*

Interim Report PEK0653

Acid Extractable Metals (Soil)

Envirolab ID	Units	PQL	PEK0653-01	PEK0653-02	PEK0653-03
Your Reference			QC04	QC14	QC12
Date Sampled			01/11/2023	02/11/2023	02/11/2023
Arsenic	mg/kg	4.0	4.7	<4.0	<4.0
Cadmium	mg/kg	0.40	<0.40	<0.40	<0.40
Chromium	mg/kg	1.0	14	1.3	1.4
Copper	mg/kg	1.0	5.8	3.4	2.8
Mercury	mg/kg	0.10	<0.10	<0.10	<0.10
Nickel	mg/kg	1.0	<1.0	<1.0	<1.0
Phosphorus	mg/kg	10	210	84	160
Lead	mg/kg	1.0	2.7	1.0	1.5
Zinc	mg/kg	1.0	4.6	5.3	7.6

Inorganics - Carbons, Nitrogen Species, Sulfur Species (Soil)

Envirolab ID	Units	PQL	PEK0653-01	PEK0653-02	PEK0653-03
Your Reference			QC04	QC14	QC12
Date Sampled			01/11/2023	02/11/2023	02/11/2023
Ammonia as N	mg/kg	0.50	1.2	1.6	1.1
Nitrate as N	mg/kg	0.50	<0.50	2.4	0.52
Nitrate as NO3 by calculation	mg/kg	3.0	<3.0	11	<3.0
Nitrite as N	mg/kg	0.50	<0.50	<0.50	<0.50
Nitrite as NO2 by calculation*	mg/kg	2.0	<2.0	<2.0	<2.0
NOx as N	mg/kg	0.50	0.68	2.7	0.58

Interim Report PEK0653

Inorganics - General Chemical Parameters (Soil)

Envirolab ID	Units	PQL	PEK0653-01	PEK0653-02	PEK0653-03
Your Reference			QC04	QC14	QC12
Date Sampled			01/11/2023	02/11/2023	02/11/2023
Phosphate as P	mg/kg	0.50	2.6	1.2	2.5

Interim Report PEK0653

Inorganics - Moisture (Soil)

Envirolab ID	Units	PQL	PEK0653-01	PEK0653-02	PEK0653-03
Your Reference			QC04	QC14	QC12
Date Sampled			01/11/2023	02/11/2023	02/11/2023
Moisture	%	0.10	1.2	1.4	2.5

ASLP Extraction - RW (Soil)

Envirolab ID	Units	PQL	PEK0653-01	PEK0653-02	PEK0653-03
Your Reference			QC04	QC14	QC12
Date Sampled			01/11/2023	02/11/2023	02/11/2023
pH of final leachate	pH units		6.8	6.6	6.5

ASLP Metals - RW (Soil)

Envirolab ID	Units	PQL	PEK0653-01	PEK0653-02	PEK0653-03
Your Reference			QC04	QC14	QC12
Date Sampled			01/11/2023	02/11/2023	02/11/2023
Arsenic	mg/L	0.050	<0.050	<0.050	<0.050
Cadmium	mg/L	0.010	<0.010	<0.010	<0.010
Chromium	mg/L	0.010	0.037	<0.010	<0.010
Copper	mg/L	0.010	<0.010	<0.010	<0.010
Mercury	mg/L	0.000050	<0.000050	<0.000050	<0.000050
Nickel	mg/L	0.020	<0.020	<0.020	<0.020
Lead	mg/L	0.030	<0.030	<0.030	<0.030
Zinc	mg/L	0.020	<0.020	<0.020	<0.020

Method Summary

Method ID	Methodology Summary
INORG-004	Toxicity Characteristic Leaching Procedure (TCLP) based upon AS 4439 and USEPA 1311. Additional information as required in AS4439.3 section 10 can be provided on request. Please note that the mass used may be scaled down from the default based on the sample mass available.
INORG-008	Moisture content determined by heating at 105+/-5 °C for a minimum of 12 hours.
INORG-055	Nitrate/Nitrite/NOx/TKN - determined colourimetrically. Waters samples are filtered on receipt prior to analysis. Soils/solids are analysed following a water extraction.
INORG-057	Ammonia - determined colourimetrically. Water samples are filtered on receipt prior to analysis. Soils and OHS media are analysed following a water extraction. Alternatively, Ammonia can be extracted from soil using 1M KCl.
INORG-060	Phosphate - determined colourimetrically using APHA latest edition 4500 P E. Water samples are filtered on receipt prior to analysis. Soils are analysed from a water extract.
METALS-020	Determination of various metals by ICP-OES.
METALS-020_NEUT	Determination of various metals by ICP-OES following leaching using ultra high purity water, i.e. reagent water = CLASS 1, 2 & 4 from AS 4439.3.
METALS-021	Determination of Mercury by Cold Vapour AAS.
METALS-021_NEUT	Determination of Mercury by Cold Vapour AAS following leaching using ultra high purity water, i.e. reagent water = CLASS 1, 2 & 4 from AS 4439.3.
ORG-022	Determination of semi-volatile organic compounds (SVOCs) by GC-MS. Water samples are extracted by LLE and soils using DCM/Acetone/Methanol.
ORG-022_OC	Determination of semi-volatile organic compounds (SVOCs) by GC-MS. Water samples are extracted by LLE and soils using DCM/Acetone/Methanol.

Result Definitions

Identifier	Description
NR	Not reported
NEPM	National Environment Protection Measure
NS	Not specified
LCS	Laboratory Control Sample
RPD	Relative Percent Difference
>	Greater than
<	Less than
PQL	Practical Quantitation Limit
INS	Insufficient sample for this test
NA	Test not required
NT	Not tested
DOL	Samples rejected due to particulate overload (air filters only)
RFD	Samples rejected due to filter damage (air filters only)
RUD	Samples rejected due to uneven deposition (air filters only)
##	Indicates a laboratory acceptance criteria outlier, for further details, see Result Comments and/or QC Comments

Quality Control Definitions

Blank

This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, and is determined by processing solvents and reagents in exactly the same manner as for samples.

Surrogate Spike

Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.

LCS (Laboratory Control Sample)

This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.

Matrix Spike

A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.

Duplicate

This is the complete duplicate analysis of a sample from the process batch. The sample selected should be one where the analyte concentration is easily measurable.

Laboratory Acceptance Criteria

Duplicate sample and matrix spike recoveries may not be reported on smaller jobs, however, were analysed at a frequency to meet or exceed NEPM requirements. All samples are tested in batches of 20. The duplicate sample RPD and matrix spike recoveries for the batch were within the laboratory acceptance criteria. Filters, swabs, wipes, tubes and badges will not have duplicate data as the whole sample is generally extracted during sample extraction. Spikes for Physical and Aggregate Tests are not applicable. For VOCs in water samples, three vials are required for duplicate or spike analysis.

General Acceptance Criteria (GAC) - Analyte specific criteria applies for some analytes and is reflected in QC recovery tables.

Duplicates: >10xPQL - RPD acceptance criteria will vary depending on the analytes and the analytical techniques but is typically in the range 20%-50% - see ELN-P05 QAQC tables for details (available on request); <10xPQL - RPD are higher as the results approach PQL and the estimated measurement uncertainty will statistically increase. Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals; 60-140% for organics (+/-50% surrogates) and 10-140% for labile SVOCs (including labile surrogates), ultra trace organics and speciated phenols is acceptable.

In circumstances where no duplicate and/or sample spike has been reported at 1 in 10 and/or 1 in 20 samples respectively, the sample volume submitted was typically insufficient in order to satisfy laboratory QA/QC protocols.

Miscellaneous Information

When samples are received where certain analytes are outside of recommended technical holding times (THTs), the analysis has proceeded. Where analytes are on the verge of breaching THTs, every effort will be made to analyse within the THT or as soon as practicable.

Where sampling dates are not provided, Envirolab are not in a position to comment on the validity of the analysis where recommended technical holding times may have been breached. We have taken the sampling date as being the date received at the laboratory.

Two significant figures are reported for the majority of tests and with a high degree of confidence, for results <10*PQL, the second significant figure may be in doubt i.e. has a relatively high degree of uncertainty and is provided for information only.

Measurement Uncertainty estimates are available for most tests upon request.

Analysis of aqueous samples typically involves the extraction/digestion and/or analysis of the liquid phase only (i.e. NOT any settled sediment phase but inclusive of suspended particles if present), unless stipulated on the Envirolab COC or by correspondence. Notable exceptions include certain Physical Tests (pH/EC/BOD/COD/Apparent Colour etc.), Solids testing, Total Recoverable metals and PFAS where sediment/solids are included by default.

Air volume measurements are not covered by Envirolab's NATA accreditation.

Interim Data Quality Assessment Summary PEK0653

Client Details

Client	Galt Environmental Pty Ltd (WA)
Your Reference	Wattleup - WAE230106
Date Issued	17/11/2023

Recommended Holding Time Compliance

Recommended holding time exceedances exist - See detailed list below

Quality Control and QC Frequency

QC Type	Compliant	Details
Blank	Yes	No Outliers
LCS	Yes	No Outliers
Duplicates	No	Duplicate Outliers Exist - See detailed list below
Matrix Spike	No	Matrix Spike Outliers Exist - See detailed list below
Surrogates / Extracted Internal Standards	Yes	No Outliers
QC Frequency	Yes	No Outliers

Surrogates/Extracted Internal Standards, Duplicates and/or Matrix Spikes are not always relevant/applicable to certain analyses and matrices. Therefore, said QC measures are deemed compliant in these situations by default. See Laboratory Acceptance Criteria for more information

Interim Data Quality Assessment Summary PEK0653

Recommended Holding Time Compliance

Analysis	Sample Number(s)	Date Sampled	Date Extracted	Date Analysed	Compliant
OCP | Soil	1	01/11/2023	13/11/2023	14/11/2023	Yes
	2-3	02/11/2023	13/11/2023	14/11/2023	Yes
OPP (21 list) | Soil	1	01/11/2023	13/11/2023	14/11/2023	Yes
	2-3	02/11/2023	13/11/2023	14/11/2023	Yes
Carbamates | Soil	1	01/11/2023	13/11/2023	14/11/2023	Yes
	2-3	02/11/2023	13/11/2023	14/11/2023	Yes
Metals | Soil	1	01/11/2023	13/11/2023	13/11/2023	Yes
	2-3	02/11/2023	13/11/2023	13/11/2023	Yes
Metals-Hg | Soil	1	01/11/2023	13/11/2023	14/11/2023	Yes
	2-3	02/11/2023	13/11/2023	14/11/2023	Yes
Nitrogen - Ammonia | Soil	1	01/11/2023	13/11/2023	16/11/2023	Yes
	2-3	02/11/2023	13/11/2023	16/11/2023	Yes
Nitrogen - Nitrate | Soil	1	01/11/2023	13/11/2023	16/11/2023	Yes
	2-3	02/11/2023	13/11/2023	16/11/2023	Yes
Nitrogen - Nitrite | Soil	1	01/11/2023	13/11/2023	16/11/2023	No
	2-3	02/11/2023	13/11/2023	16/11/2023	No
Nitrogen - NOx | Soil	1	01/11/2023	13/11/2023	16/11/2023	No
	2-3	02/11/2023	13/11/2023	16/11/2023	No
Phosphate as P | Soil	1	01/11/2023	13/11/2023	16/11/2023	No
	2-3	02/11/2023	13/11/2023	16/11/2023	No
Moisture | Soil	1	01/11/2023	13/11/2023	14/11/2023	Yes
	2-3	02/11/2023	13/11/2023	14/11/2023	Yes
ASLP Extraction pH7 | Soil	1	01/11/2023	13/11/2023	15/11/2023	Yes
	2-3	02/11/2023	13/11/2023	15/11/2023	Yes
ASLP Metals | Soil	1	01/11/2023	14/11/2023	15/11/2023	Yes
	2-3	02/11/2023	14/11/2023	15/11/2023	Yes
ASLP Metals-Hg | Soil	1	01/11/2023	14/11/2023	15/11/2023	Yes
	2-3	02/11/2023	14/11/2023	15/11/2023	Yes

Outliers: Duplicates

INORG-008|Inorganics - Moisture (Soil)| Batch BEK1341

Sample ID	Duplicate ID	Analyte	% Limits	RPD
BEK1341-DUP1#	DUP1	Moisture	50.00	120[5]

METALS-020|Acid Extractable Metals (Soil)| Batch BEK1346

Sample ID	Duplicate ID	Analyte	% Limits	RPD
BEK1346-DUP1#	DUP1	Lead	40.00	56.6[4]
BEK1346-DUP1#	DUP1	Nickel	40.00	200[4]
BEK1346-DUP2#	DUP2	Chromium	40.00	46.6[4]
BEK1346-DUP3#	DUP3	Lead	40.00	57.5[4]

ORG-022_OC|Organochlorine Pesticides (Soil)| Batch BEK1350

Sample ID	Duplicate ID	Analyte	% Limits	RPD
BEK1350-DUP2#	DUP2	Dieldrin	50.00	103[6]

Interim Data Quality Assessment Summary PEK0653

Outliers: Matrix Spike

METALS-020|Acid Extractable Metals (Soil)| Batch BEK1346

Sample ID	Analyte	% Limits	% Recovery
BEK1346-MS1#	Lead	70 - 130	179[1]

ORG-022|Carbamates (Soil)| Batch BEK1350

Sample ID	Analyte	% Limits	% Recovery
BEK1350-MS2#	p-Terphenyl-D14	60 - 140	##[3]

ORG-022|Organophosphorus Pesticides (Soil)| Batch BEK1350

Sample ID	Analyte	% Limits	% Recovery
BEK1350-MS2#	Chlorpyrifos	60 - 140	##[2]
BEK1350-MS2#	Chlorpyrifos-methyl	60 - 140	##[2]
BEK1350-MS2#	Ethion	60 - 140	##[2]
BEK1350-MS2#	Malathion	60 - 140	##[2]
BEK1350-MS2#	Parathion	60 - 140	##[2]

ORG-022_OC|Organochlorine Pesticides (Soil)| Batch BEK1350

Sample ID	Analyte	% Limits	% Recovery
BEK1350-MS2#	4,4'-DDD	60 - 140	##[2]
BEK1350-MS2#	beta-BHC	60 - 140	##[2]
BEK1350-MS2#	Dieldrin	60 - 140	##[2]
BEK1350-MS2#	Endosulfan sulfate	60 - 140	##[2]
BEK1350-MS2#	Endrin	60 - 140	##[2]
BEK1350-MS2#	Heptachlor	60 - 140	##[2]

Interim Quality Control PEK0653

ORG-022_OC|Organochlorine Pesticides (Soil) | Batch BEK1350

Analyte	Units	PQL	Blank	DUP1 BEK1350-DUP1# Samp | QC | RPD %	DUP2 BEK1350-DUP2# Samp | QC | RPD %	LCS %	Spike % BEK1350-MS2#
alpha-BHC	mg/kg	0.10	<0.10	<0.10 | <0.10 | [NA]	<0.10 | <0.10 | [NA]	90.0	102
Hexachlorobenzene	mg/kg	0.10	<0.10	<0.10 | <0.10 | [NA]	<0.10 | <0.10 | [NA]	[NA]	[NA]
beta-BHC	mg/kg	0.10	<0.10	<0.10 | <0.10 | [NA]	<0.10 | <0.10 | [NA]	85.9	##[2]
gamma-BHC	mg/kg	0.10	<0.10	<0.10 | <0.10 | [NA]	<0.10 | <0.10 | [NA]	[NA]	[NA]
delta-BHC	mg/kg	0.10	<0.10	<0.10 | <0.10 | [NA]	<0.10 | <0.10 | [NA]	[NA]	[NA]
Heptachlor	mg/kg	0.10	<0.10	<0.10 | <0.10 | [NA]	<0.10 | <0.10 | [NA]	69.4	##[2]
Aldrin	mg/kg	0.10	<0.10	<0.10 | <0.10 | [NA]	<0.10 | <0.10 | [NA]	102	92.0
Heptachlor epoxide	mg/kg	0.10	<0.10	<0.10 | <0.10 | [NA]	<0.10 | <0.10 | [NA]	69.9	102
trans-Chlordane	mg/kg	0.10	<0.10	<0.10 | <0.10 | [NA]	<0.10 | <0.10 | [NA]	[NA]	[NA]
cis-Chlordane	mg/kg	0.10	<0.10	<0.10 | <0.10 | [NA]	<0.10 | <0.10 | [NA]	[NA]	[NA]
Endosulfan I	mg/kg	0.10	<0.10	<0.10 | <0.10 | [NA]	<0.10 | <0.10 | [NA]	[NA]	[NA]
4,4'-DDE	mg/kg	0.10	<0.10	<0.10 | <0.10 | [NA]	<0.10 | <0.10 | [NA]	86.3	127
Dieldrin	mg/kg	0.10	<0.10	<0.10 | <0.10 | [NA]	0.105 | 0.329 | 103 [6]	80.4	##[2]
Endrin	mg/kg	0.10	<0.10	<0.10 | <0.10 | [NA]	<0.10 | <0.10 | [NA]	72.2	##[2]
4,4'-DDD	mg/kg	0.10	<0.10	<0.10 | <0.10 | [NA]	<0.10 | <0.10 | [NA]	106	##[2]
Endosulfan II	mg/kg	0.10	<0.10	<0.10 | <0.10 | [NA]	<0.10 | <0.10 | [NA]	[NA]	[NA]
Endrin aldehyde	mg/kg	0.10	<0.10	<0.10 | <0.10 | [NA]	<0.10 | <0.10 | [NA]	[NA]	[NA]
4,4'-DDT	mg/kg	0.10	<0.10	<0.10 | <0.10 | [NA]	<0.10 | <0.10 | [NA]	[NA]	[NA]
Endosulfan sulfate	mg/kg	0.10	<0.10	<0.10 | <0.10 | [NA]	<0.10 | <0.10 | [NA]	71.9	##[2]
Endrin ketone	mg/kg	0.10	<0.10	<0.10 | <0.10 | [NA]	<0.10 | <0.10 | [NA]	[NA]	[NA]
Methoxychlor	mg/kg	0.10	<0.10	<0.10 | <0.10 | [NA]	<0.10 | <0.10 | [NA]	[NA]	[NA]
Mirex	mg/kg	0.10	<0.10	<0.10 | <0.10 | [NA]	<0.10 | <0.10 | [NA]	[NA]	[NA]
Surrogate 2-Chlorophenol-D4	*%*		*95.1*	*92.0 | 89.5*	*95.2 | 96.9*	*92.6*	*90.1*

The QC reported was not specifically part of this workorder but formed part of the QC process batch.

Interim Quality Control PEK0653

ORG-022|Organophosphorus Pesticides (Soil) | Batch BEK1350

Analyte	Units	PQL	Blank	DUP1 BEK1350-DUP1# Samp | QC | RPD %	DUP2 BEK1350-DUP2# Samp | QC | RPD %	LCS %	Spike % BEK1350-MS2#
Dichlorvos	mg/kg	0.10	<0.10	<0.10 | <0.10 | [NA]	<0.10 | <0.10 | [NA]	108	117
Dimethoate	mg/kg	0.10	<0.10	<0.10 | <0.10 | [NA]	<0.10 | <0.10 | [NA]	[NA]	[NA]
Diazinon	mg/kg	0.10	<0.10	<0.10 | <0.10 | [NA]	<0.10 | <0.10 | [NA]	[NA]	[NA]
Chlorpyrifos-methyl	mg/kg	0.10	<0.10	<0.10 | <0.10 | [NA]	<0.10 | <0.10 | [NA]	73.5	##[2]
Ronnel	mg/kg	0.10	<0.10	<0.10 | <0.10 | [NA]	<0.10 | <0.10 | [NA]	75.2	72.3
Fenitrothion	mg/kg	0.10	<0.10	<0.10 | <0.10 | [NA]	<0.10 | <0.10 | [NA]	79.4	87.3
Malathion	mg/kg	0.10	<0.10	<0.10 | <0.10 | [NA]	<0.10 | <0.10 | [NA]	95.1	##[2]
Chlorpyrifos	mg/kg	0.10	<0.10	<0.10 | <0.10 | [NA]	<0.10 | <0.10 | [NA]	88.8	##[2]
Parathion	mg/kg	0.10	<0.10	<0.10 | <0.10 | [NA]	<0.10 | <0.10 | [NA]	96.6	##[2]
Bromophos-ethyl	mg/kg	0.10	<0.10	<0.10 | <0.10 | [NA]	<0.10 | <0.10 | [NA]	[NA]	[NA]
Ethion	mg/kg	0.10	<0.10	<0.10 | <0.10 | [NA]	<0.10 | <0.10 | [NA]	89.9	##[2]
Coumaphos	mg/kg	0.10	<0.10	<0.10 | <0.10 | [NA]	<0.10 | <0.10 | [NA]	[NA]	[NA]
Disulfoton	mg/kg	0.10	<0.10	<0.10 | <0.10 | [NA]	<0.10 | <0.10 | [NA]	[NA]	[NA]
Fenamiphos	mg/kg	0.10	<0.10	<0.10 | <0.10 | [NA]	<0.10 | <0.10 | [NA]	[NA]	[NA]
Fenthion	mg/kg	0.10	<0.10	<0.10 | <0.10 | [NA]	<0.10 | <0.10 | [NA]	[NA]	[NA]
Methidathion	mg/kg	0.10	<0.10	<0.10 | <0.10 | [NA]	<0.10 | <0.10 | [NA]	[NA]	[NA]
Mevinphos	mg/kg	0.10	<0.10	<0.10 | <0.10 | [NA]	<0.10 | <0.10 | [NA]	[NA]	[NA]
Parathion-methyl	mg/kg	0.10	<0.10	<0.10 | <0.10 | [NA]	<0.10 | <0.10 | [NA]	[NA]	[NA]
Phorate	mg/kg	0.10	<0.10	<0.10 | <0.10 | [NA]	<0.10 | <0.10 | [NA]	[NA]	[NA]
Phosalone	mg/kg	0.10	<0.10	<0.10 | <0.10 | [NA]	<0.10 | <0.10 | [NA]	[NA]	[NA]
Azinphos-methyl	mg/kg	0.10	<0.10	<0.10 | <0.10 | [NA]	<0.10 | <0.10 | [NA]	[NA]	[NA]
Surrogate 2-Chlorophenol-D4	*%*		*95.1*	*92.0 | 89.5*	*95.2 | 96.9*	*92.6*	*90.1*

The QC reported was not specifically part of this workorder but formed part of the QC process batch.

ORG-022|Carbamates (Soil) | Batch BEK1350

Analyte	Units	PQL	Blank	DUP1 BEK1350-DUP1# Samp | QC | RPD %	DUP2 BEK1350-DUP2# Samp | QC | RPD %	LCS %	Spike % BEK1350-MS2#
Molinate	mg/kg	0.50	<0.50	<0.50 | <0.50 | [NA]	<0.50 | <0.50 | [NA]	[NA]	[NA]
Carbofuran	mg/kg	0.50	<0.50	<0.50 | <0.50 | [NA]	<0.50 | <0.50 | [NA]	93.0	84.4
Carbaryl	mg/kg	0.50	<0.50	<0.50 | <0.50 | [NA]	<0.50 | <0.50 | [NA]	[NA]	[NA]
Surrogate p-Terphenyl-D14	*%*		*86.8*	*90.5 | 88.2*	*91.5 | 94.6*	*85.3*	*##[3]*

The QC reported was not specifically part of this workorder but formed part of the QC process batch.

Interim Quality Control PEK0653

METALS-020 | Acid Extractable Metals (Soil) | Batch BEK1346

Analyte	Units	PQL	Blank	DUP1 BEK1346-DUP1# Samp | QC | RPD %	DUP2 BEK1346-DUP2# Samp | QC | RPD %	LCS %	Spike % BEK1346-MS1#
Arsenic	mg/kg	4.0	<4.0	<4.0 | <4.0 | [NA]	<4.0 | <4.0 | [NA]	94.2	96.2
Cadmium	mg/kg	0.40	<0.40	<0.40 | <0.40 | [NA]	<0.40 | <0.40 | [NA]	94.4	86.6
Chromium	mg/kg	1.0	<1.0	3.97 | 3.34 | 17.4	29.4 | 18.3 | 46.6 [4]	99.4	98.0
Copper	mg/kg	1.0	<1.0	2.31 | 1.91 | 19.0	14.0 | 16.5 | 16.4	105	107
Lead	mg/kg	1.0	<1.0	93.4 | 52.2 | 56.6 [4]	20.8 | 15.6 | 28.4	95.7	179[1]
Mercury	mg/kg	0.10	<0.10	<0.10 | <0.10 | [NA]	<0.10 | <0.10 | [NA]	115	117
Nickel	mg/kg	1.0	<1.0	1.17 | <1.0 | 200 [4]	4.66 | 4.15 | 11.5	97.9	92.9
Phosphorus	mg/kg	10	<10	47.4 | 34.3 | 32.1	337 | 331 | 1.94	94.6	112
Zinc	mg/kg	1.0	<1.0	4.92 | 3.42 | 36.0	14.6 | 19.5 | 28.7	97.4	88.2

Analyte	Units	PQL	Blank	DUP3 BEK1346-DUP3# Samp | QC | RPD %	DUP4 BEK1346-DUP4# Samp | QC | RPD %	LCS %
Arsenic	mg/kg	4		<4.0 | <4.0 | [NA]	<4.0 | <4.0 | [NA]	[NA]
Cadmium	mg/kg	0.4		<0.40 | <0.40 | [NA]	<0.40 | <0.40 | [NA]	[NA]
Chromium	mg/kg	1		3.97 | 4.22 | 5.93	29.4 | 26.2 | 11.5	[NA]
Copper	mg/kg	1		2.31 | 2.58 | 10.9	14.0 | 13.9 | 0.547	[NA]
Lead	mg/kg	1		93.4 | 51.6 | 57.5 [4]	20.8 | 18.5 | 12.0	[NA]
Mercury	mg/kg	0.1		<0.10 | <0.10 | [NA]	<0.10 | <0.10 | [NA]	[NA]
Nickel	mg/kg	1		1.17 | 1.22 | 3.74	4.66 | 4.61 | 1.15	[NA]
Phosphorus	mg/kg	10		47.4 | 43.1 | 9.49	337 | 379 | 11.8	[NA]
Zinc	mg/kg	1		4.92 | 5.01 | 1.74	14.6 | 16.4 | 11.8	[NA]

The QC reported was not specifically part of this workorder but formed part of the QC process batch.

INORG-055 | Inorganics - Carbons, Nitrogen Species, Sulfur Species (Soil) | Batch BEK1447

Analyte	Units	PQL	Blank	DUP1 PEK0653-01 Samp | QC | RPD %	LCS %	Spike % PEK0653-02
Nitrate as N	mg/kg	0.50	<0.50	<0.50 | <0.50 | [NA]	96.6	102
Nitrate as NO3 by calculation	mg/kg	3.0	<3.0		[NA]	[NA]
Nitrite as N	mg/kg	0.50	<0.50	<0.50 | <0.50 | [NA]	[NA]	[NA]
Nitrite as NO2 by calculation	mg/kg	2.0	<2.0		[NA]	[NA]
NOx as N	mg/kg	0.50	<0.50	0.677 | 0.538 | 22.9	96.6	97.8

Analyte	Units	PQL	Blank	LCS %	Spike % PEK0653-02
Nitrite as N	mg/kg	0.5		98.7	93.5

INORG-057 | Inorganics - Carbons, Nitrogen Species, Sulfur Species (Soil) | Batch BEK1448

Analyte	Units	PQL	Blank	DUP1 PEK0653-01 Samp | QC | RPD %	LCS %	Spike % PEK0653-02
Ammonia as N	mg/kg	0.50	<0.50	1.18 | 1.12 | 5.54	89.7	87.6

INORG-060 | Inorganics - General Chemical Parameters (Soil) | Batch BEK1447

Analyte	Units	PQL	Blank	DUP1 PEK0653-01 Samp | QC | RPD %	LCS %	Spike % PEK0653-02
Phosphate as P	mg/kg	0.50	<0.50	2.61 | 3.39 | 26.1	95.4	70.1

Interim Quality Control PEK0653

INORG-008|Inorganics - Moisture (Soil) | Batch BEK1341

Analyte	Units	PQL	Blank	DUP1 BEK1341-DUP1# Samp | QC | RPD %	DUP2 BEK1341-DUP2# Samp | QC | RPD %	LCS %
Moisture	%	0.1		0.140|0.560|120 [5]	6.79|4.21|46.9	[NA]

The QC reported was not specifically part of this workorder but formed part of the QC process batch.

INORG-004|ASLP Extraction - RW (Soil) | Batch BEK1340

Analyte	Units	PQL	Blank	DUP1 PEK0653-01 Samp | QC | RPD %	LCS %
pH of final leachate	pH units		4.72	6.84|6.99|2.17	102

METALS-020_NEUT|ASLP Metals - RW (Soil) | Batch BEK1546

Analyte	Units	PQL	Blank	DUP1 PEK0653-01 Samp | QC | RPD %	DUP2 PEK0653-01 Samp | QC | RPD %	LCS %	Spike % PEK0653-02
Arsenic	mg/L	0.050	<0.050	<0.050|<0.050|[NA]	<0.050|<0.050|[NA]	104	102
Cadmium	mg/L	0.010	<0.010	<0.010|<0.010|[NA]	<0.010|<0.010|[NA]	107	104
Chromium	mg/L	0.010	<0.010	0.0365|0.0373|2.17	0.0365|0.0371|1.49	94.4	92.1
Copper	mg/L	0.010	<0.010	<0.010|<0.010|[NA]	<0.010|<0.010|[NA]	93.6	92.5
Lead	mg/L	0.030	<0.030	<0.030|<0.030|[NA]	<0.030|<0.030|[NA]	94.8	92.9
Nickel	mg/L	0.020	<0.020	<0.020|<0.020|[NA]	<0.020|<0.020|[NA]	95.9	95.2
Zinc	mg/L	0.020	<0.020	<0.020|<0.020|[NA]	<0.020|<0.020|[NA]	98.9	93.9

METALS-021_NEUT|ASLP Metals - RW (Soil) | Batch BEK1547

Analyte	Units	PQL	Blank	DUP1 PEK0653-01 Samp | QC | RPD %	DUP2 PEK0653-01 Samp | QC | RPD %	LCS %	Spike % PEK0653-02
Mercury	mg/L	0.000050	<0.000050	<0.000050|<0.000050|[NA]	<0.000050|<0.000050|[NA]	96.0	93.2

QC Comments

Identifier	Description
[1]	Spike recovery is outside routine acceptance criteria (70-130%), this may be due to suspected non-homogeneity and/or matrix interference effects. However, an acceptable recovery was achieved for the LCS.
[2]	Spike recovery is outside routine acceptance criteria (60-140%). Where recoveries of <20% and >200% are attributable to matrix interference effects, there will be a high uncertainty associated with the parent result.
[3]	Surrogate recovery was outside routine acceptance criteria (60-140%) due to sample matrix effects. This may be due to the presence of carbon and/or other artefacts. An acceptable recovery was achieved for the LCS surrogates.
[4]	Duplicate analysis precision is/are outside acceptable %RPD, re-analysis indicates possible sample heterogeneity.
[5]	Duplicate %RPD may be flagged as an outlier to routine laboratory acceptance, however, where one or both results are <10*PQL, the RPD acceptance criteria increases exponentially.
[6]	The laboratory duplicate RPD acceptance criteria has been exceeded. Sample heterogeneity is evident in the sample.

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Certificate of Analysis

Galt Environment P/L
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Osborne Park
WA 6017

NATA Accredited
Accreditation Number 2377
Site Number 2370

Accredited for compliance with ISO/IEC 17025 – Testing
NATA is a signatory to the ILAC Mutual Recognition Arrangement for the mutual recognition of the equivalence of testing, medical testing, calibration, inspection, proficiency testing scheme providers and reference materials producers reports and certificates.

Attention: **- ALL SRA/Results**

Report **1043004-L**
Project name WATTLEUP
Project ID WAE230106
Received Date Nov 09, 2023

Client Sample ID			**TP01/0.0**	**TP03/0.0**	**TP04/0.0**	**TP08/0.0**
Sample Matrix			**AUS Leachate - pH 5.0**	**AUS Leachate - pH 5.0**	**AUS Leachate - pH 5.0**	**AUS Leachate - pH 5.0**
Eurofins Sample No.			**L23-No0024757**	**L23-No0024758**	**L23-No0024759**	**L23-No0024760**
Date Sampled			**Nov 01, 2023**	**Nov 01, 2023**	**Nov 01, 2023**	**Nov 01, 2023**
Test/Reference	LOR	Unit				
Heavy Metals						
Arsenic	0.001	mg/L	< 0.01	< 0.01	< 0.01	< 0.01
Cadmium	0.0002	mg/L	< 0.002	< 0.002	< 0.002	< 0.002
Chromium	0.01	mg/L	< 0.01	< 0.01	< 0.01	< 0.01
Copper	0.001	mg/L	< 0.01	0.023	< 0.01	< 0.01
Lead	0.01	mg/L	< 0.01	< 0.01	< 0.01	< 0.01
Mercury	0.0001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Nickel	0.001	mg/L	< 0.01	< 0.01	< 0.01	< 0.01
Zinc	0.005	mg/L	0.27	0.33	0.37	0.27
AUS Leaching Procedure						
Leachate Fluid[C01]		comment	1.0	1.0	1.0	1.0
pH (initial)	0.1	pH Units	n/a	n/a	n/a	n/a
pH (Leachate fluid)	0.1	pH Units	5.0	5.0	5.0	5.0
pH (off)	0.1	pH Units	5.1	5.0	5.0	5.0

Client Sample ID			**TP09/0.0**	**TP11/0.0**	**TP14/0.0**	**TP15/0.0**
Sample Matrix			**AUS Leachate - pH 5.0**	**AUS Leachate - pH 5.0**	**AUS Leachate - pH 5.0**	**AUS Leachate - pH 5.0**
Eurofins Sample No.			**L23-No0024761**	**L23-No0024762**	**L23-No0024763**	**L23-No0024764**
Date Sampled			**Nov 01, 2023**	**Nov 01, 2023**	**Nov 01, 2023**	**Nov 01, 2023**
Test/Reference	LOR	Unit				
Heavy Metals						
Arsenic	0.001	mg/L	< 0.01	< 0.01	< 0.01	< 0.01
Cadmium	0.0002	mg/L	< 0.002	< 0.002	< 0.002	< 0.002
Chromium	0.01	mg/L	< 0.01	< 0.01	< 0.01	< 0.01
Copper	0.001	mg/L	< 0.01	< 0.01	< 0.01	< 0.01
Lead	0.01	mg/L	< 0.01	< 0.01	< 0.01	< 0.01
Mercury	0.0001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Nickel	0.001	mg/L	< 0.01	< 0.01	< 0.01	< 0.01
Zinc	0.005	mg/L	0.34	0.27	0.30	0.26

Client Sample ID			TP09/0.0	TP11/0.0	TP14/0.0	TP15/0.0
Sample Matrix			AUS Leachate - pH 5.0	AUS Leachate - pH 5.0	AUS Leachate - pH 5.0	AUS Leachate - pH 5.0
Eurofins Sample No.			L23-No0024761	L23-No0024762	L23-No0024763	L23-No0024764
Date Sampled			Nov 01, 2023	Nov 01, 2023	Nov 01, 2023	Nov 01, 2023
Test/Reference	LOR	Unit				
AUS Leaching Procedure						
Leachate Fluid[C01]		comment	1.0	1.0	1.0	1.0
pH (initial)	0.1	pH Units	n/a	n/a	n/a	n/a
pH (Leachate fluid)	0.1	pH Units	5.0	5.0	5.0	5.0
pH (off)	0.1	pH Units	5.0	5.0	5.0	5.0

Client Sample ID			TP19/0.0	TP20/0.0	QC03	TP21/0.0
Sample Matrix			AUS Leachate - pH 5.0	AUS Leachate - pH 5.0	AUS Leachate - pH 5.0	AUS Leachate - pH 5.0
Eurofins Sample No.			L23-No0024765	L23-No0024766	L23-No0024767	L23-No0024768
Date Sampled			Nov 01, 2023	Nov 01, 2023	Nov 01, 2023	Nov 02, 2023
Test/Reference	LOR	Unit				
Heavy Metals						
Arsenic	0.001	mg/L	0.029	0.026	0.018	< 0.01
Cadmium	0.0002	mg/L	< 0.002	< 0.002	< 0.002	< 0.002
Chromium	0.01	mg/L	0.07	0.07	0.05	0.02
Copper	0.001	mg/L	< 0.01	< 0.01	< 0.01	< 0.01
Lead	0.01	mg/L	< 0.01	< 0.01	< 0.01	< 0.01
Mercury	0.0001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Nickel	0.001	mg/L	< 0.01	< 0.01	< 0.01	< 0.01
Zinc	0.005	mg/L	0.23	0.34	0.36	0.22
AUS Leaching Procedure						
Leachate Fluid[C01]		comment	1.0	1.0	1.0	1.0
pH (initial)	0.1	pH Units	n/a	n/a	n/a	n/a
pH (Leachate fluid)	0.1	pH Units	5.0	5.0	5.0	5.0
pH (off)	0.1	pH Units	5.0	5.0	5.0	5.1

Client Sample ID			TP23/0.0	TP25/0.0	TP26/0.0	TP29/0.0
Sample Matrix			AUS Leachate - pH 5.0	AUS Leachate - pH 5.0	AUS Leachate - pH 5.0	AUS Leachate - pH 5.0
Eurofins Sample No.			L23-No0024769	L23-No0024770	L23-No0024771	L23-No0024772
Date Sampled			Nov 02, 2023	Nov 02, 2023	Nov 02, 2023	Nov 02, 2023
Test/Reference	LOR	Unit				
Heavy Metals						
Arsenic	0.001	mg/L	< 0.01	< 0.01	< 0.01	< 0.01
Cadmium	0.0002	mg/L	< 0.002	< 0.002	< 0.002	< 0.002
Chromium	0.01	mg/L	0.01	0.02	< 0.01	< 0.01
Copper	0.001	mg/L	< 0.01	< 0.01	< 0.01	< 0.01
Lead	0.01	mg/L	< 0.01	< 0.01	< 0.01	< 0.01
Mercury	0.0001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Nickel	0.001	mg/L	< 0.01	< 0.01	< 0.01	< 0.01
Zinc	0.005	mg/L	0.34	0.34	0.30	0.14
AUS Leaching Procedure						
Leachate Fluid[C01]		comment	1.0	1.0	1.0	1.0
pH (initial)	0.1	pH Units	n/a	n/a	n/a	n/a
pH (Leachate fluid)	0.1	pH Units	5.0	5.0	5.0	5.0
pH (off)	0.1	pH Units	5.1	5.0	5.0	5.0

Client Sample ID			TP30/0.0	TP34/0.0	TP35/0.0	TP38/0.0
Sample Matrix			AUS Leachate - pH 5.0	AUS Leachate - pH 5.0	AUS Leachate - pH 5.0	AUS Leachate - pH 5.0
Eurofins Sample No.			L23-No0024773	L23-No0024774	L23-No0024775	L23-No0024776
Date Sampled			Nov 02, 2023	Nov 02, 2023	Nov 02, 2023	Nov 02, 2023
Test/Reference	LOR	Unit				
Heavy Metals						
Arsenic	0.001	mg/L	< 0.01	< 0.01	< 0.01	< 0.01
Cadmium	0.0002	mg/L	< 0.002	< 0.002	< 0.002	< 0.002
Chromium	0.01	mg/L	< 0.01	< 0.01	< 0.01	< 0.01
Copper	0.001	mg/L	< 0.01	< 0.01	< 0.01	< 0.01
Lead	0.01	mg/L	< 0.01	< 0.01	< 0.01	< 0.01
Mercury	0.0001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Nickel	0.001	mg/L	< 0.01	< 0.01	< 0.01	< 0.01
Zinc	0.005	mg/L	0.25	0.098	0.12	0.11
AUS Leaching Procedure						
Leachate Fluid[C01]		comment	1.0	1.0	1.0	1.0
pH (initial)	0.1	pH Units	n/a	n/a	n/a	n/a
pH (Leachate fluid)	0.1	pH Units	5.0	5.0	5.0	5.0
pH (off)	0.1	pH Units	5.0	5.0	6.6	5.0

Client Sample ID			TP39/0.0	QC11	TP41/0.0	TP42/0.0
Sample Matrix			AUS Leachate - pH 5.0	AUS Leachate - pH 5.0	AUS Leachate - pH 5.0	AUS Leachate - pH 5.0
Eurofins Sample No.			L23-No0024777	L23-No0024778	L23-No0024779	L23-No0024780
Date Sampled			Nov 02, 2023	Nov 02, 2023	Nov 03, 2023	Nov 03, 2023
Test/Reference	LOR	Unit				
Heavy Metals						
Arsenic	0.001	mg/L	< 0.01	< 0.01	< 0.01	< 0.01
Cadmium	0.0002	mg/L	< 0.002	< 0.002	< 0.002	< 0.002
Chromium	0.01	mg/L	< 0.01	< 0.01	< 0.01	< 0.01
Copper	0.001	mg/L	< 0.01	< 0.01	< 0.01	< 0.01
Lead	0.01	mg/L	< 0.01	< 0.01	< 0.01	< 0.01
Mercury	0.0001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Nickel	0.001	mg/L	< 0.01	< 0.01	< 0.01	< 0.01
Zinc	0.005	mg/L	0.11	0.33	0.17	0.26
AUS Leaching Procedure						
Leachate Fluid[C01]		comment	1.0	1.0	1.0	1.0
pH (initial)	0.1	pH Units	n/a	n/a	n/a	n/a
pH (Leachate fluid)	0.1	pH Units	5.0	5.0	5.0	5.0
pH (off)	0.1	pH Units	5.0	5.0	5.1	5.0

Client Sample ID			TP45/0.0	TP48/0.0	TP51/0.0	TP53/0.0
Sample Matrix			AUS Leachate - pH 5.0	AUS Leachate - pH 5.0	AUS Leachate - pH 5.0	AUS Leachate - pH 5.0
Eurofins Sample No.			L23-No0024781	L23-No0024782	L23-No0024783	L23-No0024784
Date Sampled			Nov 03, 2023	Nov 03, 2023	Nov 03, 2023	Nov 03, 2023
Test/Reference	LOR	Unit				
Heavy Metals						
Arsenic	0.001	mg/L	< 0.01	< 0.01	< 0.01	< 0.01
Cadmium	0.0002	mg/L	< 0.002	< 0.002	< 0.002	< 0.002
Chromium	0.01	mg/L	< 0.01	< 0.01	< 0.01	< 0.01
Copper	0.001	mg/L	< 0.01	< 0.01	< 0.01	< 0.01
Lead	0.01	mg/L	< 0.01	< 0.01	< 0.01	< 0.01
Mercury	0.0001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Nickel	0.001	mg/L	< 0.01	< 0.01	< 0.01	< 0.01
Zinc	0.005	mg/L	0.37	0.29	0.30	0.22
AUS Leaching Procedure						
Leachate Fluid[C01]		comment	1.0	1.0	1.0	1.0
pH (initial)	0.1	pH Units	n/a	n/a	n/a	n/a
pH (Leachate fluid)	0.1	pH Units	5.0	5.0	5.0	5.0
pH (off)	0.1	pH Units	5.0	5.0	5.0	5.0

Client Sample ID			TP56/0.0	TP58/0.0	TP59/0.0	QC13
Sample Matrix			AUS Leachate - pH 5.0	AUS Leachate - pH 5.0	AUS Leachate - pH 5.0	AUS Leachate - pH 5.0
Eurofins Sample No.			L23-No0024785	L23-No0024786	L23-No0024787	L23-No0024788
Date Sampled			Nov 03, 2023	Nov 03, 2023	Nov 03, 2023	Nov 03, 2023
Test/Reference	LOR	Unit				
Heavy Metals						
Arsenic	0.001	mg/L	< 0.01	< 0.01	< 0.01	< 0.01
Cadmium	0.0002	mg/L	< 0.002	< 0.002	< 0.002	< 0.002
Chromium	0.01	mg/L	0.03	[G01]< 0.01	[G01]< 0.01	[G01]< 0.01
Copper	0.001	mg/L	< 0.01	< 0.01	< 0.01	[G01]< 0.01
Lead	0.01	mg/L	< 0.01	< 0.01	< 0.01	< 0.01
Mercury	0.0001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Nickel	0.001	mg/L	< 0.01	< 0.01	< 0.01	[G01]< 0.01
Zinc	0.005	mg/L	0.41	0.32	0.38	0.16
AUS Leaching Procedure						
Leachate Fluid[C01]		comment	1.0	1.0	1.0	1.0
pH (initial)	0.1	pH Units	n/a	n/a	n/a	n/a
pH (Leachate fluid)	0.1	pH Units	5.0	5.0	5.0	5.0
pH (off)	0.1	pH Units	5.0	5.1	5.0	5.0

Sample History

Where samples are submitted/analysed over several days, the last date of extraction is reported.

If the date and time of sampling are not provided, the Laboratory will not be responsible for compromised results should testing be performed outside the recommended holding time.

Description	Testing Site	Extracted	Holding Time
Metals M8	Welshpool	Nov 15, 2023	28 Days
- Method: LTM-MET-3040 Metals in Waters, Soils & Sediments by ICP-MS			
AUS Leaching Procedure	Welshpool	Nov 15, 2023	7 Days
- Method: LTM-GEN-7010 Leaching Procedure for Soils & Solid Wastes			

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Company Name: Galt Environment P/L
Address: 50 Edward Street
Osborne Park
WA 6017

Project Name: WATTLEUP
Project ID: WAE230106

Order No.: WAE230106
Report #: 1043004
Phone: 08 6272 0200
Fax: 08 9285 8444

Received: Nov 9, 2023 2:00 PM
Due: Nov 16, 2023
Priority: 5 Day
Contact Name: - ALL SRA/Results

Eurofins Analytical Services Manager : Natalie Hill

Sample Detail						HOLD	Phosphorus	Organochlorine Pesticides	AUS Leaching Procedure	Metals M8	Moisture Set	OCOP in Soil	OCOP in Water	Carbamates in Soil	Total Nitrogen	Carbamates	Eurofins Suite B19A
Perth Laboratory - NATA # 2377 Site # 2370						X	X	X	X	X	X	X	X	X	X	X	X
External Laboratory																	
No	**Sample ID**	**Sample Date**	**Sampling Time**	**Matrix**	**LAB ID**												
1	TP01/0.0	Nov 01, 2023		Soil	L23-No0024721		X	X		X	X				X		
2	TP03/0.0	Nov 01, 2023		Soil	L23-No0024722		X			X	X	X		X	X		
3	TP04/0.0	Nov 01, 2023		Soil	L23-No0024723		X	X		X	X				X		
4	TP08/0.0	Nov 01, 2023		Soil	L23-No0024724		X	X		X	X				X		
5	TP09/0.0	Nov 01, 2023		Soil	L23-No0024725		X	X		X	X				X		
6	TP11/0.0	Nov 01, 2023		Soil	L23-No0024726		X			X	X	X		X	X		
7	TP14/0.0	Nov 01, 2023		Soil	L23-No0024727		X	X		X	X				X		
8	TP15/0.0	Nov 01, 2023		Soil	L23-No0024728		X	X		X	X				X		
9	TP19/0.0	Nov 01, 2023		Soil	L23-No0024729		X			X	X	X		X	X		
10	TP20/0.0	Nov 01, 2023		Soil	L23-No0024730		X	X		X	X				X		
11	QC01	Nov 01, 2023		Water	L23-No0024731					X			X			X	X
12	QC02	Nov 01, 2023		Water	L23-No0024732					X			X			X	X
13	QC03	Nov 01, 2023		Soil	L23-No0024733		X			X	X	X		X	X		

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Perth Laboratory - NATA # 2377 Site # 2370						X	X	X	X	X	X	X	X	X	X	X	X
External Laboratory																	
14	TP21/0.0	Nov 02, 2023		Soil	L23-No0024734		X			X	X	X		X	X		
15	TP23/0.0	Nov 02, 2023		Soil	L23-No0024735		X	X		X	X				X		
16	TP25/0.0	Nov 02, 2023		Soil	L23-No0024736		X	X		X	X				X		
17	TP26/0.0	Nov 02, 2023		Soil	L23-No0024737		X			X	X	X		X	X		
18	TP29/0.0	Nov 02, 2023		Soil	L23-No0024738		X	X		X	X				X		
19	TP30/0.0	Nov 02, 2023		Soil	L23-No0024739		X	X		X	X				X		
20	TP34/0.0	Nov 02, 2023		Soil	L23-No0024740		X			X	X	X		X	X		
21	TP35/0.0	Nov 02, 2023		Soil	L23-No0024741		X	X		X	X				X		
22	TP38/0.0	Nov 02, 2023		Soil	L23-No0024742		X	X		X	X				X		
23	TP39/0.0	Nov 02, 2023		Soil	L23-No0024743		X	X		X	X				X		
24	QC10	Nov 02, 2023		Water	L23-No0024744					X			X			X	X
25	QC11	Nov 02, 2023		Soil	L23-No0024745		X			X	X	X		X	X		
26	TP41/0.0	Nov 03, 2023		Soil	L23-No0024746		X	X		X	X				X		
27	TP42/0.0	Nov 03, 2023		Soil	L23-No0024747		X	X		X	X				X		
28	TP45/0.0	Nov 03, 2023		Soil	L23-No0024748		X			X	X	X		X	X		

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Eurofins Analytical Services Manager : Natalie Hill

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Perth Laboratory - NATA # 2377 Site # 2370						X	X	X	X	X	X	X	X	X	X	X	X
External Laboratory																	
29	TP48/0.0	Nov 03, 2023		Soil	L23-No0024749		X	X		X	X				X		
30	TP51/0.0	Nov 03, 2023		Soil	L23-No0024750		X	X		X	X				X		
31	TP53/0.0	Nov 03, 2023		Soil	L23-No0024751		X			X	X	X		X	X		
32	TP56/0.0	Nov 03, 2023		Soil	L23-No0024752		X	X		X	X				X		
33	TP58/0.0	Nov 03, 2023		Soil	L23-No0024753		X	X		X	X				X		
34	TP59/0.0	Nov 03, 2023		Soil	L23-No0024754		X			X	X	X		X	X		
35	QC13	Nov 03, 2023		Soil	L23-No0024755		X			X	X	X		X	X		
36	QC15	Nov 03, 2023		Water	L23-No0024756					X			X			X	X
37	TP01/0.0	Nov 01, 2023		AUS Leachate - pH 5.0	L23-No0024757				X	X							
38	TP03/0.0	Nov 01, 2023		AUS Leachate - pH 5.0	L23-No0024758				X	X							
39	TP04/0.0	Nov 01, 2023		AUS Leachate - pH 5.0	L23-No0024759				X	X							
40	TP08/0.0	Nov 01, 2023		AUS Leachate - pH 5.0	L23-No0024760				X	X							

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Perth Laboratory - NATA # 2377 Site # 2370						X	X	X	X	X	X	X	X	X	X	X	X
External Laboratory																	
41	TP09/0.0	Nov 01, 2023		AUS Leachate - pH 5.0	L23-No0024761				X	X							
42	TP11/0.0	Nov 01, 2023		AUS Leachate - pH 5.0	L23-No0024762				X	X							
43	TP14/0.0	Nov 01, 2023		AUS Leachate - pH 5.0	L23-No0024763				X	X							
44	TP15/0.0	Nov 01, 2023		AUS Leachate - pH 5.0	L23-No0024764				X	X							
45	TP19/0.0	Nov 01, 2023		AUS Leachate - pH 5.0	L23-No0024765				X	X							
46	TP20/0.0	Nov 01, 2023		AUS Leachate - pH 5.0	L23-No0024766				X	X							
47	QC03	Nov 01, 2023		AUS Leachate - pH 5.0	L23-No0024767				X	X							
48	TP21/0.0	Nov 02, 2023		AUS Leachate - pH 5.0	L23-No0024768				X	X							
49	TP23/0.0	Nov 02, 2023		AUS Leachate - pH 5.0	L23-No0024769				X	X							

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Perth Laboratory - NATA # 2377 Site # 2370						X	X	X	X	X	X	X	X	X	X	X	X
External Laboratory																	
50	TP25/0.0	Nov 02, 2023		AUS Leachate - pH 5.0	L23-No0024770				X	X							
51	TP26/0.0	Nov 02, 2023		AUS Leachate - pH 5.0	L23-No0024771				X	X							
52	TP29/0.0	Nov 02, 2023		AUS Leachate - pH 5.0	L23-No0024772				X	X							
53	TP30/0.0	Nov 02, 2023		AUS Leachate - pH 5.0	L23-No0024773				X	X							
54	TP34/0.0	Nov 02, 2023		AUS Leachate - pH 5.0	L23-No0024774				X	X							
55	TP35/0.0	Nov 02, 2023		AUS Leachate - pH 5.0	L23-No0024775				X	X							
56	TP38/0.0	Nov 02, 2023		AUS Leachate - pH 5.0	L23-No0024776				X	X							
57	TP39/0.0	Nov 02, 2023		AUS Leachate - pH 5.0	L23-No0024777				X	X							
58	QC11	Nov 02, 2023		AUS Leachate - pH 5.0	L23-No0024778				X	X							

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Perth Laboratory - NATA # 2377 Site # 2370						X	X	X	X	X	X	X	X	X	X	X	X
External Laboratory																	
59	TP41/0.0	Nov 03, 2023		AUS Leachate - pH 5.0	L23-No0024779				X	X							
60	TP42/0.0	Nov 03, 2023		AUS Leachate - pH 5.0	L23-No0024780				X	X							
61	TP45/0.0	Nov 03, 2023		AUS Leachate - pH 5.0	L23-No0024781				X	X							
62	TP48/0.0	Nov 03, 2023		AUS Leachate - pH 5.0	L23-No0024782				X	X							
63	TP51/0.0	Nov 03, 2023		AUS Leachate - pH 5.0	L23-No0024783				X	X							
64	TP53/0.0	Nov 03, 2023		AUS Leachate - pH 5.0	L23-No0024784				X	X							
65	TP56/0.0	Nov 03, 2023		AUS Leachate - pH 5.0	L23-No0024785				X	X							
66	TP58/0.0	Nov 03, 2023		AUS Leachate - pH 5.0	L23-No0024786				X	X							
67	TP59/0.0	Nov 03, 2023		AUS Leachate - pH 5.0	L23-No0024787				X	X							

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Eurofins Analytical Services Manager : Natalie Hill

Sample Detail						HOLD	Phosphorus	Organochlorine Pesticides	AUS Leaching Procedure	Metals M8	Moisture Set	OCOP in Soil	OCOP in Water	Carbamates in Soil	Total Nitrogen	Carbamates	Eurofins Suite B19A
Perth Laboratory - NATA # 2377 Site # 2370						X	X	X	X	X	X	X	X	X	X	X	X
External Laboratory																	
68	QC13	Nov 03, 2023		AUS Leachate - pH 5.0	L23-No0024788				X	X							
69	TP57/0.0	Not Provided		Soil	L23-No0024789	X											
Test Counts						1	32	20	32	68	32	12	4	13	32	4	4

Internal Quality Control Review and Glossary

General

1. Laboratory QC results for Method Blanks, Duplicates, Matrix Spikes, and Laboratory Control Samples follow guidelines delineated in the National Environment Protection (Assessment of Site Contamination) Measure 1999, as amended May 2013. They are included in this QC report where applicable. Additional QC data may be available on request.
2. All soil/sediment/solid results are reported on a dry weight basis unless otherwise stated.
3. All biota/food results are reported on a wet weight basis on the edible portion unless otherwise stated.
4. For CEC results where the sample's origin is unknown or environmentally contaminated, the results should be used advisedly.
5. Actual LORs are matrix dependent. Quoted LORs may be raised where sample extracts are diluted due to interferences.
6. Results are uncorrected for matrix spikes or surrogate recoveries except for PFAS compounds.
7. SVOC analysis on waters is performed on homogenised, unfiltered samples unless noted otherwise.
8. Samples were analysed on an 'as received' basis.
9. Information identified in this report with blue colour indicates data provided by customers that may have an impact on the results.
10. This report replaces any interim results previously issued.

Holding Times

Please refer to the 'Sample Preservation and Container Guide' for holding times (QS3001).

For samples received on the last day of holding time, notification of testing requirements should have been received at least 6 hours before sample receipt deadlines as stated on the SRA.

If the Laboratory did not receive the information in the required timeframe, and despite any other integrity issues, suitably qualified results may still be reported.

Holding times apply from the date of sampling; therefore, compliance with these may be outside the laboratory's control.

For VOCs containing vinyl chloride, styrene and 2-chloroethyl vinyl ether, the holding time is 7 days; however, for all other VOCs, such as BTEX or C6-10 TRH, the holding time is 14 days.

Units

mg/kg: milligrams per kilogram
mg/L: milligrams per litre
µg/L: micrograms per litre
ppm: parts per million
ppb: parts per billion
%: Percentage
org/100 mL: Organisms per 100 millilitres
NTU: Nephelometric Turbidity Units
MPN/100 mL: Most Probable Number of organisms per 100 millilitres
CFU: Colony forming unit

Terms

APHA	American Public Health Association
CEC	Cation Exchange Capacity
COC	Chain of Custody
CP	Client Parent - QC was performed on samples pertaining to this report
CRM	Certified Reference Material (ISO17034) - reported as percent recovery.
Dry	Where moisture has been determined on a solid sample, the result is expressed on a dry weight basis.
Duplicate	A second piece of analysis from the same sample and reported in the same units as the result to show comparison.
LOR	Limit of Reporting.
LCS	Laboratory Control Sample - reported as percent recovery.
Method Blank	In the case of solid samples, these are performed on laboratory-certified clean sands and in the case of water samples, these are performed on de-ionised water.
NCP	Non-Client Parent - QC performed on samples not pertaining to this report, QC represents the sequence or batch that client samples were analysed within.
RPD	Relative Percent Difference between two Duplicate pieces of analysis.
SPIKE	Addition of the analyte to the sample and reported as percentage recovery.
SRA	Sample Receipt Advice
Surr - Surrogate	The addition of a like compound to the analyte target and reported as percentage recovery.
TBTO	Tributyltin oxide (*bis*-tributyltin oxide) - individual tributyltin compounds cannot be identified separately in the environment; however free tributyltin was measured, and its values were converted stoichiometrically into tributyltin oxide for comparison with regulatory limits.
TCLP	Toxicity Characteristic Leaching Procedure
TEQ	Toxic Equivalency Quotient or Total Equivalence
QSM	US Department of Defense Quality Systems Manual Version 5.4
US EPA	United States Environmental Protection Agency
WA DWER	Sum of PFBA, PFPeA, PFHxA, PFHpA, PFOA, PFBS, PFHxS, PFOS, 6:2 FTSA, 8:2 FTSA

QC - Acceptance Criteria

The acceptance criteria should be used as a guide only and may be different when site-specific Sampling Analysis and Quality Plan (SAQP) have been implemented.

RPD Duplicates: Global RPD Duplicates Acceptance Criteria is 30%; however the following acceptance guidelines are equally applicable: Results <10 times the LOR: No Limit

Results between 10-20 times the LOR: RPD must lie between 0-50%

Results >20 times the LOR: RPD must lie between 0-30%

NOTE: pH duplicates are reported as a range, not as RPD

Surrogate Recoveries: Recoveries must lie between 20-130% for Speciated Phenols & 50-150% for PFAS. SVOCs recoveries 20 – 150%

PFAS field samples that contain surrogate recoveries above the QC limit designated in QSM 5.4, where no positive PFAS results have been reported, have been reviewed, and no data was affected.

QC Data General Comments

1. Where a result is reported as less than (<), higher than the nominated LOR, this is due to either matrix interference, extract dilution required due to interferences or contaminant levels within the sample, high moisture content or insufficient sample provided.
2. Duplicate data shown within this report that states the word "BATCH" is a Batch Duplicate from outside of your sample batch but within the laboratory sample batch at a 1:10 ratio. The Parent and Duplicate data shown are not data from your samples.
3. pH and Free Chlorine analysed in the laboratory - Analysis on this test must begin within 30 minutes of sampling. Therefore, laboratory analysis is unlikely to be completed within holding time.Analysis will begin as soon as possible after sample receipt.
4. Recovery Data (Spikes & Surrogates) - where chromatographic interference does not allow the determination of recovery, the term "INT" appears against that analyte.
5. For Matrix Spikes and LCS results, a dash "-" in the report means that the specific analyte was not added to the QC sample.
6. Duplicate RPDs are calculated from raw analytical data; thus, it is possible to have two sets of data.

Quality Control Results

Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Duplicate									
Heavy Metals				Result 1	Result 2	RPD			
Arsenic	L23-No0014572	NCP	mg/L	0.009	0.008	5.1	30%	Pass	
Cadmium	L23-No0014572	NCP	mg/L	0.0014	0.0013	8.7	30%	Pass	
Chromium	L23-No0014572	NCP	mg/L	0.99	0.94	5.0	30%	Pass	
Copper	L23-No0014572	NCP	mg/L	0.14	0.13	5.1	30%	Pass	
Lead	L23-No0014572	NCP	mg/L	0.10	0.092	9.3	30%	Pass	
Mercury	L23-No0014572	NCP	mg/L	0.0001	0.0001	13	30%	Pass	
Nickel	L23-No0014572	NCP	mg/L	0.23	0.22	5.3	30%	Pass	
Zinc	L23-No0014572	NCP	mg/L	0.74	0.75	1.5	30%	Pass	

Comments

Sample Integrity

Custody Seals Intact (if used)	N/A
Attempt to Chill was evident	Yes
Sample correctly preserved	Yes
Appropriate sample containers have been used	Yes
Sample containers for volatile analysis received with minimal headspace	Yes
Samples received within HoldingTime	N/A
Some samples have been subcontracted	No

Qualifier Codes/Comments

Code	Description
C01	Leachate Fluid Key: 1 - pH 5.0; 2 - pH 2.9; 3 - pH 9.2; 4 - Reagent (DI) water; 5 - Client sample, 6 - other
G01	The LORs have been raised due to matrix interference

Authorised by:

Natalie Hill	Analytical Services Manager
Douglas Todd	Senior Analyst-Metal
Sam Becker	Senior Analyst-Sample Properties

Kim Rodgers
General Manager

Final Report – this report replaces any previously issued Report

- Indicates Not Requested

* Indicates NATA accreditation does not cover the performance of this service

Measurement uncertainty of test data is available on request

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Certificate of Analysis

Galt Environment P/L
50 Edward Street
Osborne Park
WA 6017

NATA Accredited
Accreditation Number 2377
Site Number 2370

Accredited for compliance with ISO/IEC 17025 – Testing
NATA is a signatory to the ILAC Mutual Recognition Arrangement for the mutual recognition of the equivalence of testing, medical testing, calibration, inspection, proficiency testing scheme providers and reference materials producers reports and certificates.

Attention: **- ALL SRA/Results**

Report **1043004-W**
Project name WATTLEUP
Project ID WAE230106
Received Date Nov 09, 2023

Client Sample ID			**QC01**	**QC02**	**QC10**	**QC15**
Sample Matrix			**Water**	**Water**	**Water**	**Water**
Eurofins Sample No.			**L23-No0024731**	**L23-No0024732**	**L23-No0024744**	**L23-No0024756**
Date Sampled			**Nov 01, 2023**	**Nov 01, 2023**	**Nov 02, 2023**	**Nov 03, 2023**
Test/Reference	LOR	Unit				
OCOP in Water						
Aldrin	0.001	ug/L	< 0.001	< 0.001	< 0.001	< 0.001
alpha-BHC (HCH)	0.001	ug/L	< 0.001	< 0.001	< 0.001	< 0.001
beta-BHC (HCH)	0.001	ug/L	< 0.001	< 0.001	< 0.001	< 0.001
delta-BHC (HCH)	0.001	ug/L	< 0.001	< 0.001	< 0.001	< 0.001
Bifenthrin	0.05	ug/L	< 0.05	< 0.05	< 0.05	< 0.05
Bromophos Ethyl	0.005	ug/L	< 0.005	< 0.005	< 0.005	< 0.005
Chlordane	0.002	ug/L	< 0.002	< 0.002	< 0.002	< 0.002
Chlorothalonil	0.01	ug/L	< 0.01	< 0.01	< 0.01	< 0.01
Chlorpyrifos	0.005	ug/L	< 0.005	< 0.005	< 0.005	< 0.005
Diazinon	0.01	ug/L	< 0.01	< 0.01	< 0.01	< 0.01
Dieldrin	0.001	ug/L	< 0.001	< 0.001	< 0.001	< 0.001
Endosulfan I	0.001	ug/L	< 0.001	< 0.001	< 0.001	< 0.001
Endosulfan II	0.001	ug/L	< 0.001	< 0.001	< 0.001	< 0.001
Endosulfan Sulfate	0.001	ug/L	< 0.001	< 0.001	< 0.001	< 0.001
Endrin	0.01	ug/L	< 0.01	< 0.01	< 0.01	< 0.01
Ethion	0.01	ug/L	< 0.01	< 0.01	< 0.01	< 0.01
Fenitrothion	0.01	ug/L	< 0.01	< 0.01	< 0.01	< 0.01
Fipronil	0.02	ug/L	< 0.02	< 0.02	< 0.02	< 0.02
Hexachlorobenzene (HCB)	0.001	ug/L	< 0.001	< 0.001	< 0.001	< 0.001
Heptachlor Epoxide	0.001	ug/L	< 0.001	< 0.001	< 0.001	< 0.001
Heptachlor	0.001	ug/L	< 0.001	< 0.001	< 0.001	< 0.001
Lindane	0.001	ug/L	< 0.001	< 0.001	< 0.001	< 0.001
Malathion	0.01	ug/L	< 0.01	< 0.01	< 0.01	< 0.01
Methoxychlor	0.02	ug/L	< 0.02	< 0.02	< 0.02	< 0.02
o.p-DDT	0.001	ug/L	< 0.001	< 0.001	< 0.001	< 0.001
Oxychlordane	0.001	ug/L	< 0.001	< 0.001	< 0.001	< 0.001
p.p-DDD	0.001	ug/L	< 0.001	< 0.001	< 0.001	< 0.001
p.p-DDE	0.001	ug/L	< 0.001	< 0.001	< 0.001	< 0.001
p.p-DDT	0.001	ug/L	< 0.001	< 0.001	< 0.001	< 0.001
Parathion Ethyl	0.02	ug/L	< 0.02	< 0.02	< 0.02	< 0.02
Parathion Methyl	0.02	ug/L	< 0.02	< 0.02	< 0.02	< 0.02
Trifluralin	0.01	ug/L	< 0.01	< 0.01	< 0.01	< 0.01
Vinclozolin	0.02	ug/L	< 0.02	< 0.02	< 0.02	< 0.02

Client Sample ID			QC01	QC02	QC10	QC15
Sample Matrix			Water	Water	Water	Water
Eurofins Sample No.			L23-No0024731	L23-No0024732	L23-No0024744	L23-No0024756
Date Sampled			Nov 01, 2023	Nov 01, 2023	Nov 02, 2023	Nov 03, 2023
Test/Reference	LOR	Unit				
Carbamates						
Aldicarb	1	ug/L	< 1	< 1	< 1	< 1
Aldicarb Sulfone	1	ug/L	< 1	< 1	< 1	< 1
Aldicarb Sulfoxide	1	ug/L	< 1	< 1	< 1	< 1
Aminocarb	1	ug/L	< 1	< 1	< 1	< 1
Bromacil	2	ug/L	< 2	< 2	< 2	< 2
Carbaryl	4	ug/L	< 4	< 4	< 4	< 4
Carbendazim	1	ug/L	< 1	< 1	< 1	< 1
Carbofuran	1	ug/L	< 1	< 1	< 1	< 1
Diuron	0.5	ug/L	< 0.5	< 0.5	< 0.5	< 0.5
EPTC	5	ug/L	< 5	< 5	< 5	< 5
Fenamiphos	0.1	ug/L	< 0.1	< 0.1	< 0.1	< 0.1
Fenuron/Fenuron TCA	2	ug/L	< 2	< 2	< 2	< 2
Fluometuron	1	ug/L	< 1	< 1	< 1	< 1
Linuron	5	ug/L	< 5	< 5	< 5	< 5
Methiocarb	4	ug/L	< 4	< 4	< 4	< 4
Methomyl	2	ug/L	< 2	< 2	< 2	< 2
Mexacarbate	1	ug/L	< 1	< 1	< 1	< 1
Monuron/Monuron TCA	2	ug/L	< 2	< 2	< 2	< 2
Oxamyl	2	ug/L	< 2	< 2	< 2	< 2
Propachlor	1	ug/L	< 1	< 1	< 1	< 1
Propham	5	ug/L	< 5	< 5	< 5	< 5
Propoxur	1	ug/L	< 1	< 1	< 1	< 1
Siduron	1	ug/L	< 1	< 1	< 1	< 1
NOx-N	0.01	mg/L	< 0.01	< 0.01	< 0.01	< 0.01
Total Kjeldahl Nitrogen	0.2	mg/L	< 0.2	< 0.2	< 0.2	< 0.2
Total Nitrogen	0.2	mg/L	< 0.2	< 0.2	< 0.2	< 0.2
Total Phosphorus	0.01	mg/L	< 0.01	< 0.01	< 0.01	< 0.01
Heavy Metals						
Arsenic	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Cadmium	0.0001	mg/L	< 0.0001	< 0.0001	< 0.0001	< 0.0001
Chromium	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Copper	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Lead	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Mercury	0.0001	mg/L	< 0.0001	< 0.0001	< 0.0001	< 0.0001
Nickel	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Zinc	0.005	mg/L	< 0.005	< 0.005	< 0.005	< 0.005

Sample History

Where samples are submitted/analysed over several days, the last date of extraction is reported.

If the date and time of sampling are not provided, the Laboratory will not be responsible for compromised results should testing be performed outside the recommended holding time.

Description	Testing Site	Extracted	Holding Time
OCOP in Water	Welshpool	Nov 15, 2023	7 Days
- Method: ARL No. 002 - OCOP and PCB in Water			
Carbamates	Welshpool	Nov 15, 2023	14 Days
- Method: SOP #6 Analysis of Volatile Organic Compounds in Passivated Canisters EPA Method TO-15			
Metals M8	Welshpool	Nov 15, 2023	28 Days
- Method: LTM-MET-3040 Metals in Waters, Soils & Sediments by ICP-MS			
NOx-N	Welshpool	Nov 15, 2023	28 Days
- Method: ARL313/319 - NOx in Water by Discrete Analyser			
Total Kjeldahl Nitrogen	Welshpool	Nov 10, 2023	28 Day
- Method: ARL No. 330 - Persulfate Method for Simultaneous Determination of TN & TP			
Total Nitrogen	Welshpool	Nov 15, 2023	28 Days
- Method: ARL No. 330 - Persulfate Method for Simultaneous Determination of TN & TP			
Total Phosphorus	Welshpool	Nov 15, 2023	28 Days
- Method: ARL308 - Total Phosphorus in Water by Discrete Analyser			

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Project Name: WATTLEUP
Project ID: WAE230106

Order No.: WAE230106
Report #: 1043004
Phone: 08 6272 0200
Fax: 08 9285 8444

Received: Nov 9, 2023 2:00 PM
Due: Nov 16, 2023
Priority: 5 Day
Contact Name: - ALL SRA/Results

Eurofins Analytical Services Manager : Natalie Hill

Sample Detail						HOLD	Phosphorus	Organochlorine Pesticides	AUS Leaching Procedure	Metals M8	Moisture Set	OCOP in Soil	OCOP in Water	Carbamates in Soil	Total Nitrogen	Carbamates	Eurofins Suite B19A
Perth Laboratory - NATA # 2377 Site # 2370						X	X	X	X	X	X	X	X	X	X	X	X
External Laboratory																	
No	**Sample ID**	**Sample Date**	**Sampling Time**	**Matrix**	**LAB ID**												
1	TP01/0.0	Nov 01, 2023		Soil	L23-No0024721		X	X		X	X				X		
2	TP03/0.0	Nov 01, 2023		Soil	L23-No0024722		X			X	X	X		X	X		
3	TP04/0.0	Nov 01, 2023		Soil	L23-No0024723		X	X		X	X				X		
4	TP08/0.0	Nov 01, 2023		Soil	L23-No0024724		X	X		X	X				X		
5	TP09/0.0	Nov 01, 2023		Soil	L23-No0024725		X	X		X	X				X		
6	TP11/0.0	Nov 01, 2023		Soil	L23-No0024726		X			X	X	X		X	X		
7	TP14/0.0	Nov 01, 2023		Soil	L23-No0024727		X	X		X	X				X		
8	TP15/0.0	Nov 01, 2023		Soil	L23-No0024728		X	X		X	X				X		
9	TP19/0.0	Nov 01, 2023		Soil	L23-No0024729		X			X	X	X		X	X		
10	TP20/0.0	Nov 01, 2023		Soil	L23-No0024730		X	X		X	X				X		
11	QC01	Nov 01, 2023		Water	L23-No0024731					X			X			X	X
12	QC02	Nov 01, 2023		Water	L23-No0024732					X			X			X	X
13	QC03	Nov 01, 2023		Soil	L23-No0024733		X			X	X	X		X	X		

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Received: Nov 9, 2023 2:00 PM
Due: Nov 16, 2023
Priority: 5 Day
Contact Name: - ALL SRA/Results

Eurofins Analytical Services Manager : Natalie Hill

Sample Detail						HOLD	Phosphorus	Organochlorine Pesticides	AUS Leaching Procedure	Metals M8	Moisture Set	OCOP in Soil	OCOP in Water	Carbamates in Soil	Total Nitrogen	Carbamates	Eurofins Suite B19A
Perth Laboratory - NATA # 2377 Site # 2370						X	X	X	X	X	X	X	X	X	X	X	X
External Laboratory																	
14	TP21/0.0	Nov 02, 2023		Soil	L23-No0024734		X			X	X	X		X	X		
15	TP23/0.0	Nov 02, 2023		Soil	L23-No0024735		X	X		X	X				X		
16	TP25/0.0	Nov 02, 2023		Soil	L23-No0024736		X	X		X	X				X		
17	TP26/0.0	Nov 02, 2023		Soil	L23-No0024737		X			X	X	X		X	X		
18	TP29/0.0	Nov 02, 2023		Soil	L23-No0024738		X	X		X	X				X		
19	TP30/0.0	Nov 02, 2023		Soil	L23-No0024739		X	X		X	X				X		
20	TP34/0.0	Nov 02, 2023		Soil	L23-No0024740		X			X	X	X		X	X		
21	TP35/0.0	Nov 02, 2023		Soil	L23-No0024741		X	X		X	X				X		
22	TP38/0.0	Nov 02, 2023		Soil	L23-No0024742		X	X		X	X				X		
23	TP39/0.0	Nov 02, 2023		Soil	L23-No0024743		X	X		X	X				X		
24	QC10	Nov 02, 2023		Water	L23-No0024744					X			X			X	X
25	QC11	Nov 02, 2023		Soil	L23-No0024745		X			X	X	X		X	X		
26	TP41/0.0	Nov 03, 2023		Soil	L23-No0024746		X	X		X	X				X		
27	TP42/0.0	Nov 03, 2023		Soil	L23-No0024747		X	X		X	X				X		
28	TP45/0.0	Nov 03, 2023		Soil	L23-No0024748		X			X	X	X		X	X		

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Project Name: WATTLEUP
Project ID: WAE230106

Order No.: WAE230106
Report #: 1043004
Phone: 08 6272 0200
Fax: 08 9285 8444

Received: Nov 9, 2023 2:00 PM
Due: Nov 16, 2023
Priority: 5 Day
Contact Name: - ALL SRA/Results

Eurofins Analytical Services Manager : Natalie Hill

Sample Detail						HOLD	Phosphorus	Organochlorine Pesticides	AUS Leaching Procedure	Metals M8	Moisture Set	OCOP in Soil	OCOP in Water	Carbamates in Soil	Total Nitrogen	Carbamates	Eurofins Suite B19A
Perth Laboratory - NATA # 2377 Site # 2370						X	X	X	X	X	X	X	X	X	X	X	X
External Laboratory																	
29	TP48/0.0	Nov 03, 2023		Soil	L23-No0024749		X	X		X	X				X		
30	TP51/0.0	Nov 03, 2023		Soil	L23-No0024750		X	X		X	X				X		
31	TP53/0.0	Nov 03, 2023		Soil	L23-No0024751		X			X	X	X		X	X		
32	TP56/0.0	Nov 03, 2023		Soil	L23-No0024752		X	X		X	X				X		
33	TP58/0.0	Nov 03, 2023		Soil	L23-No0024753		X	X		X	X				X		
34	TP59/0.0	Nov 03, 2023		Soil	L23-No0024754		X			X	X	X		X	X		
35	QC13	Nov 03, 2023		Soil	L23-No0024755		X			X	X	X		X	X		
36	QC15	Nov 03, 2023		Water	L23-No0024756					X			X			X	X
37	TP01/0.0	Nov 01, 2023		AUS Leachate - pH 5.0	L23-No0024757				X	X							
38	TP03/0.0	Nov 01, 2023		AUS Leachate - pH 5.0	L23-No0024758				X	X							
39	TP04/0.0	Nov 01, 2023		AUS Leachate - pH 5.0	L23-No0024759				X	X							
40	TP08/0.0	Nov 01, 2023		AUS Leachate - pH 5.0	L23-No0024760				X	X							

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Perth Laboratory - NATA # 2377 Site # 2370						X	X	X	X	X	X	X	X	X	X	X	X
External Laboratory																	
41	TP09/0.0	Nov 01, 2023		AUS Leachate - pH 5.0	L23-No0024761				X	X							
42	TP11/0.0	Nov 01, 2023		AUS Leachate - pH 5.0	L23-No0024762				X	X							
43	TP14/0.0	Nov 01, 2023		AUS Leachate - pH 5.0	L23-No0024763				X	X							
44	TP15/0.0	Nov 01, 2023		AUS Leachate - pH 5.0	L23-No0024764				X	X							
45	TP19/0.0	Nov 01, 2023		AUS Leachate - pH 5.0	L23-No0024765				X	X							
46	TP20/0.0	Nov 01, 2023		AUS Leachate - pH 5.0	L23-No0024766				X	X							
47	QC03	Nov 01, 2023		AUS Leachate - pH 5.0	L23-No0024767				X	X							
48	TP21/0.0	Nov 02, 2023		AUS Leachate - pH 5.0	L23-No0024768				X	X							
49	TP23/0.0	Nov 02, 2023		AUS Leachate - pH 5.0	L23-No0024769				X	X							

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Perth Laboratory - NATA # 2377 Site # 2370						X	X	X	X	X	X	X	X	X	X	X	X
External Laboratory																	
50	TP25/0.0	Nov 02, 2023		AUS Leachate - pH 5.0	L23-No0024770				X	X							
51	TP26/0.0	Nov 02, 2023		AUS Leachate - pH 5.0	L23-No0024771				X	X							
52	TP29/0.0	Nov 02, 2023		AUS Leachate - pH 5.0	L23-No0024772				X	X							
53	TP30/0.0	Nov 02, 2023		AUS Leachate - pH 5.0	L23-No0024773				X	X							
54	TP34/0.0	Nov 02, 2023		AUS Leachate - pH 5.0	L23-No0024774				X	X							
55	TP35/0.0	Nov 02, 2023		AUS Leachate - pH 5.0	L23-No0024775				X	X							
56	TP38/0.0	Nov 02, 2023		AUS Leachate - pH 5.0	L23-No0024776				X	X							
57	TP39/0.0	Nov 02, 2023		AUS Leachate - pH 5.0	L23-No0024777				X	X							
58	QC11	Nov 02, 2023		AUS Leachate - pH 5.0	L23-No0024778				X	X							

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Perth Laboratory - NATA # 2377 Site # 2370						X	X	X	X	X	X	X	X	X	X	X	X
External Laboratory																	
59	TP41/0.0	Nov 03, 2023		AUS Leachate - pH 5.0	L23-No0024779				X	X							
60	TP42/0.0	Nov 03, 2023		AUS Leachate - pH 5.0	L23-No0024780				X	X							
61	TP45/0.0	Nov 03, 2023		AUS Leachate - pH 5.0	L23-No0024781				X	X							
62	TP48/0.0	Nov 03, 2023		AUS Leachate - pH 5.0	L23-No0024782				X	X							
63	TP51/0.0	Nov 03, 2023		AUS Leachate - pH 5.0	L23-No0024783				X	X							
64	TP53/0.0	Nov 03, 2023		AUS Leachate - pH 5.0	L23-No0024784				X	X							
65	TP56/0.0	Nov 03, 2023		AUS Leachate - pH 5.0	L23-No0024785				X	X							
66	TP58/0.0	Nov 03, 2023		AUS Leachate - pH 5.0	L23-No0024786				X	X							
67	TP59/0.0	Nov 03, 2023		AUS Leachate - pH 5.0	L23-No0024787				X	X							

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Perth Laboratory - NATA # 2377 Site # 2370						X	X	X	X	X	X	X	X	X	X	X	X
External Laboratory																	
68	QC13	Nov 03, 2023		AUS Leachate - pH 5.0	L23-No0024788				X	X							
69	TP57/0.0	Not Provided		Soil	L23-No0024789	X											
Test Counts						1	32	20	32	68	32	12	4	13	32	4	4

Internal Quality Control Review and Glossary

General

1. Laboratory QC results for Method Blanks, Duplicates, Matrix Spikes, and Laboratory Control Samples follow guidelines delineated in the National Environment Protection (Assessment of Site Contamination) Measure 1999, as amended May 2013. They are included in this QC report where applicable. Additional QC data may be available on request.
2. All soil/sediment/solid results are reported on a dry weight basis unless otherwise stated.
3. All biota/food results are reported on a wet weight basis on the edible portion unless otherwise stated.
4. For CEC results where the sample's origin is unknown or environmentally contaminated, the results should be used advisedly.
5. Actual LORs are matrix dependent. Quoted LORs may be raised where sample extracts are diluted due to interferences.
6. Results are uncorrected for matrix spikes or surrogate recoveries except for PFAS compounds.
7. SVOC analysis on waters is performed on homogenised, unfiltered samples unless noted otherwise.
8. Samples were analysed on an 'as received' basis.
9. Information identified in this report with blue colour indicates data provided by customers that may have an impact on the results.
10. This report replaces any interim results previously issued.

Holding Times

Please refer to the 'Sample Preservation and Container Guide' for holding times (QS3001).

For samples received on the last day of holding time, notification of testing requirements should have been received at least 6 hours before sample receipt deadlines as stated on the SRA.

If the Laboratory did not receive the information in the required timeframe, and despite any other integrity issues, suitably qualified results may still be reported.

Holding times apply from the date of sampling; therefore, compliance with these may be outside the laboratory's control.

For VOCs containing vinyl chloride, styrene and 2-chloroethyl vinyl ether, the holding time is 7 days; however, for all other VOCs, such as BTEX or C6-10 TRH, the holding time is 14 days.

Units

mg/kg: milligrams per kilogram
mg/L: milligrams per litre
µg/L: micrograms per litre
ppm: parts per million
ppb: parts per billion
%: Percentage
org/100 mL: Organisms per 100 millilitres
NTU: Nephelometric Turbidity Units
MPN/100 mL: Most Probable Number of organisms per 100 millilitres
CFU: Colony forming unit

Terms

APHA	American Public Health Association
CEC	Cation Exchange Capacity
COC	Chain of Custody
CP	Client Parent - QC was performed on samples pertaining to this report
CRM	Certified Reference Material (ISO17034) - reported as percent recovery.
Dry	Where moisture has been determined on a solid sample, the result is expressed on a dry weight basis.
Duplicate	A second piece of analysis from the same sample and reported in the same units as the result to show comparison.
LOR	Limit of Reporting.
LCS	Laboratory Control Sample - reported as percent recovery.
Method Blank	In the case of solid samples, these are performed on laboratory-certified clean sands and in the case of water samples, these are performed on de-ionised water.
NCP	Non-Client Parent - QC performed on samples not pertaining to this report, QC represents the sequence or batch that client samples were analysed within.
RPD	Relative Percent Difference between two Duplicate pieces of analysis.
SPIKE	Addition of the analyte to the sample and reported as percentage recovery.
SRA	Sample Receipt Advice
Surr - Surrogate	The addition of a like compound to the analyte target and reported as percentage recovery.
TBTO	Tributyltin oxide (*bis*-tributyltin oxide) - individual tributyltin compounds cannot be identified separately in the environment; however free tributyltin was measured, and its values were converted stoichiometrically into tributyltin oxide for comparison with regulatory limits.
TCLP	Toxicity Characteristic Leaching Procedure
TEQ	Toxic Equivalency Quotient or Total Equivalence
QSM	US Department of Defense Quality Systems Manual Version 5.4
US EPA	United States Environmental Protection Agency
WA DWER	Sum of PFBA, PFPeA, PFHxA, PFHpA, PFOA, PFBS, PFHxS, PFOS, 6:2 FTSA, 8:2 FTSA

QC - Acceptance Criteria

The acceptance criteria should be used as a guide only and may be different when site-specific Sampling Analysis and Quality Plan (SAQP) have been implemented.

RPD Duplicates: Global RPD Duplicates Acceptance Criteria is 30%; however the following acceptance guidelines are equally applicable: Results <10 times the LOR: No Limit

Results between 10-20 times the LOR: RPD must lie between 0-50%

Results >20 times the LOR: RPD must lie between 0-30%

NOTE: pH duplicates are reported as a range, not as RPD

Surrogate Recoveries: Recoveries must lie between 20-130% for Speciated Phenols & 50-150% for PFAS. SVOCs recoveries 20 – 150%

PFAS field samples that contain surrogate recoveries above the QC limit designated in QSM 5.4, where no positive PFAS results have been reported, have been reviewed, and no data was affected.

QC Data General Comments

1. Where a result is reported as less than (<), higher than the nominated LOR, this is due to either matrix interference, extract dilution required due to interferences or contaminant levels within the sample, high moisture content or insufficient sample provided.
2. Duplicate data shown within this report that states the word "BATCH" is a Batch Duplicate from outside of your sample batch but within the laboratory sample batch at a 1:10 ratio. The Parent and Duplicate data shown are not data from your samples.
3. pH and Free Chlorine analysed in the laboratory - Analysis on this test must begin within 30 minutes of sampling. Therefore, laboratory analysis is unlikely to be completed within holding time.Analysis will begin as soon as possible after sample receipt.
4. Recovery Data (Spikes & Surrogates) - where chromatographic interference does not allow the determination of recovery, the term "INT" appears against that analyte.
5. For Matrix Spikes and LCS results, a dash "-" in the report means that the specific analyte was not added to the QC sample.
6. Duplicate RPDs are calculated from raw analytical data; thus, it is possible to have two sets of data.

Quality Control Results

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Method Blank							
OCOP in Water							
Aldrin	ug/L	< 0.001			0.001	Pass	
alpha-BHC (HCH)	ug/L	< 0.001			0.001	Pass	
beta-BHC (HCH)	ug/L	< 0.001			0.001	Pass	
delta-BHC (HCH)	ug/L	< 0.001			0.001	Pass	
Bifenthrin	ug/L	< 0.05			0.05	Pass	
Bromophos Ethyl	ug/L	< 0.005			0.005	Pass	
Chlordane	ug/L	< 0.002			0.002	Pass	
Chlorothalonil	ug/L	< 0.01			0.01	Pass	
Chlorpyrifos	ug/L	< 0.005			0.005	Pass	
Diazinon	ug/L	< 0.01			0.01	Pass	
Dieldrin	ug/L	< 0.001			0.001	Pass	
Endosulfan I	ug/L	< 0.001			0.001	Pass	
Endosulfan II	ug/L	< 0.001			0.001	Pass	
Endosulfan Sulfate	ug/L	< 0.001			0.001	Pass	
Endrin	ug/L	< 0.01			0.01	Pass	
Ethion	ug/L	< 0.01			0.01	Pass	
Fenitrothion	ug/L	< 0.01			0.01	Pass	
Fipronil	ug/L	< 0.02			0.02	Pass	
Hexachlorobenzene (HCB)	ug/L	< 0.001			0.001	Pass	
Heptachlor Epoxide	ug/L	< 0.001			0.001	Pass	
Heptachlor	ug/L	< 0.001			0.001	Pass	
Lindane	ug/L	< 0.001			0.001	Pass	
Malathion	ug/L	< 0.01			0.01	Pass	
Methoxychlor	ug/L	< 0.02			0.02	Pass	
o.p-DDT	ug/L	< 0.001			0.001	Pass	
Oxychlordane	ug/L	< 0.001			0.001	Pass	
p.p-DDD	ug/L	< 0.001			0.001	Pass	
p.p-DDE	ug/L	< 0.001			0.001	Pass	
p.p-DDT	ug/L	< 0.001			0.001	Pass	
Parathion Ethyl	ug/L	< 0.02			0.02	Pass	
Parathion Methyl	ug/L	< 0.02			0.02	Pass	
Trifluralin	ug/L	< 0.01			0.01	Pass	
Vinclozolin	ug/L	< 0.02			0.02	Pass	
Method Blank							
Carbamates							
Aldicarb	ug/L	< 1			1	Pass	
Aldicarb Sulfone	ug/L	< 1			1	Pass	
Aldicarb Sulfoxide	ug/L	< 1			1	Pass	
Aminocarb	ug/L	< 1			1	Pass	
Bromacil	ug/L	< 2			2	Pass	
Carbaryl	ug/L	< 4			4	Pass	
Carbendazim	ug/L	< 1			1	Pass	
Carbofuran	ug/L	< 1			1	Pass	
Diuron	ug/L	< 0.5			0.5	Pass	
EPTC	ug/L	< 5			5	Pass	
Fenamiphos	ug/L	< 0.1			0.1	Pass	
Fenuron/Fenuron TCA	ug/L	< 2			2	Pass	
Fluometuron	ug/L	< 1			1	Pass	
Linuron	ug/L	< 5			5	Pass	
Methiocarb	ug/L	< 4			4	Pass	

Test			Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Methomyl			ug/L	< 2			2	Pass	
Mexacarbate			ug/L	< 1			1	Pass	
Monuron/Monuron TCA			ug/L	< 2			2	Pass	
Oxamyl			ug/L	< 2			2	Pass	
Propachlor			ug/L	< 1			1	Pass	
Propham			ug/L	< 5			5	Pass	
Propoxur			ug/L	< 1			1	Pass	
Siduron			ug/L	< 1			1	Pass	
Method Blank									
NOx-N			mg/L	< 0.01			0.01	Pass	
Total Nitrogen			mg/L	< 0.2			0.2	Pass	
Total Phosphorus			mg/L	< 0.01			0.01	Pass	
Method Blank									
Heavy Metals									
Arsenic			mg/L	< 0.001			0.001	Pass	
Cadmium			mg/L	< 0.0001			0.0001	Pass	
Chromium			mg/L	< 0.001			0.001	Pass	
Copper			mg/L	< 0.001			0.001	Pass	
Lead			mg/L	< 0.001			0.001	Pass	
Mercury			mg/L	< 0.0001			0.0001	Pass	
Nickel			mg/L	< 0.001			0.001	Pass	
Zinc			mg/L	< 0.005			0.005	Pass	
LCS - % Recovery									
OCOP in Water									
Bifenthrin			%	120			60-120	Pass	
Endosulfan I			%	115			60-120	Pass	
Fipronil			%	82			60-120	Pass	
Malathion			%	105			60-120	Pass	
o.p-DDT			%	120			60-120	Pass	
Trifluralin			%	62			60-120	Pass	
LCS - % Recovery									
Heavy Metals									
Arsenic			%	112			80-120	Pass	
Cadmium			%	100			80-120	Pass	
Chromium			%	95			80-120	Pass	
Copper			%	90			80-120	Pass	
Lead			%	92			80-120	Pass	
Mercury			%	99			80-120	Pass	
Nickel			%	91			80-120	Pass	
Zinc			%	94			80-120	Pass	
Test	**Lab Sample ID**	**QA Source**	**Units**	**Result 1**			**Acceptance Limits**	**Pass Limits**	**Qualifying Code**
Spike - % Recovery									
				Result 1					
NOx-N	L23-No0025213	NCP	%	101			80-120	Pass	
Spike - % Recovery									
Heavy Metals				Result 1					
Arsenic	L23-No0024732	CP	%	111			75-125	Pass	
Cadmium	L23-No0024732	CP	%	107			75-125	Pass	
Chromium	L23-No0024732	CP	%	107			75-125	Pass	
Copper	L23-No0024732	CP	%	102			75-125	Pass	
Lead	L23-No0024732	CP	%	101			75-125	Pass	
Mercury	L23-No0024732	CP	%	111			75-125	Pass	
Nickel	L23-No0024732	CP	%	104			75-125	Pass	
Zinc	L23-No0024732	CP	%	105			75-125	Pass	

Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Spike - % Recovery									
Carbamates				Result 1					
Aldicarb	L23-No0024756	CP	%	96			60-120	Pass	
Aldicarb Sulfone	L23-No0024756	CP	%	96			60-120	Pass	
Aldicarb Sulfoxide	L23-No0024756	CP	%	91			60-120	Pass	
Aminocarb	L23-No0024756	CP	%	98			60-120	Pass	
Bromacil	L23-No0024756	CP	%	117			60-120	Pass	
Carbaryl	L23-No0024756	CP	%	99			60-120	Pass	
Carbendazim	L23-No0024756	CP	%	101			60-120	Pass	
Carbofuran	L23-No0024756	CP	%	97			60-120	Pass	
Diuron	L23-No0024756	CP	%	91			60-120	Pass	
EPTC	L23-No0024756	CP	%	95			60-120	Pass	
Fenamiphos	L23-No0024756	CP	%	112			60-120	Pass	
Fenuron/Fenuron TCA	L23-No0024756	CP	%	98			60-120	Pass	
Fluometuron	L23-No0024756	CP	%	87			60-120	Pass	
Linuron	L23-No0024756	CP	%	94			60-120	Pass	
Methiocarb	L23-No0024756	CP	%	116			60-120	Pass	
Methomyl	L23-No0024756	CP	%	91			60-120	Pass	
Mexacarbate	L23-No0024756	CP	%	100			60-120	Pass	
Monuron/Monuron TCA	L23-No0024756	CP	%	102			60-120	Pass	
Oxamyl	L23-No0024756	CP	%	100			60-120	Pass	
Propachlor	L23-No0024756	CP	%	111			60-120	Pass	
Propham	L23-No0024756	CP	%	105			60-120	Pass	
Propoxur	L23-No0024756	CP	%	100			60-120	Pass	
Siduron	L23-No0024756	CP	%	96			60-120	Pass	
Test	**Lab Sample ID**	**QA Source**	**Units**	**Result 1**			**Acceptance Limits**	**Pass Limits**	**Qualifying Code**
Duplicate									
				Result 1	Result 2	RPD			
NOx-N	L23-No0023778	NCP	mg/L	13	14	4.5	20%	Pass	
Duplicate									
Heavy Metals				Result 1	Result 2	RPD			
Arsenic	L23-No0023022	NCP	mg/L	0.002	0.002	<1	30%	Pass	
Cadmium	L23-No0023022	NCP	mg/L	< 0.0001	< 0.0001	<1	30%	Pass	
Chromium	L23-No0023022	NCP	mg/L	0.002	0.002	5.8	30%	Pass	
Copper	L23-No0023022	NCP	mg/L	0.002	0.002	<1	30%	Pass	
Lead	L23-No0023022	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Mercury	L23-No0023022	NCP	mg/L	< 0.0001	< 0.0001	<1	30%	Pass	
Nickel	L23-No0023022	NCP	mg/L	0.001	0.001	10.0	30%	Pass	
Zinc	L23-No0023022	NCP	mg/L	0.020	0.020	3.1	30%	Pass	
Duplicate									
Carbamates				Result 1	Result 2	RPD			
Aldicarb	L23-No0024744	CP	ug/L	< 1	< 1	<1	30%	Pass	
Aldicarb Sulfone	L23-No0024744	CP	ug/L	< 1	< 1	<1	30%	Pass	
Aldicarb Sulfoxide	L23-No0024744	CP	ug/L	< 1	< 1	<1	30%	Pass	
Aminocarb	L23-No0024744	CP	ug/L	< 1	< 1	<1	30%	Pass	
Bromacil	L23-No0024744	CP	ug/L	< 2	< 2	<1	30%	Pass	
Carbaryl	L23-No0024744	CP	ug/L	< 4	< 4	<1	30%	Pass	
Carbendazim	L23-No0024744	CP	ug/L	< 1	< 1	<1	30%	Pass	
Carbofuran	L23-No0024744	CP	ug/L	< 1	< 1	<1	30%	Pass	
Diuron	L23-No0024744	CP	ug/L	< 0.5	< 0.5	<1	30%	Pass	
EPTC	L23-No0024744	CP	ug/L	< 5	< 5	<1	30%	Pass	
Fenamiphos	L23-No0024744	CP	ug/L	< 0.1	< 0.1	<1	30%	Pass	
Fenuron/Fenuron TCA	L23-No0024744	CP	ug/L	< 2	< 2	<1	30%	Pass	
Fluometuron	L23-No0024744	CP	ug/L	< 1	< 1	<1	30%	Pass	

Duplicate									
Carbamates				Result 1	Result 2	RPD			
Linuron	L23-No0024744	CP	ug/L	< 5	< 5	<1	30%	Pass	
Methiocarb	L23-No0024744	CP	ug/L	< 4	< 4	<1	30%	Pass	
Methomyl	L23-No0024744	CP	ug/L	< 2	< 2	<1	30%	Pass	
Mexacarbate	L23-No0024744	CP	ug/L	< 1	< 1	<1	30%	Pass	
Monuron/Monuron TCA	L23-No0024744	CP	ug/L	< 2	< 2	<1	30%	Pass	
Oxamyl	L23-No0024744	CP	ug/L	< 2	< 2	<1	30%	Pass	
Propachlor	L23-No0024744	CP	ug/L	< 1	< 1	<1	30%	Pass	
Propham	L23-No0024744	CP	ug/L	< 5	< 5	<1	30%	Pass	
Propoxur	L23-No0024744	CP	ug/L	< 1	< 1	<1	30%	Pass	
Siduron	L23-No0024744	CP	ug/L	< 1	< 1	<1	30%	Pass	

Comments

Sample Integrity

Custody Seals Intact (if used)	N/A
Attempt to Chill was evident	Yes
Sample correctly preserved	Yes
Appropriate sample containers have been used	Yes
Sample containers for volatile analysis received with minimal headspace	Yes
Samples received within HoldingTime	N/A
Some samples have been subcontracted	No

Authorised by:

Natalie Hill	Analytical Services Manager
Douglas Todd	Senior Analyst-Metal
Paul Nottle	Senior Analyst-Organic
Sam Becker	Senior Analyst-Inorganic

Kim Rodgers
General Manager

Final Report – this report replaces any previously issued Report

- Indicates Not Requested

* Indicates NATA accreditation does not cover the performance of this service

Measurement uncertainty of test data is available on request

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Accreditation Number 2377
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Galt Environment P/L
50 Edward Street
Osborne Park
WA 6017

Attention: **- ALL SRA/Results**

Report **1045303-W**
Project name WATTLEUP
Project ID WAE230106
Received Date Nov 17, 2023

Client Sample ID			**MW01**	**MW02**	**MW03**	**QC19**
Sample Matrix			**Water**	**Water**	**Water**	**Water**
Eurofins Sample No.			**L23-No0042918**	**L23-No0042919**	**L23-No0042920**	**L23-No0042921**
Date Sampled			**Nov 15, 2023**	**Nov 15, 2023**	**Nov 15, 2023**	**Nov 15, 2023**
Test/Reference	LOR	Unit				
Organochlorine Pesticides						
Chlordanes - Total	0.002	mg/L	< 0.002	< 0.002	< 0.002	< 0.002
4.4'-DDD	0.0002	mg/L	< 0.0002	< 0.0002	< 0.0002	< 0.0002
4.4'-DDE	0.0002	mg/L	< 0.0002	< 0.0002	< 0.0002	< 0.0002
4.4'-DDT	0.0002	mg/L	< 0.0002	< 0.0002	< 0.0002	< 0.0002
a-HCH	0.0002	mg/L	< 0.0002	< 0.0002	< 0.0002	< 0.0002
Aldrin	0.0002	mg/L	< 0.0002	< 0.0002	< 0.0002	< 0.0002
b-HCH	0.0002	mg/L	< 0.0002	< 0.0002	< 0.0002	< 0.0002
d-HCH	0.0002	mg/L	< 0.0002	< 0.0002	< 0.0002	< 0.0002
Dieldrin	0.0002	mg/L	< 0.0002	< 0.0002	< 0.0002	< 0.0002
Endosulfan I	0.0002	mg/L	< 0.0002	< 0.0002	< 0.0002	< 0.0002
Endosulfan II	0.0002	mg/L	< 0.0002	< 0.0002	< 0.0002	< 0.0002
Endosulfan sulphate	0.0002	mg/L	< 0.0002	< 0.0002	< 0.0002	< 0.0002
Endrin	0.0002	mg/L	< 0.0002	< 0.0002	< 0.0002	< 0.0002
Endrin aldehyde	0.0002	mg/L	< 0.0002	< 0.0002	< 0.0002	< 0.0002
Endrin ketone	0.0002	mg/L	< 0.0002	< 0.0002	< 0.0002	< 0.0002
g-HCH (Lindane)	0.0002	mg/L	< 0.0002	< 0.0002	< 0.0002	< 0.0002
Heptachlor	0.0002	mg/L	< 0.0002	< 0.0002	< 0.0002	< 0.0002
Heptachlor epoxide	0.0002	mg/L	< 0.0002	< 0.0002	< 0.0002	< 0.0002
Hexachlorobenzene	0.0002	mg/L	< 0.0002	< 0.0002	< 0.0002	< 0.0002
Methoxychlor	0.0002	mg/L	< 0.0002	< 0.0002	< 0.0002	< 0.0002
Toxaphene	0.005	mg/L	< 0.005	< 0.005	< 0.005	< 0.005
Aldrin and Dieldrin (Total)*	0.0002	mg/L	< 0.0002	< 0.0002	< 0.0002	< 0.0002
DDT + DDE + DDD (Total)*	0.0002	mg/L	< 0.0002	< 0.0002	< 0.0002	< 0.0002
Vic EPA IWRG 621 OCP (Total)*	0.002	mg/L	< 0.002	< 0.002	< 0.002	< 0.002
Vic EPA IWRG 621 Other OCP (Total)*	0.002	mg/L	< 0.002	< 0.002	< 0.002	< 0.002
Dibutylchlorendate (surr.)	1	%	82	123	148	121
Tetrachloro-m-xylene (surr.)	1	%	68	135	89	81
Organophosphorus Pesticides						
Azinphos-methyl	0.002	mg/L	< 0.002	< 0.002	< 0.002	< 0.002
Bolstar	0.002	mg/L	< 0.002	< 0.002	< 0.002	< 0.002
Chlorfenvinphos	0.02	mg/L	< 0.02	< 0.02	< 0.02	< 0.02
Chlorpyrifos	0.002	mg/L	< 0.002	< 0.002	< 0.002	< 0.002
Chlorpyrifos-methyl	0.002	mg/L	< 0.002	< 0.002	< 0.002	< 0.002
Coumaphos	0.02	mg/L	< 0.02	< 0.02	< 0.02	< 0.02
Demeton-S	0.002	mg/L	< 0.002	< 0.002	< 0.002	< 0.002

Client Sample ID			MW01	MW02	MW03	QC19
Sample Matrix			Water	Water	Water	Water
Eurofins Sample No.			L23-No0042918	L23-No0042919	L23-No0042920	L23-No0042921
Date Sampled			Nov 15, 2023	Nov 15, 2023	Nov 15, 2023	Nov 15, 2023
Test/Reference	LOR	Unit				
Organophosphorus Pesticides						
Demeton-O	0.002	mg/L	< 0.002	< 0.002	< 0.002	< 0.002
Diazinon	0.002	mg/L	< 0.002	< 0.002	< 0.002	< 0.002
Dichlorvos	0.002	mg/L	< 0.002	< 0.002	< 0.002	< 0.002
Dimethoate	0.002	mg/L	< 0.002	< 0.002	< 0.002	< 0.002
Disulfoton	0.002	mg/L	< 0.002	< 0.002	< 0.002	< 0.002
EPN	0.002	mg/L	< 0.002	< 0.002	< 0.002	< 0.002
Ethion	0.002	mg/L	< 0.002	< 0.002	< 0.002	< 0.002
Ethoprop	0.002	mg/L	< 0.002	< 0.002	< 0.002	< 0.002
Ethyl parathion	0.002	mg/L	< 0.002	< 0.002	< 0.002	< 0.002
Fenitrothion	0.002	mg/L	< 0.002	< 0.002	< 0.002	< 0.002
Fensulfothion	0.002	mg/L	< 0.002	< 0.002	< 0.002	< 0.002
Fenthion	0.002	mg/L	< 0.002	< 0.002	< 0.002	< 0.002
Malathion	0.002	mg/L	< 0.002	< 0.002	< 0.002	< 0.002
Merphos	0.002	mg/L	< 0.002	< 0.002	< 0.002	< 0.002
Methyl parathion	0.002	mg/L	< 0.002	< 0.002	< 0.002	< 0.002
Mevinphos	0.002	mg/L	< 0.002	< 0.002	< 0.002	< 0.002
Monocrotophos	0.002	mg/L	< 0.002	< 0.002	< 0.002	< 0.002
Naled	0.002	mg/L	< 0.002	< 0.002	< 0.002	< 0.002
Omethoate	0.02	mg/L	< 0.02	< 0.02	< 0.02	< 0.02
Phorate	0.002	mg/L	< 0.002	< 0.002	< 0.002	< 0.002
Pirimiphos-methyl	0.02	mg/L	< 0.02	< 0.02	< 0.02	< 0.02
Pyrazophos	0.002	mg/L	< 0.002	< 0.002	< 0.002	< 0.002
Ronnel	0.002	mg/L	< 0.002	< 0.002	< 0.002	< 0.002
Terbufos	0.002	mg/L	< 0.002	< 0.002	< 0.002	< 0.002
Tetrachlorvinphos	0.002	mg/L	< 0.002	< 0.002	< 0.002	< 0.002
Tokuthion	0.002	mg/L	< 0.002	< 0.002	< 0.002	< 0.002
Trichloronate	0.002	mg/L	< 0.002	< 0.002	< 0.002	< 0.002
Triphenylphosphate (surr.)	1	%	85	129	143	134
Carbamates						
Aldicarb	1	ug/L	< 1	< 1	< 1	< 1
Aldicarb Sulfone	1	ug/L	< 1	< 1	< 1	< 1
Aldicarb Sulfoxide	1	ug/L	< 1	< 1	< 1	< 1
Aminocarb	1	ug/L	< 1	< 1	< 1	< 1
Bromacil	2	ug/L	< 2	< 2	< 2	< 2
Carbaryl	4	ug/L	< 4	< 4	< 4	< 4
Carbendazim	1	ug/L	< 1	< 1	< 1	< 1
Carbofuran	1	ug/L	< 1	< 1	< 1	< 1
Diuron	0.5	ug/L	< 0.5	< 0.5	< 0.5	< 0.5
EPTC	5	ug/L	< 5	< 5	< 5	< 5
Fenamiphos	0.1	ug/L	< 0.1	< 0.1	< 0.1	< 0.1
Fenuron/Fenuron TCA	2	ug/L	< 2	< 2	< 2	< 2
Fluometuron	1	ug/L	< 1	< 1	< 1	< 1
Linuron	5	ug/L	< 5	< 5	< 5	< 5
Methiocarb	4	ug/L	< 4	< 4	< 4	< 4
Methomyl	2	ug/L	< 2	< 2	< 2	< 2
Mexacarbate	1	ug/L	< 1	< 1	< 1	< 1
Monuron/Monuron TCA	2	ug/L	< 2	< 2	< 2	< 2
Oxamyl	2	ug/L	< 2	< 2	< 2	< 2
Propachlor	1	ug/L	< 1	< 1	< 1	< 1

Client Sample ID			MW01	MW02	MW03	QC19
Sample Matrix			Water	Water	Water	Water
Eurofins Sample No.			L23-No0042918	L23-No0042919	L23-No0042920	L23-No0042921
Date Sampled			Nov 15, 2023	Nov 15, 2023	Nov 15, 2023	Nov 15, 2023
Test/Reference	LOR	Unit				
Carbamates						
Propham	5	ug/L	< 5	< 5	< 5	< 5
Propoxur	1	ug/L	< 1	< 1	< 1	< 1
Siduron	1	ug/L	< 1	< 1	< 1	< 1
NOx-N	0.01	mg/L	0.01	5.5	9.6	6.1
Total Kjeldahl Nitrogen	0.2	mg/L	4.4	< 0.2	< 0.2	< 0.2
Total Nitrogen	0.2	mg/L	4.4	5.5	9.6	6.1
Total Phosphorus	0.01	mg/L	0.49	0.05	0.33	0.05
Heavy Metals						
Arsenic	0.001	mg/L	0.004	0.002	< 0.001	0.002
Cadmium	0.0001	mg/L	0.0003	< 0.0001	< 0.0001	< 0.0001
Chromium	0.001	mg/L	0.28	0.032	0.027	0.023
Copper	0.001	mg/L	0.19	0.008	0.001	0.009
Lead	0.001	mg/L	0.014	0.015	0.047	0.013
Mercury	0.0001	mg/L	< 0.0001	< 0.0001	0.0001	< 0.0001
Nickel	0.001	mg/L	0.091	0.008	0.002	0.008
Zinc	0.005	mg/L	0.24	0.015	0.007	0.016

Client Sample ID			QC20	QC21
Sample Matrix			Water	Water
Eurofins Sample No.			L23-No0042922	L23-No0042923
Date Sampled			Nov 15, 2023	Nov 15, 2023
Test/Reference	LOR	Unit		
Organochlorine Pesticides				
Chlordanes - Total	0.002	mg/L	< 0.002	< 0.002
4.4'-DDD	0.0002	mg/L	< 0.0002	< 0.0002
4.4'-DDE	0.0002	mg/L	< 0.0002	< 0.0002
4.4'-DDT	0.0002	mg/L	< 0.0002	< 0.0002
a-HCH	0.0002	mg/L	< 0.0002	< 0.0002
Aldrin	0.0002	mg/L	< 0.0002	< 0.0002
b-HCH	0.0002	mg/L	< 0.0002	< 0.0002
d-HCH	0.0002	mg/L	< 0.0002	< 0.0002
Dieldrin	0.0002	mg/L	< 0.0002	< 0.0002
Endosulfan I	0.0002	mg/L	< 0.0002	< 0.0002
Endosulfan II	0.0002	mg/L	< 0.0002	< 0.0002
Endosulfan sulphate	0.0002	mg/L	< 0.0002	< 0.0002
Endrin	0.0002	mg/L	< 0.0002	< 0.0002
Endrin aldehyde	0.0002	mg/L	< 0.0002	< 0.0002
Endrin ketone	0.0002	mg/L	< 0.0002	< 0.0002
g-HCH (Lindane)	0.0002	mg/L	< 0.0002	< 0.0002
Heptachlor	0.0002	mg/L	< 0.0002	< 0.0002
Heptachlor epoxide	0.0002	mg/L	< 0.0002	< 0.0002
Hexachlorobenzene	0.0002	mg/L	< 0.0002	< 0.0002
Methoxychlor	0.0002	mg/L	< 0.0002	< 0.0002
Toxaphene	0.005	mg/L	< 0.005	< 0.005
Aldrin and Dieldrin (Total)*	0.0002	mg/L	< 0.0002	< 0.0002
DDT + DDE + DDD (Total)*	0.0002	mg/L	< 0.0002	< 0.0002

Client Sample ID			QC20	QC21
Sample Matrix			Water	Water
Eurofins Sample No.			L23-No0042922	L23-No0042923
Date Sampled			Nov 15, 2023	Nov 15, 2023
Test/Reference	LOR	Unit		
Organochlorine Pesticides				
Vic EPA IWRG 621 OCP (Total)*	0.002	mg/L	< 0.002	< 0.002
Vic EPA IWRG 621 Other OCP (Total)*	0.002	mg/L	< 0.002	< 0.002
Dibutylchlorendate (surr.)	1	%	147	95
Tetrachloro-m-xylene (surr.)	1	%	89	59
Organophosphorus Pesticides				
Azinphos-methyl	0.002	mg/L	< 0.002	< 0.002
Bolstar	0.002	mg/L	< 0.002	< 0.002
Chlorfenvinphos	0.02	mg/L	< 0.02	< 0.02
Chlorpyrifos	0.002	mg/L	< 0.002	< 0.002
Chlorpyrifos-methyl	0.002	mg/L	< 0.002	< 0.002
Coumaphos	0.02	mg/L	< 0.02	< 0.02
Demeton-S	0.002	mg/L	< 0.002	< 0.002
Demeton-O	0.002	mg/L	< 0.002	< 0.002
Diazinon	0.002	mg/L	< 0.002	< 0.002
Dichlorvos	0.002	mg/L	< 0.002	< 0.002
Dimethoate	0.002	mg/L	< 0.002	< 0.002
Disulfoton	0.002	mg/L	< 0.002	< 0.002
EPN	0.002	mg/L	< 0.002	< 0.002
Ethion	0.002	mg/L	< 0.002	< 0.002
Ethoprop	0.002	mg/L	< 0.002	< 0.002
Ethyl parathion	0.002	mg/L	< 0.002	< 0.002
Fenitrothion	0.002	mg/L	< 0.002	< 0.002
Fensulfothion	0.002	mg/L	< 0.002	< 0.002
Fenthion	0.002	mg/L	< 0.002	< 0.002
Malathion	0.002	mg/L	< 0.002	< 0.002
Merphos	0.002	mg/L	< 0.002	< 0.002
Methyl parathion	0.002	mg/L	< 0.002	< 0.002
Mevinphos	0.002	mg/L	< 0.002	< 0.002
Monocrotophos	0.002	mg/L	< 0.002	< 0.002
Naled	0.002	mg/L	< 0.002	< 0.002
Omethoate	0.02	mg/L	< 0.02	< 0.02
Phorate	0.002	mg/L	< 0.002	< 0.002
Pirimiphos-methyl	0.02	mg/L	< 0.02	< 0.02
Pyrazophos	0.002	mg/L	< 0.002	< 0.002
Ronnel	0.002	mg/L	< 0.002	< 0.002
Terbufos	0.002	mg/L	< 0.002	< 0.002
Tetrachlorvinphos	0.002	mg/L	< 0.002	< 0.002
Tokuthion	0.002	mg/L	< 0.002	< 0.002
Trichloronate	0.002	mg/L	< 0.002	< 0.002
Triphenylphosphate (surr.)	1	%	82	56
Carbamates				
Aldicarb	1	ug/L	< 1	< 1
Aldicarb Sulfone	1	ug/L	< 1	< 1
Aldicarb Sulfoxide	1	ug/L	< 1	< 1
Aminocarb	1	ug/L	< 1	< 1
Bromacil	2	ug/L	< 2	< 2
Carbaryl	4	ug/L	< 4	< 4
Carbendazim	1	ug/L	< 1	< 1
Carbofuran	1	ug/L	< 1	< 1

Client Sample ID			QC20	QC21
Sample Matrix			Water	Water
Eurofins Sample No.			L23-No0042922	L23-No0042923
Date Sampled			Nov 15, 2023	Nov 15, 2023
Test/Reference	LOR	Unit		
Carbamates				
Diuron	0.5	ug/L	< 0.5	< 0.5
EPTC	5	ug/L	< 5	< 5
Fenamiphos	0.1	ug/L	< 0.1	< 0.1
Fenuron/Fenuron TCA	2	ug/L	< 2	< 2
Fluometuron	1	ug/L	< 1	< 1
Linuron	5	ug/L	< 5	< 5
Methiocarb	4	ug/L	< 4	< 4
Methomyl	2	ug/L	< 2	< 2
Mexacarbate	1	ug/L	< 1	< 1
Monuron/Monuron TCA	2	ug/L	< 2	< 2
Oxamyl	2	ug/L	< 2	< 2
Propachlor	1	ug/L	< 1	< 1
Propham	5	ug/L	< 5	< 5
Propoxur	1	ug/L	< 1	< 1
Siduron	1	ug/L	< 1	< 1
NOx-N	0.01	mg/L	< 0.01	< 0.01
Total Kjeldahl Nitrogen	0.2	mg/L	< 0.2	< 0.2
Total Nitrogen	0.2	mg/L	< 0.2	< 0.2
Total Phosphorus	0.01	mg/L	< 0.01	< 0.01
Heavy Metals				
Arsenic	0.001	mg/L	< 0.001	< 0.001
Cadmium	0.0001	mg/L	< 0.0001	< 0.0001
Chromium	0.001	mg/L	< 0.001	< 0.001
Copper	0.001	mg/L	< 0.001	< 0.001
Lead	0.001	mg/L	< 0.001	< 0.001
Mercury	0.0001	mg/L	< 0.0001	< 0.0001
Nickel	0.001	mg/L	< 0.001	< 0.001
Zinc	0.005	mg/L	< 0.005	< 0.005

Sample History

Where samples are submitted/analysed over several days, the last date of extraction is reported.

If the date and time of sampling are not provided, the Laboratory will not be responsible for compromised results should testing be performed outside the recommended holding time.

Description	Testing Site	Extracted	Holding Time
Suite B14: OCP/OPP			
Organochlorine Pesticides	Melbourne	Nov 20, 2023	7 Days
- Method: LTM-ORG-2220 OCP & PCB in Soil and Water (USEPA 8270)			
Organophosphorus Pesticides	Melbourne	Nov 20, 2023	7 Days
- Method: LTM-ORG-2200 Organophosphorus Pesticides by GC-MS (USEPA 8270)			
Carbamates	Welshpool	Nov 20, 2023	14 Days
- Method: SOP #6 Analysis of Volatile Organic Compounds in Passivated Canisters EPA Method TO-15			
Metals M8	Welshpool	Nov 20, 2023	28 Days
- Method: LTM-MET-3040 Metals in Waters, Soils & Sediments by ICP-MS			
NOx-N	Welshpool	Nov 20, 2023	28 Days
- Method: ARL313/319 - NOx in Water by Discrete Analyser			
Total Kjeldahl Nitrogen	Welshpool	Nov 17, 2023	28 Day
- Method: ARL No. 330 - Persulfate Method for Simultaneous Determination of TN & TP			
Total Nitrogen	Welshpool	Nov 20, 2023	28 Days
- Method: ARL No. 330 - Persulfate Method for Simultaneous Determination of TN & TP			
Total Phosphorus	Welshpool	Nov 20, 2023	28 Days
- Method: ARL308 - Total Phosphorus in Water by Discrete Analyser			

eurofins

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Company Name:	Galt Environment P/L	**Order No.:**	WAE230106	**Received:**	Nov 17, 2023 12:34 PM
Address:	50 Edward Street Osborne Park WA 6017	**Report #:**	1045303	**Due:**	Nov 24, 2023
		Phone:	08 6272 0200	**Priority:**	5 Day
		Fax:	08 9285 8444	**Contact Name:**	- ALL SRA/Results
Project Name:	WATTLEUP				
Project ID:	WAE230106				

Eurofins Analytical Services Manager : Natalie Hill

Sample Detail						Metals M8	Suite B14: OCP/OPP	Carbamates	Eurofins Suite B19A
Perth Laboratory - NATA # 2377 Site # 2370						X		X	X
Melbourne Laboratory - NATA # 1261 Site # 1254							X		
External Laboratory									
No	**Sample ID**	**Sample Date**	**Sampling Time**	**Matrix**	**LAB ID**				
1	MW01	Nov 15, 2023		Water	L23-No0042918	X	X	X	X
2	MW02	Nov 15, 2023		Water	L23-No0042919	X	X	X	X
3	MW03	Nov 15, 2023		Water	L23-No0042920	X	X	X	X
4	QC19	Nov 15, 2023		Water	L23-No0042921	X	X	X	X
5	QC20	Nov 15, 2023		Water	L23-No0042922	X	X	X	X
6	QC21	Nov 15, 2023		Water	L23-No0042923	X	X	X	X
Test Counts						6	6	6	6

Internal Quality Control Review and Glossary

General

1. Laboratory QC results for Method Blanks, Duplicates, Matrix Spikes, and Laboratory Control Samples follow guidelines delineated in the National Environment Protection (Assessment of Site Contamination) Measure 1999, as amended May 2013. They are included in this QC report where applicable. Additional QC data may be available on request.
2. All soil/sediment/solid results are reported on a dry weight basis unless otherwise stated.
3. All biota/food results are reported on a wet weight basis on the edible portion unless otherwise stated.
4. For CEC results where the sample's origin is unknown or environmentally contaminated, the results should be used advisedly.
5. Actual LORs are matrix dependent. Quoted LORs may be raised where sample extracts are diluted due to interferences.
6. Results are uncorrected for matrix spikes or surrogate recoveries except for PFAS compounds.
7. SVOC analysis on waters is performed on homogenised, unfiltered samples unless noted otherwise.
8. Samples were analysed on an 'as received' basis.
9. Information identified in this report with blue colour indicates data provided by customers that may have an impact on the results.
10. This report replaces any interim results previously issued.

Holding Times

Please refer to the 'Sample Preservation and Container Guide' for holding times (QS3001).

For samples received on the last day of holding time, notification of testing requirements should have been received at least 6 hours before sample receipt deadlines as stated on the SRA.

If the Laboratory did not receive the information in the required timeframe, and despite any other integrity issues, suitably qualified results may still be reported.

Holding times apply from the date of sampling; therefore, compliance with these may be outside the laboratory's control.

For VOCs containing vinyl chloride, styrene and 2-chloroethyl vinyl ether, the holding time is 7 days; however, for all other VOCs, such as BTEX or C6-10 TRH, the holding time is 14 days.

Units

mg/kg: milligrams per kilogram
mg/L: milligrams per litre
µg/L: micrograms per litre
ppm: parts per million
ppb: parts per billion
%: Percentage
org/100 mL: Organisms per 100 millilitres
NTU: Nephelometric Turbidity Units
MPN/100 mL: Most Probable Number of organisms per 100 millilitres
CFU: Colony forming unit

Terms

APHA	American Public Health Association
CEC	Cation Exchange Capacity
COC	Chain of Custody
CP	Client Parent - QC was performed on samples pertaining to this report
CRM	Certified Reference Material (ISO17034) - reported as percent recovery.
Dry	Where moisture has been determined on a solid sample, the result is expressed on a dry weight basis.
Duplicate	A second piece of analysis from the same sample and reported in the same units as the result to show comparison.
LOR	Limit of Reporting.
LCS	Laboratory Control Sample - reported as percent recovery.
Method Blank	In the case of solid samples, these are performed on laboratory-certified clean sands and in the case of water samples, these are performed on de-ionised water.
NCP	Non-Client Parent - QC performed on samples not pertaining to this report, QC represents the sequence or batch that client samples were analysed within.
RPD	Relative Percent Difference between two Duplicate pieces of analysis.
SPIKE	Addition of the analyte to the sample and reported as percentage recovery.
SRA	Sample Receipt Advice
Surr - Surrogate	The addition of a like compound to the analyte target and reported as percentage recovery.
TBTO	Tributyltin oxide (*bis*-tributyltin oxide) - individual tributyltin compounds cannot be identified separately in the environment; however free tributyltin was measured, and its values were converted stoichiometrically into tributyltin oxide for comparison with regulatory limits.
TCLP	Toxicity Characteristic Leaching Procedure
TEQ	Toxic Equivalency Quotient or Total Equivalence
QSM	US Department of Defense Quality Systems Manual Version 5.4
US EPA	United States Environmental Protection Agency
WA DWER	Sum of PFBA, PFPeA, PFHxA, PFHpA, PFOA, PFBS, PFHxS, PFOS, 6:2 FTSA, 8:2 FTSA

QC - Acceptance Criteria

The acceptance criteria should be used as a guide only and may be different when site-specific Sampling Analysis and Quality Plan (SAQP) have been implemented.

RPD Duplicates: Global RPD Duplicates Acceptance Criteria is 30%; however the following acceptance guidelines are equally applicable: Results <10 times the LOR: No Limit

Results between 10-20 times the LOR: RPD must lie between 0-50%

Results >20 times the LOR: RPD must lie between 0-30%

NOTE: pH duplicates are reported as a range, not as RPD

Surrogate Recoveries: Recoveries must lie between 20-130% for Speciated Phenols & 50-150% for PFAS. SVOCs recoveries 20 – 150%

PFAS field samples that contain surrogate recoveries above the QC limit designated in QSM 5.4, where no positive PFAS results have been reported, have been reviewed, and no data was affected.

QC Data General Comments

1. Where a result is reported as less than (<), higher than the nominated LOR, this is due to either matrix interference, extract dilution required due to interferences or contaminant levels within the sample, high moisture content or insufficient sample provided.
2. Duplicate data shown within this report that states the word "BATCH" is a Batch Duplicate from outside of your sample batch but within the laboratory sample batch at a 1:10 ratio. The Parent and Duplicate data shown are not data from your samples.
3. pH and Free Chlorine analysed in the laboratory - Analysis on this test must begin within 30 minutes of sampling. Therefore, laboratory analysis is unlikely to be completed within holding time.Analysis will begin as soon as possible after sample receipt.
4. Recovery Data (Spikes & Surrogates) - where chromatographic interference does not allow the determination of recovery, the term "INT" appears against that analyte.
5. For Matrix Spikes and LCS results, a dash "-" in the report means that the specific analyte was not added to the QC sample.
6. Duplicate RPDs are calculated from raw analytical data; thus, it is possible to have two sets of data.

Quality Control Results

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Method Blank							
Organochlorine Pesticides							
Chlordanes - Total	mg/L	< 0.002			0.002	Pass	
4.4'-DDD	mg/L	< 0.0002			0.0002	Pass	
4.4'-DDE	mg/L	< 0.0002			0.0002	Pass	
4.4'-DDT	mg/L	< 0.0002			0.0002	Pass	
a-HCH	mg/L	< 0.0002			0.0002	Pass	
Aldrin	mg/L	< 0.0002			0.0002	Pass	
b-HCH	mg/L	< 0.0002			0.0002	Pass	
d-HCH	mg/L	< 0.0002			0.0002	Pass	
Dieldrin	mg/L	< 0.0002			0.0002	Pass	
Endosulfan I	mg/L	< 0.0002			0.0002	Pass	
Endosulfan II	mg/L	< 0.0002			0.0002	Pass	
Endosulfan sulphate	mg/L	< 0.0002			0.0002	Pass	
Endrin	mg/L	< 0.0002			0.0002	Pass	
Endrin aldehyde	mg/L	< 0.0002			0.0002	Pass	
Endrin ketone	mg/L	< 0.0002			0.0002	Pass	
g-HCH (Lindane)	mg/L	< 0.0002			0.0002	Pass	
Heptachlor	mg/L	< 0.0002			0.0002	Pass	
Heptachlor epoxide	mg/L	< 0.0002			0.0002	Pass	
Hexachlorobenzene	mg/L	< 0.0002			0.0002	Pass	
Methoxychlor	mg/L	< 0.0002			0.0002	Pass	
Toxaphene	mg/L	< 0.005			0.005	Pass	
Method Blank							
Organophosphorus Pesticides							
Azinphos-methyl	mg/L	< 0.002			0.002	Pass	
Bolstar	mg/L	< 0.002			0.002	Pass	
Chlorfenvinphos	mg/L	< 0.02			0.02	Pass	
Chlorpyrifos	mg/L	< 0.002			0.002	Pass	
Chlorpyrifos-methyl	mg/L	< 0.002			0.002	Pass	
Coumaphos	mg/L	< 0.02			0.02	Pass	
Demeton-S	mg/L	< 0.002			0.002	Pass	
Demeton-O	mg/L	< 0.002			0.002	Pass	
Diazinon	mg/L	< 0.002			0.002	Pass	
Dichlorvos	mg/L	< 0.002			0.002	Pass	
Dimethoate	mg/L	< 0.002			0.002	Pass	
Disulfoton	mg/L	< 0.002			0.002	Pass	
EPN	mg/L	< 0.002			0.002	Pass	
Ethion	mg/L	< 0.002			0.002	Pass	
Ethoprop	mg/L	< 0.002			0.002	Pass	
Ethyl parathion	mg/L	< 0.002			0.002	Pass	
Fenitrothion	mg/L	< 0.002			0.002	Pass	
Fensulfothion	mg/L	< 0.002			0.002	Pass	
Fenthion	mg/L	< 0.002			0.002	Pass	
Malathion	mg/L	< 0.002			0.002	Pass	
Merphos	mg/L	< 0.002			0.002	Pass	
Methyl parathion	mg/L	< 0.002			0.002	Pass	
Mevinphos	mg/L	< 0.002			0.002	Pass	
Monocrotophos	mg/L	< 0.002			0.002	Pass	
Naled	mg/L	< 0.002			0.002	Pass	
Omethoate	mg/L	< 0.02			0.02	Pass	
Phorate	mg/L	< 0.002			0.002	Pass	

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Pirimiphos-methyl	mg/L	< 0.02			0.02	Pass	
Pyrazophos	mg/L	< 0.002			0.002	Pass	
Ronnel	mg/L	< 0.002			0.002	Pass	
Terbufos	mg/L	< 0.002			0.002	Pass	
Tetrachlorvinphos	mg/L	< 0.002			0.002	Pass	
Tokuthion	mg/L	< 0.002			0.002	Pass	
Trichloronate	mg/L	< 0.002			0.002	Pass	
Method Blank							
Carbamates							
Aldicarb	ug/L	< 1			1	Pass	
Aldicarb Sulfone	ug/L	< 1			1	Pass	
Aldicarb Sulfoxide	ug/L	< 1			1	Pass	
Aminocarb	ug/L	< 1			1	Pass	
Bromacil	ug/L	< 2			2	Pass	
Carbaryl	ug/L	< 4			4	Pass	
Carbendazim	ug/L	< 1			1	Pass	
Carbofuran	ug/L	< 1			1	Pass	
Diuron	ug/L	< 0.5			0.5	Pass	
EPTC	ug/L	< 5			5	Pass	
Fenamiphos	ug/L	< 0.1			0.1	Pass	
Fenuron/Fenuron TCA	ug/L	< 2			2	Pass	
Fluometuron	ug/L	< 1			1	Pass	
Linuron	ug/L	< 5			5	Pass	
Methiocarb	ug/L	< 4			4	Pass	
Methomyl	ug/L	< 2			2	Pass	
Mexacarbate	ug/L	< 1			1	Pass	
Monuron/Monuron TCA	ug/L	< 2			2	Pass	
Oxamyl	ug/L	< 2			2	Pass	
Propachlor	ug/L	< 1			1	Pass	
Propham	ug/L	< 5			5	Pass	
Propoxur	ug/L	< 1			1	Pass	
Siduron	ug/L	< 1			1	Pass	
Method Blank							
NOx-N	mg/L	< 0.01			0.01	Pass	
Total Nitrogen	mg/L	< 0.2			0.2	Pass	
Total Phosphorus	mg/L	< 0.01			0.01	Pass	
Method Blank							
Heavy Metals							
Arsenic	mg/L	< 0.001			0.001	Pass	
Cadmium	mg/L	< 0.0001			0.0001	Pass	
Chromium	mg/L	< 0.001			0.001	Pass	
Copper	mg/L	< 0.001			0.001	Pass	
Lead	mg/L	< 0.001			0.001	Pass	
Mercury	mg/L	< 0.0001			0.0001	Pass	
Nickel	mg/L	< 0.001			0.001	Pass	
Zinc	mg/L	< 0.005			0.005	Pass	
LCS - % Recovery							
Organochlorine Pesticides							
Chlordanes - Total	%	108			70-130	Pass	
4.4'-DDD	%	101			70-130	Pass	
4.4'-DDE	%	80			70-130	Pass	
4.4'-DDT	%	83			70-130	Pass	
a-HCH	%	121			70-130	Pass	
Aldrin	%	129			70-130	Pass	

Test			Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
b-HCH			%	114			70-130	Pass	
d-HCH			%	82			70-130	Pass	
Dieldrin			%	103			70-130	Pass	
Endosulfan I			%	123			70-130	Pass	
Endosulfan II			%	91			70-130	Pass	
Endosulfan sulphate			%	83			70-130	Pass	
Endrin			%	107			70-130	Pass	
Endrin aldehyde			%	103			70-130	Pass	
Endrin ketone			%	103			70-130	Pass	
g-HCH (Lindane)			%	107			70-130	Pass	
Heptachlor			%	114			70-130	Pass	
Heptachlor epoxide			%	104			70-130	Pass	
Hexachlorobenzene			%	112			70-130	Pass	
Methoxychlor			%	129			70-130	Pass	
LCS - % Recovery									
Organophosphorus Pesticides									
Diazinon			%	100			70-130	Pass	
Dimethoate			%	82			70-130	Pass	
Ethion			%	84			70-130	Pass	
Fenitrothion			%	82			70-130	Pass	
Methyl parathion			%	107			70-130	Pass	
Mevinphos			%	87			70-130	Pass	
LCS - % Recovery									
Heavy Metals									
Arsenic			%	103			80-120	Pass	
Cadmium			%	94			80-120	Pass	
Chromium			%	95			80-120	Pass	
Copper			%	87			80-120	Pass	
Lead			%	90			80-120	Pass	
Mercury			%	96			80-120	Pass	
Nickel			%	88			80-120	Pass	
Zinc			%	91			80-120	Pass	
CRM - % Recovery									
NOx-N			%	107			80-120	Pass	
Total Nitrogen			%	92			80-120	Pass	
Total Phosphorus			%	98			80-120	Pass	
Test	**Lab Sample ID**	**QA Source**	**Units**	**Result 1**			**Acceptance Limits**	**Pass Limits**	**Qualifying Code**
Spike - % Recovery									
Organochlorine Pesticides				Result 1					
Chlordanes - Total	S23-No0038563	NCP	%	81			70-130	Pass	
4.4'-DDD	S23-No0038563	NCP	%	89			70-130	Pass	
4.4'-DDE	S23-No0038563	NCP	%	87			70-130	Pass	
4.4'-DDT	S23-No0038563	NCP	%	91			70-130	Pass	
a-HCH	S23-No0038563	NCP	%	81			70-130	Pass	
Aldrin	S23-No0038563	NCP	%	80			70-130	Pass	
b-HCH	S23-No0038563	NCP	%	96			70-130	Pass	
d-HCH	S23-No0038563	NCP	%	102			70-130	Pass	
Dieldrin	S23-No0038563	NCP	%	89			70-130	Pass	
Endosulfan I	S23-No0038563	NCP	%	84			70-130	Pass	
Endosulfan II	S23-No0038563	NCP	%	75			70-130	Pass	
Endosulfan sulphate	S23-No0038563	NCP	%	97			70-130	Pass	
Endrin	S23-No0038563	NCP	%	99			70-130	Pass	
Endrin aldehyde	S23-No0038563	NCP	%	80			70-130	Pass	
Endrin ketone	S23-No0038563	NCP	%	90			70-130	Pass	

Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
g-HCH (Lindane)	S23-No0038563	NCP	%	88			70-130	Pass	
Heptachlor	S23-No0038563	NCP	%	91			70-130	Pass	
Heptachlor epoxide	S23-No0038563	NCP	%	90			70-130	Pass	
Hexachlorobenzene	S23-No0038563	NCP	%	88			70-130	Pass	
Methoxychlor	S23-No0038563	NCP	%	85			70-130	Pass	
Spike - % Recovery									
Organophosphorus Pesticides				Result 1					
Diazinon	M23-No0021430	NCP	%	106			70-130	Pass	
Dimethoate	M23-No0021430	NCP	%	86			70-130	Pass	
Ethion	M23-No0021430	NCP	%	114			70-130	Pass	
Fenitrothion	M23-No0021430	NCP	%	115			70-130	Pass	
Methyl parathion	M23-No0021430	NCP	%	111			70-130	Pass	
Mevinphos	M23-No0021430	NCP	%	114			70-130	Pass	
Spike - % Recovery									
Carbamates				Result 1					
Aldicarb	L23-No0042918	CP	%	101			60-120	Pass	
Aldicarb Sulfone	L23-No0042918	CP	%	91			60-120	Pass	
Aldicarb Sulfoxide	L23-No0042918	CP	%	89			60-120	Pass	
Aminocarb	L23-No0042918	CP	%	90			60-120	Pass	
Bromacil	L23-No0042918	CP	%	98			60-120	Pass	
Carbaryl	L23-No0042918	CP	%	89			60-120	Pass	
Carbendazim	L23-No0042918	CP	%	90			60-120	Pass	
Carbofuran	L23-No0042918	CP	%	85			60-120	Pass	
Diuron	L23-No0042918	CP	%	85			60-120	Pass	
EPTC	L23-No0042918	CP	%	81			60-120	Pass	
Fenamiphos	L23-No0042918	CP	%	95			60-120	Pass	
Fenuron/Fenuron TCA	L23-No0042918	CP	%	95			60-120	Pass	
Fluometuron	L23-No0042918	CP	%	87			60-120	Pass	
Linuron	L23-No0042918	CP	%	96			60-120	Pass	
Methiocarb	L23-No0042918	CP	%	91			60-120	Pass	
Methomyl	L23-No0042918	CP	%	95			60-120	Pass	
Mexacarbate	L23-No0042918	CP	%	89			60-120	Pass	
Monuron/Monuron TCA	L23-No0042918	CP	%	92			60-120	Pass	
Oxamyl	L23-No0042918	CP	%	89			60-120	Pass	
Propachlor	L23-No0042918	CP	%	94			60-120	Pass	
Propham	L23-No0042918	CP	%	97			60-120	Pass	
Propoxur	L23-No0042918	CP	%	87			60-120	Pass	
Siduron	L23-No0042918	CP	%	85			60-120	Pass	
Spike - % Recovery									
				Result 1					
NOx-N	S23-No0049803	NCP	%	93			80-120	Pass	
Spike - % Recovery									
Heavy Metals				Result 1					
Arsenic	L23-No0042921	CP	%	110			75-125	Pass	
Cadmium	L23-No0042921	CP	%	102			75-125	Pass	
Chromium	L23-No0042921	CP	%	106			75-125	Pass	
Copper	L23-No0042921	CP	%	96			75-125	Pass	
Lead	L23-No0042921	CP	%	97			75-125	Pass	
Mercury	L23-No0042921	CP	%	110			75-125	Pass	
Nickel	L23-No0042921	CP	%	97			75-125	Pass	
Zinc	L23-No0042921	CP	%	100			75-125	Pass	

Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Duplicate									
Organochlorine Pesticides				Result 1	Result 2	RPD			
Chlordanes - Total	M23-No0044620	NCP	mg/L	< 0.002	< 0.002	<1	30%	Pass	
4.4'-DDD	M23-No0044620	NCP	mg/L	< 0.0002	< 0.0002	<1	30%	Pass	
4.4'-DDE	M23-No0044620	NCP	mg/L	< 0.0002	< 0.0002	<1	30%	Pass	
4.4'-DDT	M23-No0044620	NCP	mg/L	< 0.0002	< 0.0002	<1	30%	Pass	
a-HCH	M23-No0044620	NCP	mg/L	< 0.0002	< 0.0002	<1	30%	Pass	
Aldrin	M23-No0044620	NCP	mg/L	< 0.0002	< 0.0002	<1	30%	Pass	
b-HCH	M23-No0044620	NCP	mg/L	< 0.0002	< 0.0002	<1	30%	Pass	
d-HCH	M23-No0044620	NCP	mg/L	< 0.0002	< 0.0002	<1	30%	Pass	
Dieldrin	M23-No0044620	NCP	mg/L	< 0.0002	< 0.0002	<1	30%	Pass	
Endosulfan I	M23-No0044620	NCP	mg/L	< 0.0002	< 0.0002	<1	30%	Pass	
Endosulfan II	M23-No0044620	NCP	mg/L	< 0.0002	< 0.0002	<1	30%	Pass	
Endosulfan sulphate	M23-No0044620	NCP	mg/L	< 0.0002	< 0.0002	<1	30%	Pass	
Endrin	M23-No0044620	NCP	mg/L	< 0.0002	< 0.0002	<1	30%	Pass	
Endrin aldehyde	M23-No0044620	NCP	mg/L	< 0.0002	< 0.0002	<1	30%	Pass	
Endrin ketone	M23-No0044620	NCP	mg/L	< 0.0002	< 0.0002	<1	30%	Pass	
g-HCH (Lindane)	M23-No0044620	NCP	mg/L	< 0.0002	< 0.0002	<1	30%	Pass	
Heptachlor	M23-No0044620	NCP	mg/L	< 0.0002	< 0.0002	<1	30%	Pass	
Heptachlor epoxide	M23-No0044620	NCP	mg/L	< 0.0002	< 0.0002	<1	30%	Pass	
Hexachlorobenzene	M23-No0044620	NCP	mg/L	< 0.0002	< 0.0002	<1	30%	Pass	
Methoxychlor	M23-No0044620	NCP	mg/L	< 0.0002	< 0.0002	<1	30%	Pass	
Toxaphene	M23-No0044620	NCP	mg/L	< 0.005	< 0.005	<1	30%	Pass	
Duplicate									
Organophosphorus Pesticides				Result 1	Result 2	RPD			
Azinphos-methyl	M23-No0044620	NCP	mg/L	< 0.002	< 0.002	<1	30%	Pass	
Bolstar	M23-No0044620	NCP	mg/L	< 0.002	< 0.002	<1	30%	Pass	
Chlorfenvinphos	M23-No0044620	NCP	mg/L	< 0.02	< 0.02	<1	30%	Pass	
Chlorpyrifos	M23-No0044620	NCP	mg/L	< 0.002	< 0.002	<1	30%	Pass	
Chlorpyrifos-methyl	M23-No0044620	NCP	mg/L	< 0.002	< 0.002	<1	30%	Pass	
Coumaphos	M23-No0044620	NCP	mg/L	< 0.02	< 0.02	<1	30%	Pass	
Demeton-S	M23-No0044620	NCP	mg/L	< 0.002	< 0.002	<1	30%	Pass	
Demeton-O	M23-No0044620	NCP	mg/L	< 0.002	< 0.002	<1	30%	Pass	
Diazinon	M23-No0044620	NCP	mg/L	< 0.002	< 0.002	<1	30%	Pass	
Dichlorvos	M23-No0044620	NCP	mg/L	< 0.002	< 0.002	<1	30%	Pass	
Dimethoate	M23-No0044620	NCP	mg/L	< 0.002	< 0.002	<1	30%	Pass	
Disulfoton	M23-No0044620	NCP	mg/L	< 0.002	< 0.002	<1	30%	Pass	
EPN	M23-No0044620	NCP	mg/L	< 0.002	< 0.002	<1	30%	Pass	
Ethion	M23-No0044620	NCP	mg/L	< 0.002	< 0.002	<1	30%	Pass	
Ethoprop	M23-No0044620	NCP	mg/L	< 0.002	< 0.002	<1	30%	Pass	
Ethyl parathion	M23-No0044620	NCP	mg/L	< 0.002	< 0.002	<1	30%	Pass	
Fenitrothion	M23-No0044620	NCP	mg/L	< 0.002	< 0.002	<1	30%	Pass	
Fensulfothion	M23-No0044620	NCP	mg/L	< 0.002	< 0.002	<1	30%	Pass	
Fenthion	M23-No0044620	NCP	mg/L	< 0.002	< 0.002	<1	30%	Pass	
Malathion	M23-No0044620	NCP	mg/L	< 0.002	< 0.002	<1	30%	Pass	
Merphos	M23-No0044620	NCP	mg/L	< 0.002	< 0.002	<1	30%	Pass	
Methyl parathion	M23-No0044620	NCP	mg/L	< 0.002	< 0.002	<1	30%	Pass	
Mevinphos	M23-No0044620	NCP	mg/L	< 0.002	< 0.002	<1	30%	Pass	
Monocrotophos	M23-No0044620	NCP	mg/L	< 0.002	< 0.002	<1	30%	Pass	
Naled	M23-No0044620	NCP	mg/L	< 0.002	< 0.002	<1	30%	Pass	
Omethoate	M23-No0044620	NCP	mg/L	< 0.02	< 0.02	<1	30%	Pass	
Phorate	M23-No0044620	NCP	mg/L	< 0.002	< 0.002	<1	30%	Pass	
Pirimiphos-methyl	M23-No0044620	NCP	mg/L	< 0.02	< 0.02	<1	30%	Pass	
Pyrazophos	M23-No0044620	NCP	mg/L	< 0.002	< 0.002	<1	30%	Pass	

Duplicate									
Organophosphorus Pesticides				Result 1	Result 2	RPD			
Ronnel	M23-No0044620	NCP	mg/L	< 0.002	< 0.002	<1	30%	Pass	
Terbufos	M23-No0044620	NCP	mg/L	< 0.002	< 0.002	<1	30%	Pass	
Tetrachlorvinphos	M23-No0044620	NCP	mg/L	< 0.002	< 0.002	<1	30%	Pass	
Tokuthion	M23-No0044620	NCP	mg/L	< 0.002	< 0.002	<1	30%	Pass	
Trichloronate	M23-No0044620	NCP	mg/L	< 0.002	< 0.002	<1	30%	Pass	
Duplicate									
				Result 1	Result 2	RPD			
NOx-N	S23-No0049802	NCP	mg/L	< 0.01	< 0.01	<1	20%	Pass	
Duplicate									
Heavy Metals				Result 1	Result 2	RPD			
Arsenic	L23-No0042004	NCP	mg/L	0.002	0.002	5.6	30%	Pass	
Cadmium	L23-No0042004	NCP	mg/L	< 0.0001	< 0.0001	<1	30%	Pass	
Chromium	L23-No0042004	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Copper	L23-No0042004	NCP	mg/L	0.003	0.003	<1	30%	Pass	
Lead	L23-No0042004	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Mercury	L23-No0042004	NCP	mg/L	< 0.0001	< 0.0001	<1	30%	Pass	
Nickel	L23-No0042004	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Zinc	L23-No0042004	NCP	mg/L	0.006	0.006	<1	30%	Pass	
Duplicate									
Carbamates				Result 1	Result 2	RPD			
Aldicarb	L23-No0042923	CP	ug/L	< 1	< 1	<1	30%	Pass	
Aldicarb Sulfone	L23-No0042923	CP	ug/L	< 1	< 1	<1	30%	Pass	
Aldicarb Sulfoxide	L23-No0042923	CP	ug/L	< 1	< 1	<1	30%	Pass	
Aminocarb	L23-No0042923	CP	ug/L	< 1	< 1	<1	30%	Pass	
Bromacil	L23-No0042923	CP	ug/L	< 2	< 2	<1	30%	Pass	
Carbaryl	L23-No0042923	CP	ug/L	< 4	< 4	<1	30%	Pass	
Carbendazim	L23-No0042923	CP	ug/L	< 1	< 1	<1	30%	Pass	
Carbofuran	L23-No0042923	CP	ug/L	< 1	< 1	<1	30%	Pass	
Diuron	L23-No0042923	CP	ug/L	< 0.5	< 0.5	<1	30%	Pass	
EPTC	L23-No0042923	CP	ug/L	< 5	< 5	<1	30%	Pass	
Fenamiphos	L23-No0042923	CP	ug/L	< 0.1	< 0.1	<1	30%	Pass	
Fenuron/Fenuron TCA	L23-No0042923	CP	ug/L	< 2	< 2	<1	30%	Pass	
Fluometuron	L23-No0042923	CP	ug/L	< 1	< 1	<1	30%	Pass	
Linuron	L23-No0042923	CP	ug/L	< 5	< 5	<1	30%	Pass	
Methiocarb	L23-No0042923	CP	ug/L	< 4	< 4	<1	30%	Pass	
Methomyl	L23-No0042923	CP	ug/L	< 2	< 2	<1	30%	Pass	
Mexacarbate	L23-No0042923	CP	ug/L	< 1	< 1	<1	30%	Pass	
Monuron/Monuron TCA	L23-No0042923	CP	ug/L	< 2	< 2	<1	30%	Pass	
Oxamyl	L23-No0042923	CP	ug/L	< 2	< 2	<1	30%	Pass	
Propachlor	L23-No0042923	CP	ug/L	< 1	< 1	<1	30%	Pass	
Propham	L23-No0042923	CP	ug/L	< 5	< 5	<1	30%	Pass	
Propoxur	L23-No0042923	CP	ug/L	< 1	< 1	<1	30%	Pass	
Siduron	L23-No0042923	CP	ug/L	< 1	< 1	<1	30%	Pass	

Comments

Sample Integrity

Custody Seals Intact (if used)	N/A
Attempt to Chill was evident	Yes
Sample correctly preserved	Yes
Appropriate sample containers have been used	Yes
Sample containers for volatile analysis received with minimal headspace	Yes
Samples received within HoldingTime	Yes
Some samples have been subcontracted	No

Qualifier Codes/Comments

Code	Description
Q08	The matrix spike recovery is outside of the recommended acceptance criteria. An acceptable recovery was obtained for the laboratory control sample indicating a sample matrix interference.

Authorised by:

Natalie Hill	Analytical Services Manager
Douglas Todd	Senior Analyst-Metal
Joseph Edouard	Senior Analyst-Organic
Paul Nottle	Senior Analyst-Organic
Sam Becker	Senior Analyst-Inorganic

Kim Rodgers
General Manager

Final Report – this report replaces any previously issued Report

- Indicates Not Requested

* Indicates NATA accreditation does not cover the performance of this service

Measurement uncertainty of test data is available on request

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Certificate of Analysis PEK1349

Client Details

Client	Galt Environmental Pty Ltd (WA)
Contact	Sarah Carter
Address	50 Edward Street, Osborne Park, WA, 6017

Sample Details

Your Reference	Wattleup - WAE230106
Number of Samples	1 Water
Date Samples Received	17/11/2023
Date Instructions Received	17/11/2023

Analysis Details

Please refer to the following pages for results, methodology summary and quality control data.
Samples were analysed as received from the client. Results relate specifically to the samples as received.
Results are reported on a dry weight basis for solids and on an as received basis for other matrices.

Report Details

Date Results Requested by	24/11/2023
Date of Issue	24/11/2023

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Authorisation Details

Results Approved By	Heram Halim, Operations Manager Lien Tang, Assistant Operations Manager Todd Lee, Group Operations Manager Travis Carey, Organics Supervisor
Laboratory Manager	Michael Kubiak

Samples in this Report

Envirolab ID	Sample ID	Matrix	Date Sampled	Date Received
PEK1349-01	QC18	Water	15/11/2023	17/11/2023

Certificate of Analysis PEK1349

Organochlorine Pesticides (Water)

Envirolab ID	**Units**	**PQL**	PEK1349-01
Your Reference			QC18
Date Sampled			15/11/2023
alpha-BHC	µg/L	0.20	<0.20
Hexachlorobenzene	µg/L	0.20	<0.20
beta-BHC	µg/L	0.20	<0.20
gamma-BHC	µg/L	0.20	<0.20
delta-BHC	µg/L	0.20	<0.20
Heptachlor	µg/L	0.20	<0.20
Aldrin	µg/L	0.20	<0.20
Heptachlor epoxide	µg/L	0.20	<0.20
trans-Chlordane	µg/L	0.20	<0.20
cis-Chlordane	µg/L	0.20	<0.20
Endosulfan I	µg/L	0.20	<0.20
4,4'-DDE	µg/L	0.20	<0.20
Dieldrin	µg/L	0.20	<0.20
Endrin	µg/L	0.20	<0.20
4,4'-DDD	µg/L	0.20	<0.20
Endosulfan II	µg/L	0.20	<0.20
Endrin aldehyde	µg/L	0.20	<0.20
4,4'-DDT	µg/L	0.20	<0.20
Endosulfan sulfate	µg/L	0.20	<0.20
Endrin ketone	µg/L	0.20	<0.20
Methoxychlor	µg/L	0.20	<0.20
Mirex	µg/L	0.20	<0.20
Total +ve OCP	µg/L	0.20	<0.20
Surrogate 2-Chlorophenol-D4	%		*78.0*

Organophosphorus Pesticides (Water)

Envirolab ID	Units	PQL	PEK1349-01
Your Reference			QC18
Date Sampled			15/11/2023
Dichlorvos	µg/L	0.20	<0.20
Dimethoate	µg/L	0.20	<0.20
Diazinon	µg/L	0.20	<0.20
Chlorpyrifos-methyl	µg/L	0.20	<0.20
Ronnel	µg/L	0.20	<0.20
Fenitrothion	µg/L	0.20	<0.20
Malathion	µg/L	0.20	<0.20
Chlorpyrifos	µg/L	0.20	<0.20
Parathion	µg/L	0.20	<0.20
Bromophos-ethyl	µg/L	0.20	<0.20
Ethion	µg/L	0.20	<0.20
Coumaphos	µg/L	0.20	<0.20
Disulfoton	µg/L	0.20	<0.20
Fenamiphos	µg/L	0.20	<0.20
Fenthion	µg/L	0.20	<0.20
Methidathion	µg/L	0.20	<0.20
Mevinphos	µg/L	0.20	<0.20
Parathion-methyl	µg/L	0.20	<0.20
Phorate	µg/L	0.20	<0.20
Phosalone	µg/L	0.20	<0.20
Azinphos-methyl	µg/L	0.20	<0.20
Surrogate 2-Chlorophenol-D4	%		*78.0*

Certificate of Analysis PEK1349

Carbamates (Water)

Envirolab ID	Units	PQL	PEK1349-01
Your Reference			QC18
Date Sampled			15/11/2023
Molinate	µg/L	0.50	<0.50
Carbofuran	µg/L	0.50	<0.50
Carbaryl	µg/L	0.50	<0.50
Surrogate p-Terphenyl-D14	%		*56.9 [2]*

Certificate of Analysis PEK1349

Acid Extractable Metals (Water)

Envirolab ID	Units	PQL	PEK1349-01
Your Reference			QC18
Date Sampled			15/11/2023
Phosphorus	mg/L	0.050	<0.050

Certificate of Analysis PEK1349

Dissolved Low Level Metals (Water)

Envirolab ID	Units	PQL	PEK1349-01
Your Reference			QC18
Date Sampled			15/11/2023
Arsenic	µg/L	1.0	<1.0
Cadmium	µg/L	0.10	<0.10
Chromium	µg/L	1.0	3.2
Copper	µg/L	1.0	<1.0
Mercury	µg/L	0.050	<0.050
Nickel	µg/L	1.0	4.2
Lead	µg/L	1.0	<1.0
Zinc	µg/L	1.0	9.7

Certificate of Analysis PEK1349

Inorganics - Nutrients (Water)

Envirolab ID	Units	PQL	PEK1349-01
Your Reference			QC18
Date Sampled			15/11/2023
NOx as N	mg/L	0.0050	5.8
TKN as N by calculation	mg/L	0.10	<0.10
Total Nitrogen	mg/L	0.10	5.8

Result Comments

Identifier	Description
[2]	Surrogate recovery was low due to sample(s) emulsifying during liquid liquid extraction.

Method Summary

Method ID	Methodology Summary
Calc - TKN	TKN determined by calculation (Total Nitrogen - NOx).
INORG-055	Nitrate/Nitrite/NOx/TKN - determined colourimetrically. Waters samples are filtered on receipt prior to analysis. Soils/solids are analysed following a water extraction.
INORG-127	Total Nitrogen by high temperature catalytic combustion with chemiluminescence detection. Organic Carbon forms (inorganic, organic, total) determined using a TOC/NDIR analyser via combustion. Dissolved forms require filtering prior to determination.
METALS-020	Determination of various metals by ICP-OES.
METALS-021	Determination of Mercury by Cold Vapour AAS.
METALS-022	Determination of various metals by ICP-MS. Please note for Bromine and Iodine, any forms of these elements that are present are included together in the one result reported for each of these two elements.
ORG-022	Determination of semi-volatile organic compounds (SVOCs) by GC-MS. Water samples are extracted by LLE and soils using DCM/Acetone/Methanol.
ORG-022_OC	Determination of semi-volatile organic compounds (SVOCs) by GC-MS. Water samples are extracted by LLE and soils using DCM/Acetone/Methanol.

Result Definitions

Identifier	Description
NR	Not reported
NEPM	National Environment Protection Measure
NS	Not specified
LCS	Laboratory Control Sample
RPD	Relative Percent Difference
>	Greater than
<	Less than
PQL	Practical Quantitation Limit
INS	Insufficient sample for this test
NA	Test not required
NT	Not tested
DOL	Samples rejected due to particulate overload (air filters only)
RFD	Samples rejected due to filter damage (air filters only)
RUD	Samples rejected due to uneven deposition (air filters only)
##	Indicates a laboratory acceptance criteria outlier, for further details, see Result Comments and/or QC Comments

Quality Control Definitions

Blank

This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, and is determined by processing solvents and reagents in exactly the same manner as for samples.

Surrogate Spike

Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.

LCS (Laboratory Control Sample)

This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.

Matrix Spike

A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.

Duplicate

This is the complete duplicate analysis of a sample from the process batch. The sample selected should be one where the analyte concentration is easily measurable.

Laboratory Acceptance Criteria

Duplicate sample and matrix spike recoveries may not be reported on smaller jobs, however, were analysed at a frequency to meet or exceed NEPM requirements. All samples are tested in batches of 20. The duplicate sample RPD and matrix spike recoveries for the batch were within the laboratory acceptance criteria. Filters, swabs, wipes, tubes and badges will not have duplicate data as the whole sample is generally extracted during sample extraction. Spikes for Physical and Aggregate Tests are not applicable. For VOCs in water samples, three vials are required for duplicate or spike analysis.

General Acceptance Criteria (GAC) - Analyte specific criteria applies for some analytes and is reflected in QC recovery tables.

Duplicates: >10xPQL - RPD acceptance criteria will vary depending on the analytes and the analytical techniques but is typically in the range 20%-50% - see ELN-P05 QAQC tables for details (available on request); <10xPQL - RPD are higher as the results approach PQL and the estimated measurement uncertainty will statistically increase. Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals; 60-140% for organics (+/-50% surrogates) and 10-140% for labile SVOCs (including labile surrogates), ultra trace organics and speciated phenols is acceptable.

In circumstances where no duplicate and/or sample spike has been reported at 1 in 10 and/or 1 in 20 samples respectively, the sample volume submitted was typically insufficient in order to satisfy laboratory QA/QC protocols.

Miscellaneous Information

When samples are received where certain analytes are outside of recommended technical holding times (THTs), the analysis has proceeded. Where analytes are on the verge of breaching THTs, every effort will be made to analyse within the THT or as soon as practicable.

Where sampling dates are not provided, Envirolab are not in a position to comment on the validity of the analysis where recommended technical holding times may have been breached. We have taken the sampling date as being the date received at the laboratory.

Two significant figures are reported for the majority of tests and with a high degree of confidence, for results <10*PQL, the second significant figure may be in doubt i.e. has a relatively high degree of uncertainty and is provided for information only.

Measurement Uncertainty estimates are available for most tests upon request.

Analysis of aqueous samples typically involves the extraction/digestion and/or analysis of the liquid phase only (i.e. NOT any settled sediment phase but inclusive of suspended particles if present), unless stipulated on the Envirolab COC or by correspondence. Notable exceptions include certain Physical Tests (pH/EC/BOD/COD/Apparent Colour etc.), Solids testing, Total Recoverable metals and PFAS where sediment/solids are included by default.

Urine Analysis - The BEI values listed are taken from the 2022 edition of *TLVs and BEIs Threshold Limits by ACGIH*.

Air volume measurements are not covered by Envirolab's NATA accreditation.

Data Quality Assessment Summary PEK1349

Client Details

Client	Galt Environmental Pty Ltd (WA)
Your Reference	Wattleup - WAE230106
Date Issued	24/11/2023

Recommended Holding Time Compliance

Recommended holding time exceedances exist - See detailed list below

Quality Control and QC Frequency

QC Type	Compliant	Details
Blank	Yes	No Outliers
LCS	Yes	No Outliers
Duplicates	No	Duplicate Outliers Exist - See detailed list below
Matrix Spike	No	Matrix Spike Outliers Exist - See detailed list below
Surrogates / Extracted Internal Standards	No	Surrogates / Extracted ISTD Outliers Exist - See detailed list below
QC Frequency	Yes	No Outliers

Surrogates/Extracted Internal Standards, Duplicates and/or Matrix Spikes are not always relevant/applicable to certain analyses and matrices. Therefore, said QC measures are deemed compliant in these situations by default. See Laboratory Acceptance Criteria for more information

Data Quality Assessment Summary PEK1349

Recommended Holding Time Compliance

Analysis	Sample Number(s)	Date Sampled	Date Extracted	Date Analysed	Compliant
OCP | Water	1	15/11/2023	20/11/2023	20/11/2023	Yes
OPP (21 list) | Water	1	15/11/2023	20/11/2023	20/11/2023	Yes
Carbamates | Water	1	15/11/2023	20/11/2023	20/11/2023	Yes
Total Phosphorus | Water	1	15/11/2023	20/11/2023	23/11/2023	Yes
Dissolved Metals (LL) | Water	1	15/11/2023	20/11/2023	22/11/2023	Yes
Dissolved Metals (LL)-Hg | Water	1	15/11/2023	20/11/2023	21/11/2023	Yes
Nitrogen - NOx | Water	1	15/11/2023	21/11/2023	21/11/2023	No
Nitrogen - Total N | Water	1	15/11/2023	20/11/2023	21/11/2023	Yes
TKN as N calc | Water	1	15/11/2023	20/11/2023	24/11/2023	Yes

Outliers: Duplicates

METALS-022|Dissolved Low Level Metals (Water)| Batch BEK2324

Sample ID	Duplicate ID	Analyte	% Limits	RPD
BEK2324-DUP2#	DUP2	Zinc	20.00	200[3]

Outliers: Matrix Spike

INORG-055|Inorganics - Nutrients (Water)| Batch BEK2444

Sample ID	Analyte	% Limits	% Recovery
BEK2444-MS1#	NOx as N	70 - 130	##[1]

Outliers: Surrogate / Extracted Internal Standards

ORG-022|Carbamates (Matrix)| Batch BEK2197

Sample ID	Analyte	% Limits	% Recovery
PEK1349-01	p-Terphenyl-D14	60 - 140	56.9% [2]

Quality Control PEK1349

ORG-022_OC|Organochlorine Pesticides (Water) | Batch BEK2197

Analyte	Units	PQL	Blank	DUP1 BEK2197-DUP1# Samp | QC | RPD %	DUP2 BEK2197-DUP2# Samp | QC | RPD %	LCS %	Spike % BEK2197-MS2#
alpha-BHC	µg/L	0.20	<0.20	<0.20 | <0.20 | [NA]	<0.20 | <0.20 | [NA]	79.1	86.5
Hexachlorobenzene	µg/L	0.20	<0.20	<0.20 | <0.20 | [NA]	<0.20 | <0.20 | [NA]	[NA]	[NA]
beta-BHC	µg/L	0.20	<0.20	<0.20 | <0.20 | [NA]	<0.20 | <0.20 | [NA]	77.0	82.1
gamma-BHC	µg/L	0.20	<0.20	<0.20 | <0.20 | [NA]	<0.20 | <0.20 | [NA]	[NA]	[NA]
delta-BHC	µg/L	0.20	<0.20	<0.20 | <0.20 | [NA]	<0.20 | <0.20 | [NA]	[NA]	[NA]
Heptachlor	µg/L	0.20	<0.20	<0.20 | <0.20 | [NA]	<0.20 | <0.20 | [NA]	76.4	83.6
Aldrin	µg/L	0.20	<0.20	<0.20 | <0.20 | [NA]	<0.20 | <0.20 | [NA]	71.1	78.1
Heptachlor epoxide	µg/L	0.20	<0.20	<0.20 | <0.20 | [NA]	<0.20 | <0.20 | [NA]	81.9	88.9
trans-Chlordane	µg/L	0.20	<0.20	<0.20 | <0.20 | [NA]	<0.20 | <0.20 | [NA]	[NA]	[NA]
cis-Chlordane	µg/L	0.20	<0.20	<0.20 | <0.20 | [NA]	<0.20 | <0.20 | [NA]	[NA]	[NA]
Endosulfan I	µg/L	0.20	<0.20	<0.20 | <0.20 | [NA]	<0.20 | <0.20 | [NA]	[NA]	[NA]
4,4'-DDE	µg/L	0.20	<0.20	<0.20 | <0.20 | [NA]	<0.20 | <0.20 | [NA]	81.4	88.2
Dieldrin	µg/L	0.20	<0.20	<0.20 | <0.20 | [NA]	<0.20 | <0.20 | [NA]	77.9	87.6
Endrin	µg/L	0.20	<0.20	<0.20 | <0.20 | [NA]	<0.20 | <0.20 | [NA]	82.7	92.6
4,4'-DDD	µg/L	0.20	<0.20	<0.20 | <0.20 | [NA]	<0.20 | <0.20 | [NA]	79.6	88.5
Endosulfan II	µg/L	0.20	<0.20	<0.20 | <0.20 | [NA]	<0.20 | <0.20 | [NA]	[NA]	[NA]
Endrin aldehyde	µg/L	0.20	<0.20	<0.20 | <0.20 | [NA]	<0.20 | <0.20 | [NA]	[NA]	[NA]
4,4'-DDT	µg/L	0.20	<0.20	<0.20 | <0.20 | [NA]	<0.20 | <0.20 | [NA]	[NA]	[NA]
Endosulfan sulfate	µg/L	0.20	<0.20	<0.20 | <0.20 | [NA]	<0.20 | <0.20 | [NA]	80.5	91.3
Endrin ketone	µg/L	0.20	<0.20	<0.20 | <0.20 | [NA]	<0.20 | <0.20 | [NA]	[NA]	[NA]
Methoxychlor	µg/L	0.20	<0.20	<0.20 | <0.20 | [NA]	<0.20 | <0.20 | [NA]	[NA]	[NA]
Mirex	µg/L	0.20	<0.20	<0.20 | <0.20 | [NA]	<0.20 | <0.20 | [NA]	[NA]	[NA]
Surrogate 2-Chlorophenol-D4	*%*		*79.6*	*70.7 | 73.0*	*91.5 | 90.5*	*76.9*	*83.0*

The QC reported was not specifically part of this workorder but formed part of the QC process batch.

ORG-022|Organophosphorus Pesticides (Water) | Batch BEK2197

Analyte	Units	PQL	Blank	DUP1 BEK2197-DUP1# Samp | QC | RPD %	DUP2 BEK2197-DUP2# Samp | QC | RPD %	LCS %	Spike % BEK2197-MS2#
Dichlorvos	µg/L	0.20	<0.20	<0.20 | <0.20 | [NA]	<0.20 | <0.20 | [NA]	84.6	93.8
Dimethoate	µg/L	0.20	<0.20	<0.20 | <0.20 | [NA]	<0.20 | <0.20 | [NA]	[NA]	[NA]
Diazinon	µg/L	0.20	<0.20	<0.20 | <0.20 | [NA]	<0.20 | <0.20 | [NA]	[NA]	[NA]
Chlorpyrifos-methyl	µg/L	0.20	<0.20	<0.20 | <0.20 | [NA]	<0.20 | <0.20 | [NA]	74.9	84.1
Ronnel	µg/L	0.20	<0.20	<0.20 | <0.20 | [NA]	<0.20 | <0.20 | [NA]	72.4	79.3
Fenitrothion	µg/L	0.20	<0.20	<0.20 | <0.20 | [NA]	<0.20 | <0.20 | [NA]	77.8	89.5
Malathion	µg/L	0.20	<0.20	<0.20 | <0.20 | [NA]	<0.20 | <0.20 | [NA]	67.1	74.0
Chlorpyrifos	µg/L	0.20	<0.20	<0.20 | <0.20 | [NA]	<0.20 | <0.20 | [NA]	71.4	78.8
Parathion	µg/L	0.20	<0.20	<0.20 | <0.20 | [NA]	<0.20 | <0.20 | [NA]	79.3	90.8
Bromophos-ethyl	µg/L	0.20	<0.20	<0.20 | <0.20 | [NA]	<0.20 | <0.20 | [NA]	[NA]	[NA]
Ethion	µg/L	0.20	<0.20	<0.20 | <0.20 | [NA]	<0.20 | <0.20 | [NA]	81.6	94.9
Coumaphos	µg/L	0.20	<0.20	<0.20 | <0.20 | [NA]	<0.20 | <0.20 | [NA]	[NA]	[NA]
Disulfoton	µg/L	0.20	<0.20	<0.20 | <0.20 | [NA]	<0.20 | <0.20 | [NA]	[NA]	[NA]
Fenamiphos	µg/L	0.20	<0.20	<0.20 | <0.20 | [NA]	<0.20 | <0.20 | [NA]	[NA]	[NA]
Fenthion	µg/L	0.20	<0.20	<0.20 | <0.20 | [NA]	<0.20 | <0.20 | [NA]	[NA]	[NA]
Methidathion	µg/L	0.20	<0.20	<0.20 | <0.20 | [NA]	<0.20 | <0.20 | [NA]	[NA]	[NA]
Mevinphos	µg/L	0.20	<0.20	<0.20 | <0.20 | [NA]	<0.20 | <0.20 | [NA]	[NA]	[NA]
Parathion-methyl	µg/L	0.20	<0.20	<0.20 | <0.20 | [NA]	<0.20 | <0.20 | [NA]	[NA]	[NA]
Phorate	µg/L	0.20	<0.20	<0.20 | <0.20 | [NA]	<0.20 | <0.20 | [NA]	[NA]	[NA]
Phosalone	µg/L	0.20	<0.20	<0.20 | <0.20 | [NA]	<0.20 | <0.20 | [NA]	[NA]	[NA]
Azinphos-methyl	µg/L	0.20	<0.20	<0.20 | <0.20 | [NA]	<0.20 | <0.20 | [NA]	[NA]	[NA]
Surrogate 2-Chlorophenol-D4	*%*		*79.6*	*70.7 | 73.0*	*91.5 | 90.5*	*76.9*	*83.0*

The QC reported was not specifically part of this workorder but formed part of the QC process batch.

Quality Control PEK1349

ORG-022 | Carbamates (Water) | Batch BEK2197

Analyte	Units	PQL	Blank	DUP1 BEK2197-DUP1# Samp | QC | RPD %	DUP2 BEK2197-DUP2# Samp | QC | RPD %	LCS %	Spike % BEK2197-MS2#
Molinate	µg/L	0.50	<0.50	<0.50 | <0.50 | [NA]	<0.50 | <0.50 | [NA]	[NA]	[NA]
Carbofuran	µg/L	0.50	<0.50	<0.50 | <0.50 | [NA]	<0.50 | <0.50 | [NA]	84.8	97.6
Carbaryl	µg/L	0.50	<0.50	<0.50 | <0.50 | [NA]	<0.50 | <0.50 | [NA]	[NA]	[NA]
Surrogate p-Terphenyl-D14	*%*		*78.1*	*71.3 | 76.6*	*78.7 | 70.7*	*80.9*	*75.7*

The QC reported was not specifically part of this workorder but formed part of the QC process batch.

METALS-020 | Acid Extractable Metals (Water) | Batch BEK2253

Analyte	Units	PQL	Blank	DUP1 BEK2253-DUP1# Samp | QC | RPD %	DUP2 BEK2253-DUP2# Samp | QC | RPD %	LCS %	Spike % BEK2253-MS1#
Phosphorus	mg/L	0.050	<0.050	<0.050 | <0.050 | [NA]	0.574 | 0.572 | 0.283	104	102

The QC reported was not specifically part of this workorder but formed part of the QC process batch.

METALS-021 | Dissolved Low Level Metals (Water) | Batch BEK2279

Analyte	Units	PQL	Blank	DUP1 BEK2279-DUP1# Samp | QC | RPD %	DUP2 BEK2279-DUP2# Samp | QC | RPD %	LCS %	Spike % BEK2279-MS1#
Mercury	µg/L	0.050	<0.050	<0.050 | <0.050 | [NA]	<0.050 | <0.050 | [NA]	101	117

The QC reported was not specifically part of this workorder but formed part of the QC process batch.

METALS-022 | Dissolved Low Level Metals (Water) | Batch BEK2324

Analyte	Units	PQL	Blank	DUP1 BEK2324-DUP1# Samp | QC | RPD %	DUP2 BEK2324-DUP2# Samp | QC | RPD %	LCS %	Spike % BEK2324-MS1#
Arsenic	µg/L	1.0	<1.0	<1.0 | <1.0 | [NA]	<1.0 | <1.0 | [NA]	112	104
Cadmium	µg/L	0.10	<0.10	<0.10 | <0.10 | [NA]	<0.10 | <0.10 | [NA]	113	105
Chromium	µg/L	1.0	<1.0	<1.0 | <1.0 | [NA]	<1.0 | <1.0 | [NA]	111	103
Copper	µg/L	1.0	<1.0	<1.0 | <1.0 | [NA]	<1.0 | <1.0 | [NA]	109	103
Lead	µg/L	1.0	<1.0	<1.0 | <1.0 | [NA]	<1.0 | <1.0 | [NA]	109	104
Nickel	µg/L	1.0	<1.0	<1.0 | <1.0 | [NA]	<1.0 | <1.0 | [NA]	108	99.7
Zinc	µg/L	1.0	<1.0	5.17 | 5.42 | 4.74	1.02 | <1.0 | 200 [3]	107	102

The QC reported was not specifically part of this workorder but formed part of the QC process batch.

INORG-127 | Inorganics - Nutrients (Water) | Batch BEK2264

Analyte	Units	PQL	Blank	DUP1 BEK2264-DUP1# Samp | QC | RPD %		LCS %	Spike % BEK2264-MS1#
Total Nitrogen	mg/L	0.10	<0.10	0.501 | 0.459 | 8.77		108	103

The QC reported was not specifically part of this workorder but formed part of the QC process batch.

INORG-055 | Inorganics - Nutrients (Water) | Batch BEK2444

Analyte	Units	PQL	Blank	DUP1 BEK2444-DUP1# Samp | QC | RPD %	DUP2 BEK2444-DUP2# Samp | QC | RPD %	LCS %	Spike % BEK2444-MS1#
NOx as N	mg/L	0.0050	<0.0050	16.4 | 16.3 | 0.313	15.8 | 16.3 | 2.69	104	##[1]

The QC reported was not specifically part of this workorder but formed part of the QC process batch.

QC Comments

Identifier	Description
[1]	Spike recovery is not applicable due to the relatively high analyte background in the sample (>3* spike level). However, the LCS recovery is within acceptance criteria.
[3]	Duplicate %RPD may be flagged as an outlier to routine laboratory acceptance, however, where one or both results are <10*PQL, the RPD acceptance criteria increases exponentially.

Appendix J: Soil Laboratory Results

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Soil Analytical Results

				Field ID	TP01/0.0	TP03/0.0	TP04/0.0	TP08/0.0	TP09/0.0	TP11/0.0	TP14/0.0	TP15/0.0	TP19/0.0	TP20/0.0	TP21/0.0	TP23/0.0	TP25/0.0	TP26/0.0
				Date	01 Nov 2023	01 Nov 2023	01 Nov 2023	01 Nov 2023	01 Nov 2023	01 Nov 2023	01 Nov 2023	01 Nov 2023	01 Nov 2023	01 Nov 2023	02 Nov 2023	02 Nov 2023	02 Nov 2023	02 Nov 2023
	Unit	EQL	NEPM 2013 Table 1B(5) Generic EIL - Urban Res & Public Open Space	NEPM 2013 Table 1A(1) HILs Res A Soil														
NA																		
Aminocarb	MG/KG	0.04				<0.04				<0.04			<0.04		<0.04			<0.04
Fenuron/Fenuron TCA	MG/KG	0.005				<0.005				<0.005			<0.005		<0.005			<0.005
Thidiazuron	MG/KG	0.04				<0.04				<0.04			<0.04		<0.04			<0.04
Pesticides by LCMSMS (Positive																		
Siduron	mg/kg	0.02				<0.02				<0.02			<0.02		<0.02			<0.02
Carbamates																		
Methiocarb	mg/kg	0.04				<0.04				<0.04			<0.04		<0.04			<0.04
Fungicides																		
Carbendazim	mg/kg	0.04				<0.04				<0.04			<0.04		<0.04			<0.04
Halogenated Benzenes																		
Hexachlorobenzene	mg/kg	0.01		10	<0.05	<0.01	<0.05	<0.05	<0.05	<0.01	<0.05	<0.05	<0.01	<0.05	<0.01	<0.05	<0.05	<0.01
Herbicides																		
Monuron	mg/kg	0.04				<0.04				<0.04			<0.04		<0.04			<0.04
Neburon	mg/kg	0.04				<0.04				<0.04			<0.04		<0.04			<0.04
Propachlor	mg/kg	0.02				<0.02				<0.02			<0.02		<0.02			<0.02
Bromacil	mg/kg	0.04				<0.04				<0.04			<0.04		<0.04			<0.04
Diuron	mg/kg	0.04				<0.04				<0.04			<0.04		<0.04			<0.04
Fluometuron	mg/kg	0.02				<0.02				<0.02			<0.02		<0.02			<0.02
Linuron	mg/kg	0.04				<0.04				<0.04			<0.04		<0.04			<0.04
Trifluralin	mg/kg	0.2				<0.2				<0.2			<0.2		<0.2			<0.2
Inorganics																		
Nitrite + Nitrate as N	mg/kg	1			3.6	2.3	2.6	1.2	1.9	1.5	2.2	2.4	1.5	2.9	2.1	<1	1.2	2.1
Kjeldahl Nitrogen Total	mg/kg	10			460	280	300	160	230	180	310	200	150	200	390	440	410	250
Moisture Content (dried @ 103°C)	%	1			<1	<1	<1	<1	<1	<1	<1	<1	1.2	1.1	<1	<1	<1	<1
Nitrogen (Total)	mg/kg	10			460	280	300	160	230	180	310	200	150	200	390	440	410	250
Total Phosphorus (Organic Phosphate)	mg/kg	1			280	400	280	400	570	400	350	280	170	120	64	51	44	43
Metals																		
Arsenic	mg/kg	2	100	100	<2	<2	<2	<2	<2	<2	<2	<2	3.4	3.4	2.7	2.1	<2	<2
Cadmium	mg/kg	0.1		20	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Chromium (III+VI)	mg/kg	1			2.4	2.3	1.2	1.6	2.2	2.1	3.2	2.8	8.3	10	6.6	5.8	4.3	3.3
Copper	mg/kg	1		6,000	6.2	3.5	4.0	4.5	7.3	6.2	8.9	2.9	3.4	2.0	<1	<1	<1	<1
Lead	mg/kg	1		300	1.6	1.4	<1	<1	<1	<1	<1	<1	1.0	1.1	1.8	1.3	1.5	1.2
Mercury	mg/kg	0.02		40	<0.02	<0.02	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Nickel	mg/kg	1		400	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Zinc	mg/kg	5		7,400	7.2	12	10	13	16	9.9	10	5.1	<5	<5	<5	<5	<5	<5
Organochlorine Pesticides																		
Organochlorine pesticides EPAVic	mg/kg	0.1			<0.1		<0.1	<0.1	<0.1		<0.1	<0.1		<0.1		<0.1	<0.1	
Other organochlorine pesticides EPAVic	mg/kg	0.1			<0.1		<0.1	<0.1	<0.1		<0.1	<0.1		<0.1		<0.1	<0.1	
2,4-DDT	mg/kg	0.01				<0.01				<0.01			<0.01		<0.01			<0.01
4,4-DDE	mg/kg	0.01			<0.05	<0.01	<0.05	<0.05	<0.05	<0.01	<0.05	<0.05	<0.01	<0.05	<0.01	<0.05	<0.05	<0.01
a-BHC	mg/kg	0.01			<0.05	<0.01	<0.05	<0.05	<0.05	<0.01	<0.05	<0.05	<0.01	<0.05	<0.01	<0.05	<0.05	<0.01
Aldrin	mg/kg	0.01			<0.05	<0.01	<0.05	<0.05	<0.05	<0.01	<0.05	<0.05	<0.01	<0.05	<0.01	<0.05	<0.05	<0.01
Aldrin + Dieldrin	mg/kg	0.05		6	<0.05		<0.05	<0.05	<0.05		<0.05	<0.05		<0.05		<0.05	<0.05	
b-BHC	mg/kg	0.01			<0.05	<0.01	<0.05	<0.05	<0.05	<0.01	<0.05	<0.05	<0.01	<0.05	<0.01	<0.05	<0.05	<0.01
Chlordane	mg/kg	0.01		50	<0.1	<0.01	<0.1	<0.1	<0.1	<0.01	<0.1	<0.1	<0.01	<0.1	<0.01	<0.1	<0.1	<0.01
d-BHC	mg/kg	0.01			<0.05	<0.01	<0.05	<0.05	<0.05	<0.01	<0.05	<0.05	<0.01	<0.05	<0.01	<0.05	<0.05	<0.01
DDD	mg/kg	0.01			<0.05	<0.01	<0.05	<0.05	<0.05	<0.01	<0.05	<0.05	<0.01	<0.05	<0.01	<0.05	<0.05	<0.01
DDT	mg/kg	0.01	180		<0.05	<0.01	<0.05	<0.05	<0.05	<0.01	<0.05	<0.05	<0.01	<0.05	<0.01	<0.05	<0.05	<0.01
DDT+DDE+DDD	mg/kg	0.05		240	<0.05		<0.05	<0.05	<0.05		<0.05	<0.05		<0.05		<0.05	<0.05	
Dieldrin	mg/kg	0.01			<0.05	<0.01	<0.05	<0.05	<0.05	<0.01	<0.05	<0.05	<0.01	<0.05	<0.01	<0.05	<0.05	<0.01
Endosulfan I	mg/kg	0.01			<0.05	<0.01	<0.05	<0.05	<0.05	<0.01	<0.05	<0.05	<0.01	<0.05	<0.01	<0.05	<0.05	<0.01
Endosulfan II	mg/kg	0.01			<0.05	<0.01	<0.05	<0.05	<0.05	<0.01	<0.05	<0.05	<0.01	<0.05	<0.01	<0.05	<0.05	<0.01
Endosulfan sulphate	mg/kg	0.01			<0.05	<0.01	<0.05	<0.05	<0.05	<0.01	<0.05	<0.05	<0.01	<0.05	<0.01	<0.05	<0.05	<0.01
Endrin	mg/kg	0.01		10	<0.05	<0.01	<0.05	<0.05	<0.05	<0.01	<0.05	<0.05	<0.01	<0.05	<0.01	<0.05	<0.05	<0.01
Endrin aldehyde	mg/kg	0.05			<0.05		<0.05	<0.05	<0.05		<0.05	<0.05		<0.05		<0.05	<0.05	
Endrin ketone	mg/kg	0.05			<0.05		<0.05	<0.05	<0.05		<0.05	<0.05		<0.05		<0.05	<0.05	
g-BHC (Lindane)	mg/kg	0.01			<0.05	<0.01	<0.05	<0.05	<0.05	<0.01	<0.05	<0.05	<0.01	<0.05	<0.01	<0.05	<0.05	<0.01
Heptachlor	mg/kg	0.01		6	<0.05	<0.01	<0.05	<0.05	<0.05	<0.01	<0.05	<0.05	<0.01	<0.05	<0.01	<0.05	<0.05	<0.01
Heptachlor epoxide	mg/kg	0.01			<0.05	<0.01	<0.05	<0.05	<0.05	<0.01	<0.05	<0.05	<0.01	<0.05	<0.01	<0.05	<0.05	<0.01
Methoxychlor	mg/kg	0.05		300	<0.05	<0.2	<0.05	<0.05	<0.05	<0.2	<0.05	<0.05	<0.2	<0.05	<0.2	<0.05	<0.05	<0.2
Oxychlordane	mg/kg	0.01				<0.01				<0.01			<0.01		<0.01			<0.01
Toxaphene	mg/kg	0.5		20	<0.5		<0.5	<0.5	<0.5		<0.5	<0.5		<0.5		<0.5	<0.5	
Organophosphorous Pesticides																		
Chlorpyrifos	mg/kg	0.02		160		<0.02				<0.02			<0.02		<0.02			<0.02
Diazinon	mg/kg	0.2				<0.2				<0.2			<0.2		<0.2			<0.2
Ethion	mg/kg	0.05				<0.05				<0.05			<0.05		<0.05			<0.05
Fenitrothion	mg/kg	0.1				<0.1				<0.1			<0.1		<0.1			<0.1
Malathion	mg/kg	0.1				<0.1				<0.1			<0.1		<0.1			<0.1
Pesticides																		
Mexacarbate	mg/kg	0.02				<0.02				<0.02			<0.02		<0.02			<0.02
Aldicarb sulfoxide	mg/kg	0.004				<0.004				<0.004			<0.004		<0.004			<0.004
Aldicarb	mg/kg	0.004				<0.004				<0.004			<0.004		<0.004			<0.004
Aldicarb sulfone	mg/kg	0.02				<0.02				<0.02			<0.02		<0.02			<0.02
Baygon	mg/kg	0.004				<0.004				<0.004			<0.004		<0.004			<0.004
Bifenthrin	mg/kg	0.2		600		<0.2				<0.2			<0.2		<0.2			<0.2
Bromophos	mg/kg	0.05				<0.05				<0.05			<0.05		<0.05			<0.05
Carbaryl	mg/kg	0.05				<0.05				<0.05			<0.05		<0.05			<0.05
Carbofuran	mg/kg	0.04				<0.04				<0.04			<0.04		<0.04			<0.04
Methomyl	mg/kg	0.04				<0.04				<0.04			<0.04		<0.04			<0.04
Oxamyl	mg/kg	0.04				<0.04				<0.04			<0.04		<0.04			<0.04

Soil Analytical Results

				Field ID	TP29/0.0	TP30/0.0	TP34/0.0	TP35/0.0	TP38/0.0	TP39/0.0	TP41/0.0	TP42/0.0	TP45/0.0	TP48/0.0	TP51/0.0	TP53/0.0	TP56/0.0	TP58/0.0	TP59/0.0
				Date	02 Nov 2023	02 Nov 2023	02 Nov 2023	02 Nov 2023	02 Nov 2023	02 Nov 2023	03 Nov 2023	03 Nov 2023	03 Nov 2023	03 Nov 2023	03 Nov 2023	03 Nov 2023	03 Nov 2023	03 Nov 2023	03 Nov 2023
	Unit	EQL	NEPM 2013 Table 1B(5) Generic EIL - Urban Res & Public Open Space	NEPM 2013 Table 1A(1) HILs Res A Soil															
NA																			
Aminocarb	MG/KG	0.04					<0.04						<0.04			<0.04			<0.04
Fenuron/Fenuron TCA	MG/KG	0.005					<0.005						<0.005			<0.005			<0.005
Thidiazuron	MG/KG	0.04					<0.04						<0.04			<0.04			<0.04
Pesticides by LCMSMS (Positive																			
Siduron	mg/kg	0.02					<0.02						<0.02			<0.02			<0.02
Carbamates																			
Methiocarb	mg/kg	0.04					<0.04						<0.04			<0.04			<0.04
Fungicides																			
Carbendazim	mg/kg	0.04					<0.04						<0.04			<0.04			<0.04
Halogenated Benzenes																			
Hexachlorobenzene	mg/kg	0.01		10	<0.05	<0.05	<0.01	<0.05	<0.05	<0.05	<0.05	<0.05	<0.01	<0.05	<0.05	<0.01	<0.05	<0.05	<0.01
Herbicides																			
Monuron	mg/kg	0.04					<0.04						<0.04			<0.04			<0.04
Neburon	mg/kg	0.04					<0.04						<0.04			<0.04			<0.04
Propachlor	mg/kg	0.02					<0.02						<0.02			<0.02			<0.02
Bromacil	mg/kg	0.04					<0.04						<0.04			<0.04			<0.04
Diuron	mg/kg	0.04					<0.04						<0.04			<0.04			<0.04
Fluometuron	mg/kg	0.02					<0.02						<0.02			<0.02			<0.02
Linuron	mg/kg	0.04					<0.04						<0.04			<0.04			<0.04
Trifluralin	mg/kg	0.2					<0.2						<0.2			<0.2			<0.2
Inorganics																			
Nitrite + Nitrate as N	mg/kg	1			1.6	1.0	<1	<1	2.1	<1	1.2	<1	2.0	1.8	2.1	2.1	1.2	2.9	3.1
Kjeldahl Nitrogen Total	mg/kg	10			350	460	250	170	200	250	580	350	310	470	370	450	170	970	760
Moisture Content (dried @ 103°C)	%	1			<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	1.0	<1	2.2	1.6
Nitrogen (Total)	mg/kg	10			350	460	250	170	200	250	580	350	310	470	370	450	170	970	760
Total Phosphorus (Organic Phosphate)	mg/kg	1			30	69	19	180	9.4	33	310	240	64	330	120	130	130	450	430
Metals																			
Arsenic	mg/kg	2	100	100	<2	<2	<2	3.1	<2	<2	<2	<2	<2	<2	<2	<2	3.2	4.1	3.8
Cadmium	mg/kg	0.1		20	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Chromium (III+VI)	mg/kg	1			<1	2.2	<1	10	<1	1.4	1.0	<1	<1	2.3	2.6	2.8	8.4	12	10
Copper	mg/kg	1		6,000	<1	1.9	<1	<1	<1	<1	130	81	62	6.5	3.0	3.7	<1	8.2	7.3
Lead	mg/kg	1		300	1.1	2.1	<1	<1	<1	1.5	1.3	1.7	1.2	1.7	1.7	1.5	2.2	2.9	2.9
Mercury	mg/kg	0.02		40	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Nickel	mg/kg	1		400	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Zinc	mg/kg	5		7,400	<5	<5	<5	7.1	<5	<5	9.7	19	5.4	14	5.4	<5	9.9	20	8.9
Organochlorine Pesticides																			
Organochlorine pesticides EPAVic	mg/kg	0.1			<0.1	<0.1		<0.1	<0.1	<0.1	<0.1	<0.1		<0.1	<0.1		<0.1	<0.1	
Other organochlorine pesticides EPAVic	mg/kg	0.1			<0.1	<0.1		<0.1	<0.1	<0.1	<0.1	<0.1		<0.1	<0.1		<0.1	<0.1	
2,4-DDT	mg/kg	0.01					<0.01						<0.01			<0.01			<0.01
4,4-DDE	mg/kg	0.01			<0.05	<0.05	<0.01	<0.05	<0.05	<0.05	<0.05	<0.05	<0.01	<0.05	<0.05	<0.01	<0.05	<0.05	<0.01
a-BHC	mg/kg	0.01			<0.05	<0.05	<0.01	<0.05	<0.05	<0.05	<0.05	<0.05	<0.01	<0.05	<0.05	<0.01	<0.05	<0.05	<0.01
Aldrin	mg/kg	0.01			<0.05	<0.05	<0.01	<0.05	<0.05	<0.05	<0.05	<0.05	<0.01	<0.05	<0.05	<0.01	<0.05	<0.05	<0.01
Aldrin + Dieldrin	mg/kg	0.05		6	<0.05	<0.05		<0.05	<0.05	<0.05	<0.05	<0.05		<0.05	<0.05		<0.05	<0.05	
b-BHC	mg/kg	0.01			<0.05	<0.05	<0.01	<0.05	<0.05	<0.05	<0.05	<0.05	<0.01	<0.05	<0.05	<0.01	<0.05	<0.05	<0.01
Chlordane	mg/kg	0.01		50	<0.1	<0.1	<0.01	<0.1	<0.1	<0.1	<0.1	<0.1	<0.01	<0.1	<0.1	<0.01	<0.1	<0.1	<0.01
d-BHC	mg/kg	0.01			<0.05	<0.05	<0.01	<0.05	<0.05	<0.05	<0.05	<0.05	<0.01	<0.05	<0.05	<0.01	<0.05	<0.05	<0.01
DDD	mg/kg	0.01			<0.05	<0.05	<0.01	<0.05	<0.05	<0.05	<0.05	<0.05	<0.01	<0.05	<0.05	<0.01	<0.05	<0.05	<0.01
DDT	mg/kg	0.01	180		<0.05	<0.05	<0.01	<0.05	<0.05	<0.05	<0.05	<0.05	<0.01	<0.05	<0.05	<0.01	<0.05	<0.05	<0.01
DDT+DDE+DDD	mg/kg	0.05		240	<0.05	<0.05		<0.05	<0.05	<0.05	<0.05	<0.05		<0.05	<0.05		<0.05	<0.05	
Dieldrin	mg/kg	0.01			<0.05	<0.05	<0.01	<0.05	<0.05	<0.05	<0.05	<0.05	<0.01	<0.05	<0.05	<0.01	<0.05	<0.05	<0.01
Endosulfan I	mg/kg	0.01			<0.05	<0.05	<0.01	<0.05	<0.05	<0.05	<0.05	<0.05	<0.01	<0.05	<0.05	<0.01	<0.05	<0.05	<0.01
Endosulfan II	mg/kg	0.01			<0.05	<0.05	<0.01	<0.05	<0.05	<0.05	<0.05	<0.05	<0.01	<0.05	<0.05	<0.01	<0.05	<0.05	<0.01
Endosulfan sulphate	mg/kg	0.01			<0.05	<0.05	<0.01	<0.05	<0.05	<0.05	<0.05	<0.05	<0.01	<0.05	<0.05	<0.01	<0.05	<0.05	<0.01
Endrin	mg/kg	0.01		10	<0.05	<0.05	<0.01	<0.05	<0.05	<0.05	<0.05	<0.05	<0.01	<0.05	<0.05	<0.01	<0.05	<0.05	<0.01
Endrin aldehyde	mg/kg	0.05			<0.05	<0.05		<0.05	<0.05	<0.05	<0.05	<0.05		<0.05	<0.05		<0.05	<0.05	
Endrin ketone	mg/kg	0.05			<0.05	<0.05		<0.05	<0.05	<0.05	<0.05	<0.05		<0.05	<0.05		<0.05	<0.05	
g-BHC (Lindane)	mg/kg	0.01			<0.05	<0.05	<0.01	<0.05	<0.05	<0.05	<0.05	<0.05	<0.01	<0.05	<0.05	<0.01	<0.05	<0.05	<0.01
Heptachlor	mg/kg	0.01		6	<0.05	<0.05	<0.01	<0.05	<0.05	<0.05	<0.05	<0.05	<0.01	<0.05	<0.05	<0.01	<0.05	<0.05	<0.01
Heptachlor epoxide	mg/kg	0.01			<0.05	<0.05	<0.01	<0.05	<0.05	<0.05	<0.05	<0.05	<0.01	<0.05	<0.05	<0.01	<0.05	<0.05	<0.01
Methoxychlor	mg/kg	0.05		300	<0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.05	<0.05	<0.2	<0.05	<0.05	<0.2	<0.05	<0.05	<0.2
Oxychlordane	mg/kg	0.01					<0.01						<0.01			<0.01			<0.01
Toxaphene	mg/kg	0.5		20	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5	<0.5		<0.5	<0.5		<0.5	<0.5	
Organophosphorous Pesticides																			
Chlorpyrifos	mg/kg	0.02		160			<0.02						<0.02			<0.02			<0.02
Diazinon	mg/kg	0.2					<0.2						<0.2			<0.2			<0.2
Ethion	mg/kg	0.05					<0.05						<0.05			<0.05			<0.05
Fenitrothion	mg/kg	0.1					<0.1						<0.1			<0.1			<0.1
Malathion	mg/kg	0.1					<0.1						<0.1			<0.1			<0.1
Pesticides																			
Mexacarbate	mg/kg	0.02					<0.02						<0.02			<0.02			<0.02
Aldicarb sulfoxide	mg/kg	0.004					<0.004						<0.004			<0.004			<0.004
Aldicarb	mg/kg	0.004					<0.004						<0.004			<0.004			<0.004
Aldicarb sulfone	mg/kg	0.02					<0.02						<0.02			<0.02			<0.02
Baygon	mg/kg	0.004					<0.004						<0.004			<0.004			<0.004
Bifenthrin	mg/kg	0.2		600			<0.2						<0.2			<0.2			<0.2
Bromophos	mg/kg	0.05					<0.05						<0.05			<0.05			<0.05
Carbaryl	mg/kg	0.05					<0.05						<0.05			<0.05			<0.05
Carbofuran	mg/kg	0.04					<0.04						<0.04			<0.04			<0.04
Methomyl	mg/kg	0.04					<0.04						<0.04			<0.04			<0.04
Oxamyl	mg/kg	0.04					<0.04						<0.04			<0.04			<0.04

Appendix K: Groundwater Laboratory Results

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Groundwater Analytical Results

				Field ID	MW01	MW02	MW03
				Date	15 Nov 2023	15 Nov 2023	15 Nov 2023
	Unit	EQL	Non-potable use of groundwater	NEPM 2013 Table 1C GILs, Drinking Water			
NA							
Aminocarb	**UG/L**	1			<1	<1	<1
Fenuron/Fenuron TCA	**UG/L**	2			<2	<2	<2
Pesticides by LCMSMS (Positive							
Siduron	**µg/L**	1			<1	<1	<1
Carbamates							
Methiocarb	**µg/L**	4	70	7	<4	<4	<4
Fungicides							
Carbendazim	**µg/L**	1	900	90	<1	<1	<1
Halogenated Benzenes							
Hexachlorobenzene	**µg/L**	0.2			<0.2	<0.2	<0.2
Herbicides							
Monuron	**mg/L**	0.002			<0.002	<0.002	<0.002
Propachlor	**µg/L**	1	700	70	<1	<1	<1
Bromacil	**µg/L**	2	4,000	400	<2	<2	<2
Diuron	**µg/L**	0.5	200	20	<0.5	<0.5	<0.5
s-Ethyl dipropylthiocarbamate	**µg/L**	5	3,000	300	<5	<5	<5
Fluometuron	**µg/L**	1	700	70	<1	<1	<1
Linuron	**µg/L**	5			<5	<5	<5
Propham	**µg/L**	5			<5	<5	<5
Inorganics							
Nitrite + Nitrate as N	**mg/L**	0.01			0.01	5.5	9.6
Kjeldahl Nitrogen Total	**mg/L**	0.2			4.4	<0.2	<0.2
Nitrogen (Total)	**mg/L**	0.2			4.4	5.5	9.6
Total Phosphorus (Organic Phosphate)	**mg/L**	0.01			0.49	0.05	0.33
Metals							
Arsenic	**mg/L**	0.001	0.1	0.01	0.004	0.002	<0.001
Cadmium	**mg/L**	0.0001	0.02	0.002	0.0003	<0.0001	<0.0001
Chromium (III+VI)	**mg/L**	0.001			0.28	0.032	0.027
Copper	**mg/L**	0.001	20	2	0.19	0.008	0.001
Lead	**mg/L**	0.001	0.1	0.01	0.014	0.015	0.047
Mercury	**mg/L**	0.0001	0.01	0.001	<0.0001	<0.0001	0.0001
Nickel	**mg/L**	0.001	0.2	0.02	0.091	0.008	0.002
Zinc	**mg/L**	0.005			0.24	0.015	0.007
Organochlorine Pesticides							
Organochlorine pesticides EPAVic	**µg/L**	2			<2	<2	<2
Other organochlorine pesticides EPAVic	**µg/L**	2			<2	<2	<2
4,4-DDE	**µg/L**	0.2			<0.2	<0.2	<0.2
a-BHC	**µg/L**	0.2			<0.2	<0.2	<0.2
Aldrin	**µg/L**	0.2			<0.2	<0.2	<0.2
Aldrin + Dieldrin	**µg/L**	0.2	3	0.3	<0.2	<0.2	<0.2
b-BHC	**µg/L**	0.2			<0.2	<0.2	<0.2
Chlordane	**µg/L**	2	20	2	<2	<2	<2
d-BHC	**µg/L**	0.2			<0.2	<0.2	<0.2
DDD	**µg/L**	0.2			<0.2	<0.2	<0.2
DDT	**µg/L**	0.2	90	9	<0.2	<0.2	<0.2
DDT+DDE+DDD	**µg/L**	0.2			<0.2	<0.2	<0.2
Dieldrin	**µg/L**	0.2			<0.2	<0.2	<0.2
Endosulfan I	**µg/L**	0.2			<0.2	<0.2	<0.2
Endosulfan II	**µg/L**	0.2			<0.2	<0.2	<0.2
Endosulfan sulphate	**µg/L**	0.2			<0.2	<0.2	<0.2
Endrin	**µg/L**	0.2			<0.2	<0.2	<0.2
Endrin aldehyde	**µg/L**	0.2			<0.2	<0.2	<0.2
Endrin ketone	**µg/L**	0.2			<0.2	<0.2	<0.2
g-BHC (Lindane)	**µg/L**	0.2	100	10	<0.2	<0.2	<0.2
Heptachlor	**µg/L**	0.2	3		<0.2	<0.2	<0.2
Heptachlor epoxide	**µg/L**	0.2		0.3	<0.2	<0.2	<0.2
Methoxychlor	**µg/L**	0.2			<0.2	<0.2	<0.2
Toxaphene	**mg/L**	0.005			<0.005	<0.005	<0.005
Organophosphorous Pesticides							
Tokuthion	**mg/L**	0.002			<0.002	<0.002	<0.002
Azinophos methyl	**µg/L**	2	300	30	<2	<2	<2
Bolstar (Sulprofos)	**µg/L**	2	100	10	<2	<2	<2
Chlorfenvinphos	**µg/L**	20	20	2	<20	<20	<20
Chlorpyrifos	**µg/L**	2	100	10	<2	<2	<2
Chlorpyrifos-methyl	**mg/L**	0.002			<0.002	<0.002	<0.002
Coumaphos	**µg/L**	20			<20	<20	<20
Demeton-O	**µg/L**	2			<2	<2	<2
Demeton-S	**µg/L**	2			<2	<2	<2
Diazinon	**µg/L**	2	40	4	<2	<2	<2
Dichlorvos	**µg/L**	2	50	5	<2	<2	<2
Dimethoate	**µg/L**	2	70	7	<2	<2	<2
Disulfoton	**µg/L**	2	40	4	<2	<2	<2
Ethion	**µg/L**	2	40	4	<2	<2	<2
Ethoprop	**µg/L**	2	10	1	<2	<2	<2
Fenitrothion	**µg/L**	2	70	7	<2	<2	<2
Fensulfothion	**µg/L**	2	100		<2	<2	<2
Fenthion	**µg/L**	2	70	7	<2	<2	<2
EPN	**µg/L**	2			<2	<2	<2
Malathion	**µg/L**	2	700	70	<2	<2	<2
Merphos	**mg/L**	0.002			<0.002	<0.002	<0.002
Methyl parathion	**µg/L**	2	7	0.7	<2	<2	<2
Mevinphos (Phosdrin)	**µg/L**	2	60	6	<2	<2	<2
Monocrotophos	**µg/L**	2	20		<2	<2	<2
Naled (Dibrom)	**µg/L**	2			<2	<2	<2
Omethoate	**µg/L**	20	10	1	<20	<20	<20
Phorate	**µg/L**	2			<2	<2	<2
Pyrazophos	**µg/L**	2	200	20	<2	<2	<2
Ronnel	**µg/L**	2			<2	<2	<2
Terbufos	**µg/L**	2	9	0.9	<2	<2	<2
Trichloronate	**µg/L**	2			<2	<2	<2
Tetrachlorvinphos	**mg/L**	0.002	1		<0.002	<0.002	<0.002
Pesticides							
Mexacarbate	**mg/L**	0.001			<0.001	<0.001	<0.001
Aldicarb sulfoxide	**µg/L**	1			<1	<1	<1
Aldicarb	**µg/L**	1	40	4	<1	<1	<1
Aldicarb sulfone	**µg/L**	1			<1	<1	<1
Baygon	**µg/L**	1			<1	<1	<1
Carbaryl	**µg/L**	4	300	30	<4	<4	<4
Carbofuran	**mg/L**	0.001	0.1	0.01	<0.001	<0.001	<0.001
Fenamiphos	**µg/L**	0.1	5	0.5	<0.1	<0.1	<0.1
Methomyl	**mg/L**	0.002	0.2	0.02	<0.002	<0.002	<0.002
Oxamyl	**µg/L**	2	70	7	<2	<2	<2
Parathion	**µg/L**	2	200	20	<2	<2	<2
Pirimiphos-methyl	**mg/L**	0.02	0.9	0.09	<0.02	<0.02	<0.02

Appendix L: Understanding Your Report

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UNDERSTANDING YOUR REPORT

GALT FORM PMP29 Rev3

1. EXPECTATIONS OF THE REPORT

This document has been prepared to clarify what is and is not provided in your report. It is intended to inform you of what your realistic expectations of this report should be and how to manage your risks associated with the conditions on site.

Geotechnical engineering and environmental science are less exact than other engineering and scientific disciplines. We include this information to help you understand where our responsibilities begin and end. You should read and understand this information. Please contact us if you do not understand the report or this explanation. We have extensive experience in a wide variety of projects and we can help you to manage your risk.

2. THIS REPORT RELATES TO PROJECT-SPECIFIC CONDITIONS

This report was developed for a unique set of project-specific conditions to meet the needs of the nominated client. It took into account the following:

- the project objectives as we understood them and as described in this report;
- the specific site mentioned in this report; and
- the current and proposed development at the site.

It should not be used for any purpose other than that indicated in the report. You should not rely on this report if any of the following conditions apply:

- the report was not written for you;
- the report was not written for the site specific to your development;
- the report was not written for your project (including a development at the correct site but other than that listed in the report); or
- the report was written before significant changes occurred at the site (such as a development or a change in ground conditions).

You should always inform us of changes in the proposed project (including minor changes) and request an assessment of their impact.

Where we are not informed of developments relevant to your report, we cannot be held responsible or liable for problems that may arise as a consequence.

Where design is to be carried out by others using information provided by us, we recommend that we be involved in the design process by being engaged for consultation with other members of the project team. Furthermore, we recommend that we be able to review work produced by other members of the project team that relies on information provided in our report.

3. DATA PROVIDED BY THIRD PARTIES

Where data is provided by third parties, it will be identified as such in our reports. We necessarily rely on the completeness and accuracy of data provided by third parties in order to draw conclusions presented in our reports. We are not responsible for omissions, incomplete or inaccurate data associated with third party data, including where we have been requested to provide advice in relation to field investigation data provided by third parties.

4. SOIL LOGS

Our reports often include logs of intrusive and non-intrusive investigation techniques. These logs are based on our interpretation of field data and laboratory results. The logs should only be read in conjunction with the report they were issued with and should not be re-drawn for inclusion in other documents not prepared by us.

5. THIRD PARTY RELIANCE

We have prepared this report for use by the client. This report must be regarded as confidential to the client and the client's professional advisors. We do not accept any responsibility for contents of this document from any party other than the nominated client. We take no responsibility for any damages suffered by a third party because of any decisions or actions they may make based on this report. Any reliance or decisions made by a third party based on this report are the responsibility of the third party and not of us.

6. CHANGE IN SUBSURFACE CONDITIONS

The recommendations in this report are based on the ground conditions that existed at the time when the study was undertaken. Changes in ground conditions can occur in numerous ways including anthropogenic events (such as construction or contaminating activities on or adjacent to the site) or natural events (such as floods, groundwater fluctuations or earthquakes). We should be consulted prior to use of this report so that we can comment on its reliability. It is important to note that where ground conditions have changed, additional sampling, testing or analysis may be required to fully assess the changed conditions.

7. SUBSURFACE CONDITIONS DURING CONSTRUCTION

Practical constraints mean that we cannot know every minute detail about the subsurface conditions at a particular site. We use professional judgement to form an opinion about the subsurface conditions at the site. Some variation to our evaluated conditions is likely and significant variation is possible. Accordingly, our report should not be considered as final as it is developed from professional judgement and opinion.

The most effective means of dealing with unanticipated ground conditions is to engage us for construction support. We can only finalise our recommendations by observing actual subsurface conditions encountered during construction. We cannot accept liability for a report's recommendations if we cannot observe construction.

8. ENVIRONMENTAL AND GEOTECHNICAL ISSUES

Unless specifically mentioned otherwise in our report, environmental considerations are not addressed in geotechnical reports. Similarly, geotechnical issues are not addressed in environmental reports. The investigation techniques used for geotechnical investigations can differ from those used for environmental investigations. It is the client's responsibility to satisfy themselves that geotechnical and environmental considerations have been taken into account for the site.

Geotechnical advice presented in a Galt Environmental report has been provided by Galt Geotechnics under a sub-contract agreement. Similarly, environmental advice presented in a Galt Geotechnics report has been provided by Galt Environmental under a sub-contract agreement.

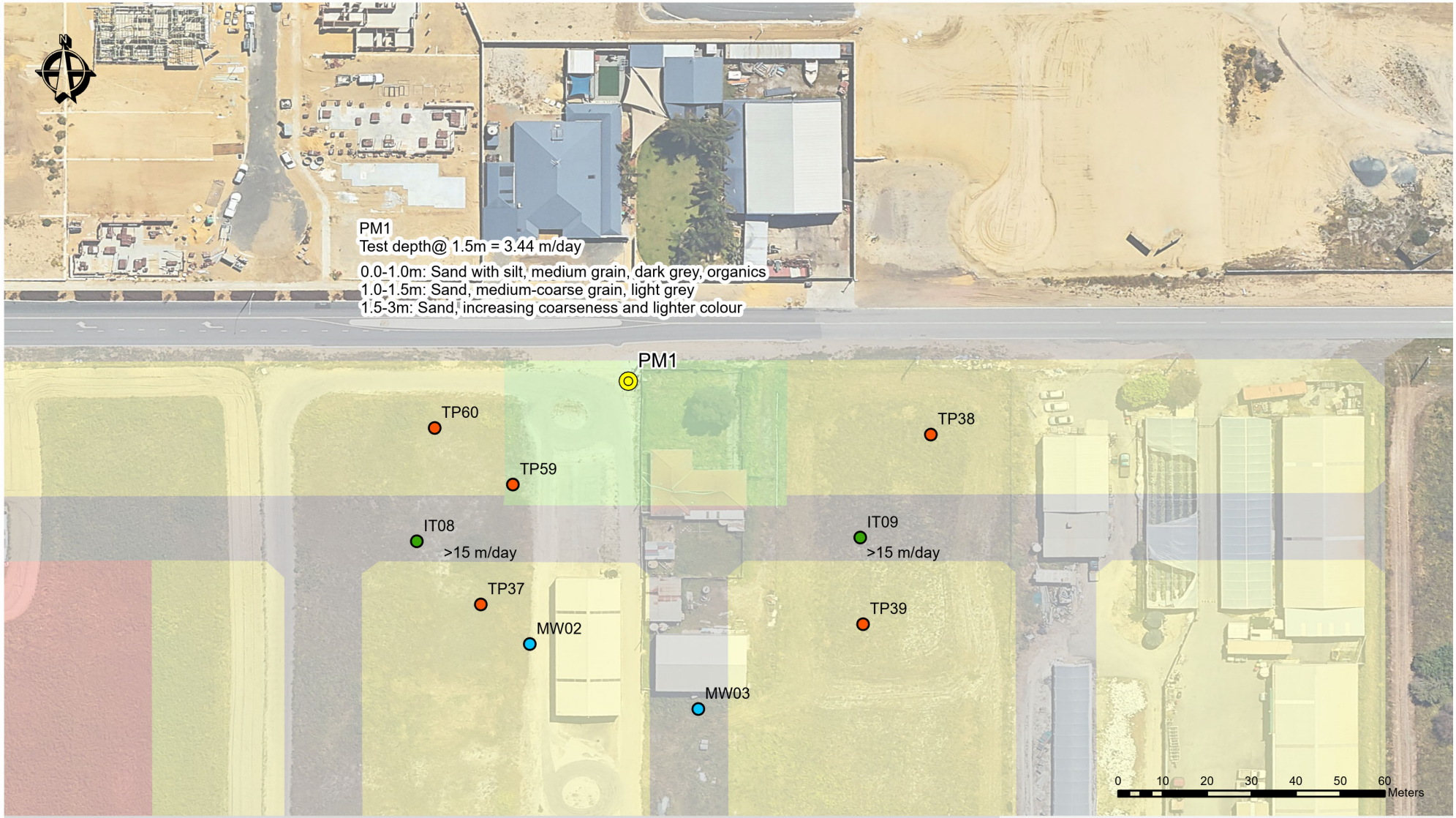
Unless specifically noted otherwise, no parties shall draw any inferences about the applicability of the Western Australian state government landfill levy from the contents of this document.

O:\Administration\Standard Forms and Documents\GEPL Forms\PMP29-Rev4 Understanding your Report Env Logo.docx

ATTACHMENT C

Hyd2o Permeability Testing

Date: 05/07/2024 Job No. H24019



Lots Standard
Lots Transitional
POS
Road

Hyd2o Permeability
Infiltration Test (Galt)
Test Pit (Galt)
Monitoring Well (Galt)

hyd2o

Hammond Quarter UWMP Addendum

Galt Geotech & Hyd2o Permeability

Attachment C

Borehole Permeameter : Field Result Analysis

Project/Site	Hammond Quarter - PM1 (1.5m test depth)	
Location	389817	mE
	6439309	mN

TEST 1

r	5.5	cm
H	17.0	cm
time step	10	secs
H/r	3.09	
C	1.20	

Time (sec)	Level (cm)	Diff (cm)
0	**8.0**	
10	**17.0**	9.0
20	**25.3**	8.3
30	**29.2**	3.9
40	**38.0**	8.8
50	**42.2**	4.2
55	**EOT**	
		6.8
	q (cm^3/s)	6.4

Soil Profile

Depth (m)

1.0-1.5 Sand, medium-coarse grain, light grey.

1.5-3.0 Increasing coarseness and lighter colour.

location

course grained sand at depth

METHOD 1 : Elrick and Reynolds (1992)

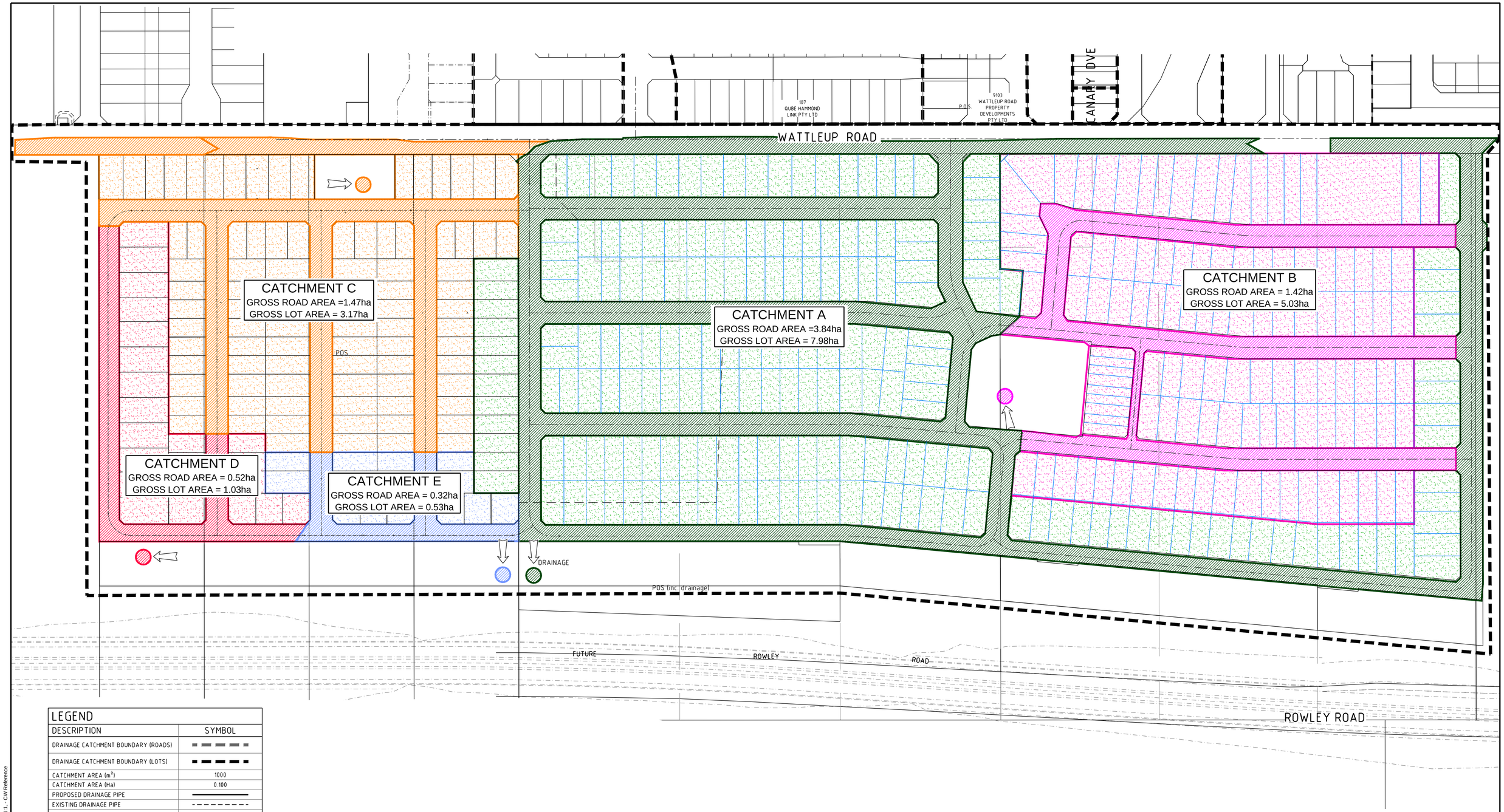
Ks (cm/s)	0.0040
Ks (m/day)	3.44
Average (m/day)	**3.44**

METHOD 2 : Talsma and Hallam Method (recommended for low Ks only <2.9)

q (cm3/min)	383.3
r (cm)	5.5
H (cm)	17.0
$0.5\sinh^{-1}(H/2r)$	0.61
-sqrt((r/H)^2+0.25)	-0.60
r/H	0.32
Sum	0.34
Sum*4.4*q	569.80
$2*pi*H^2$	1815.84
Ksat (cm/min)	0.3
Ksat (m/day)	4.52
Average (m/day)	**4.52**

ATTACHMENT D

Engineering Drawings



LEGEND

DESCRIPTION	SYMBOL
DRAINAGE CATCHMENT BOUNDARY (ROADS)	
DRAINAGE CATCHMENT BOUNDARY (LOTS)	
CATCHMENT AREA (m^2)	1000
CATCHMENT AREA (Ha)	0.100
PROPOSED DRAINAGE PIPE	
EXISTING DRAINAGE PIPE	
FUTURE DRAINAGE PIPE	
PROPOSED ROAD	
EXISTING ROAD	
FUTURE ROAD	
CATCHMENT A	
CATCHMENT B	
CATCHMENT C	
CATCHMENT D	
CATCHMENT E	

REV	DATE	DRN	CKD	APP	AMENDMENT
A	10.05.24	ACB			CATCHMENT AREA ALONG WATTLEUP ROAD UPDATED

N

DIAL BEFORE YOU DIG www.1100.com.au

0m 20m 40m 60m
1:1250

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This plan is not to be used for construction unless issued as revision 0 or higher

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CLIENT: QUBE / PRIMEWEST

APPROVED

DESIGNED: ACB

SCALE: 1:1250

PROJECT: WATTELUP SOUTH

TITLE: DRAINAGE STRATEGY CONCEPT PLAN

WAPC No. 148010 & 147989

DRAWING No. 5910-ST-700

REVISION A

ORIGINAL SIZE A1

P:\5910 Wattleup\5910-ST\Acad\5910-ST-700.dwg, 10/05/2024 4:10:16 PM, eliak, Digital Signing PDF.pc3, 1:1, - CW Reference

Cossill & Webley
CONSULTING ENGINEERS

Hammond Quarter West Amended Structure Plan Engineering Report

Lots 80, 815, 78 & 813 Wattleup Road, Wattleup

November 2025

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1. EXECUTIVE SUMMARY

This report has been prepared by Cossill & Webley Pty Ltd (CW) to inform the engineering requirements for the proposed development of Lots 80, 815, 78 & 813 Wattleup Road, Wattleup. This report supports the Amendment to the Hammond Quarter Structure Plan.

This report summarises the results of a review of the civil engineering issues which have influenced the form of the Plan as they relate to future servicing of the developed land and provides details of each major infrastructure type and a servicing strategy for implementation required for the development of the area. The level of detail is consistent with the requirements of a structure plan and acknowledges further, more detailed, work will be required at the time of subdivision.

The engineering review covers siteworks, roadworks, stormwater drainage, sewerage, water supply and utility services.

The investigation has found the land is suitable for development in accordance with the proposed Plan with logical progressive extension of infrastructure and base capacity.

The ground conditions and past uses are well suited to future urban development.

The available road access via Wattleup Road, and the future extension of Rowley Road, adjacent the development will provide excellent connectivity to the external arterial road system, and we anticipate will be progressively upgraded to accommodate the expected regional traffic demand.

Sewer infrastructure will be provided via connection to the existing Water Corporation pump station on Lot 74, via extension of the proposed gravity network.

Water supply, electrical supply, telecommunications and gas will all be available via the existing network in Wattleup Road. There is capacity within the existing infrastructure for servicing development of this site.

The investigation for this report is largely based on preliminary advice from the various service authorities, and is current as at June 2025.

2. INTRODUCTION

This report has been prepared by Cossill & Webley Pty Ltd (CW) to confirm the servicing requirements for Lots 80, 815, 78 & 813 Wattleup Road, Wattleup to support the Amendment to the Hammond Quarter Structure Plan.

This report summarises the results of a review of the civil engineering issues which have influenced the Plan as they relate to future servicing of the developed land. Figure 1 below presents the Hammond Quarter West Structure Plan.

Figure 1: Hammond Quarter West Structure Plan (Hatch, 2024)

The Site is located within the City of Cockburn and is bound by the existing Wattleup Road to the north, rural lots to the west, future residential lots to the east and the future Rowley Road Planning Control Area to the south.

The location of the Site will require a coordinated approach to development with neighbouring properties, for the connection of roads and services.

3. SITE DESCRIPTION

3.1 Site Vegetation

Historically, development has consisted of a mixture of semi-rural and agricultural uses resulting in the clearing of majority of the site as presented below in Figure 2. Lot 813 is currently being used for storage and is covered in hard stand and commercial sheds, which will require demolition and removal prior to the commencement of development.

Figure 2: Aerial Photography (MNG Maps 2025)

3.2 Geology

The Geological Survey of Western Australia Perth Metropolitan Region soils maps for Fremantle (part 2033I & 2033IV) indicates that the majority of the site is generally characterised by Sand derived from Tamala Limestone (Refer Figure 3 below). These soil types are well suited to urban development, with very good permeability anticipated. The soil maps indicate a small area of Peaty Clay may be present in the northern portion of Lot 78, which may require some remediation as part of the earthworks preparation for the Site. Development north of Wattleup Road has been completed, and Peaty Clay has not been present within 6 metres of the existing natural surface.

A site-specific geotechnical investigation will be undertaken at the detailed design stage to outline requirements for residential development and provide feedback on works required to obtain the desired site classification.

Based on experience east and west of the Site, we anticipate a Site Classification A will be provided in accordance with Australian Standard AS2870: “Residential Slabs and Footings”.

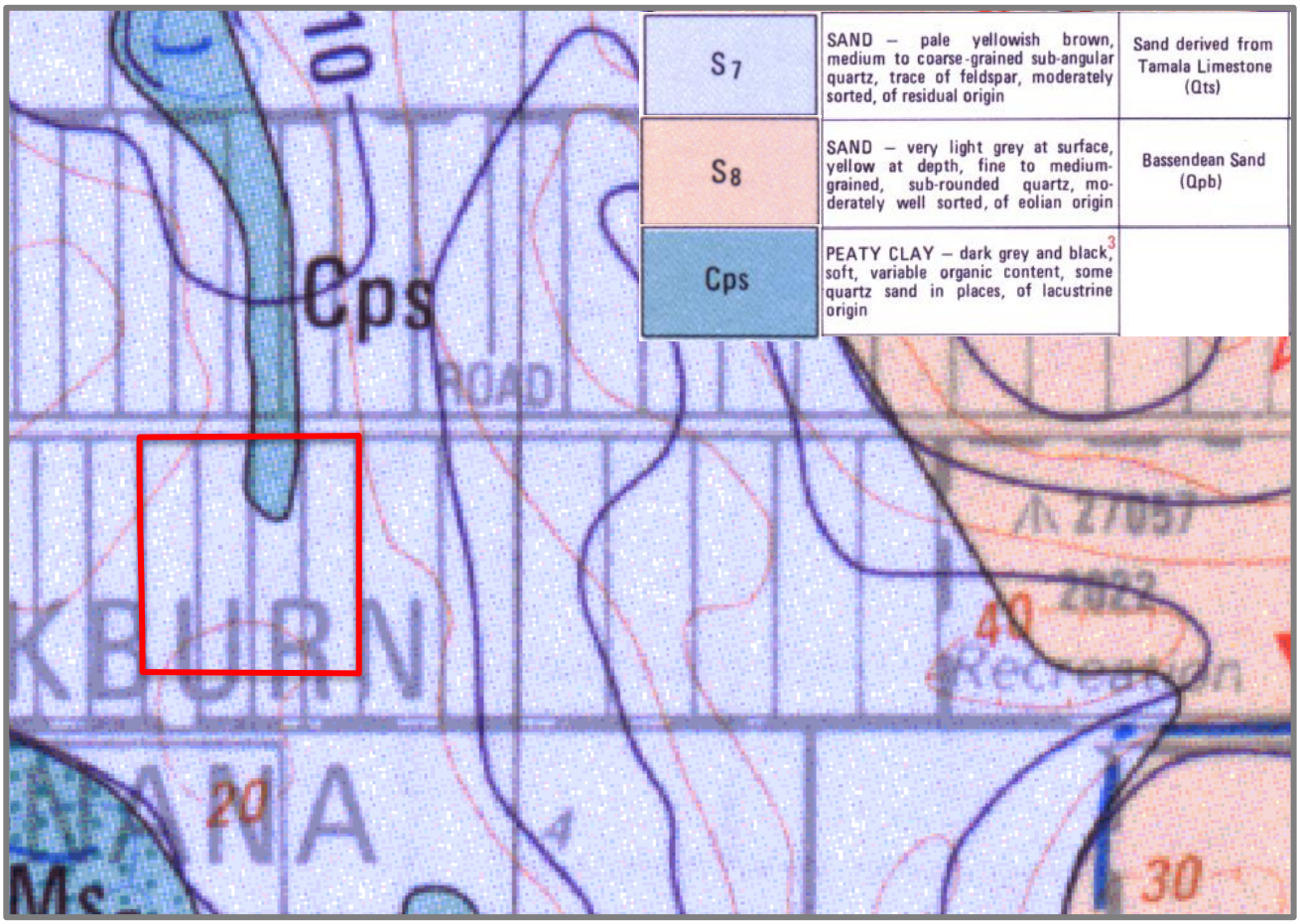


Figure 3: Geotechnical Information (Geological Survey of WA)

3.3 Topography

The Site gently grades from south to north, with levels generally ranging from a high point of RL 24m AHD at along the southern boundary of the Site to RL17.0mAHD adjacent Wattleup Road as presented below in Figure 4.

Figure 4: Existing Topography (MNG Maps 2025)

3.4 Groundwater

The Maximum Groundwater Levels (MGL) vary from approximately RL11mAHD at the south-west boundary to RL12m AHD at the north-east boundary as presented below in Figure 5. We anticipate that preliminary earthworks levels will provide at least 4 metres clearance to groundwater, hence we do not anticipate groundwater will restrict or influence the development of the Site.

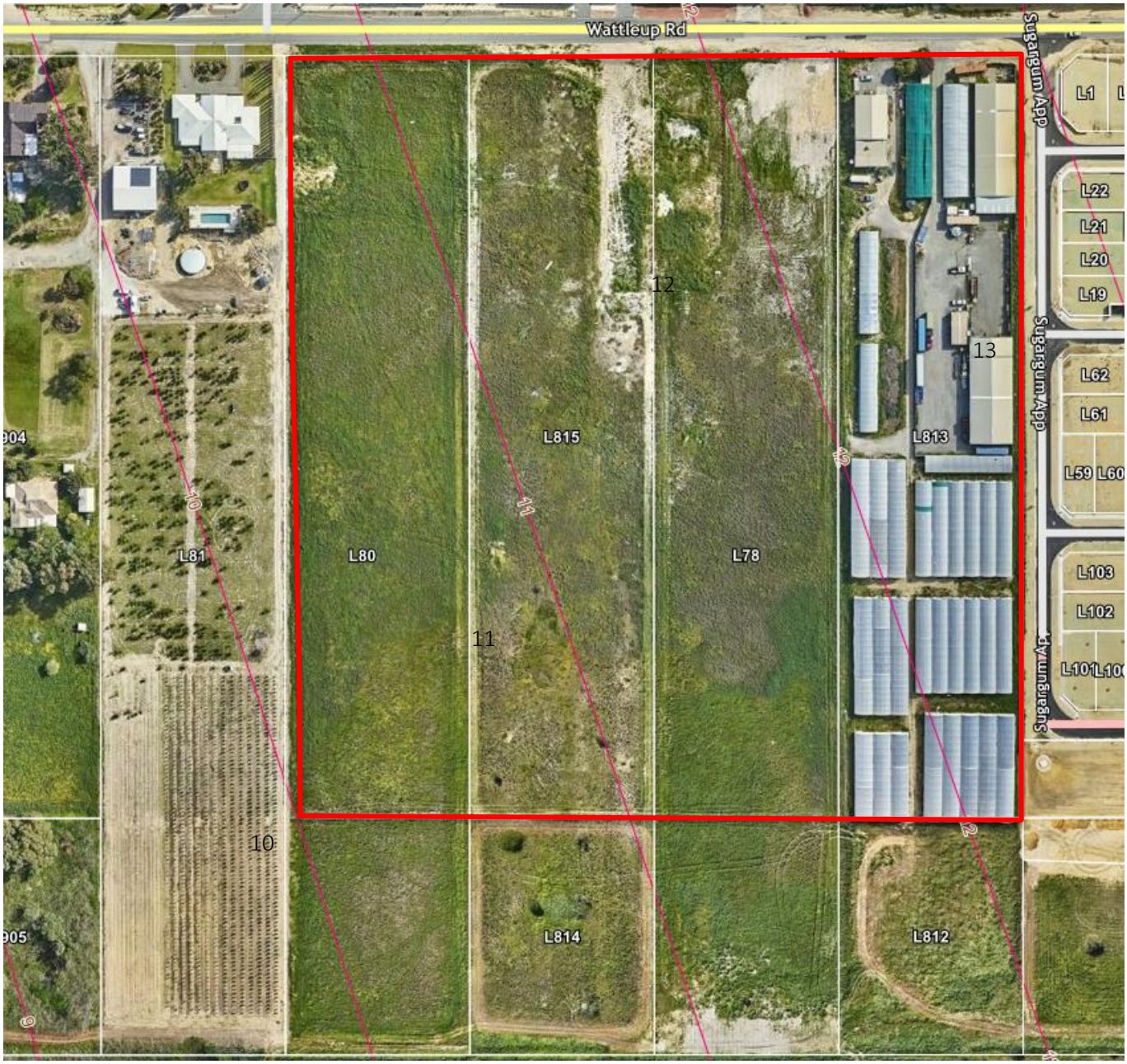


Figure 5: Department of Water 2019 Maximum Groundwater Levels (MNG Maps 2025)

3.5 Acid Sulphate Soils

A desk top review of the Department of Environment and Conservation's ASS Risk Map for the South Metropolitan Region for potential acid sulphate soils (ASS) indicates the majority of the Site is classed as having a no risk of ASS potential within 3m, or deeper from the natural surface as presented below in *Figure 6*.

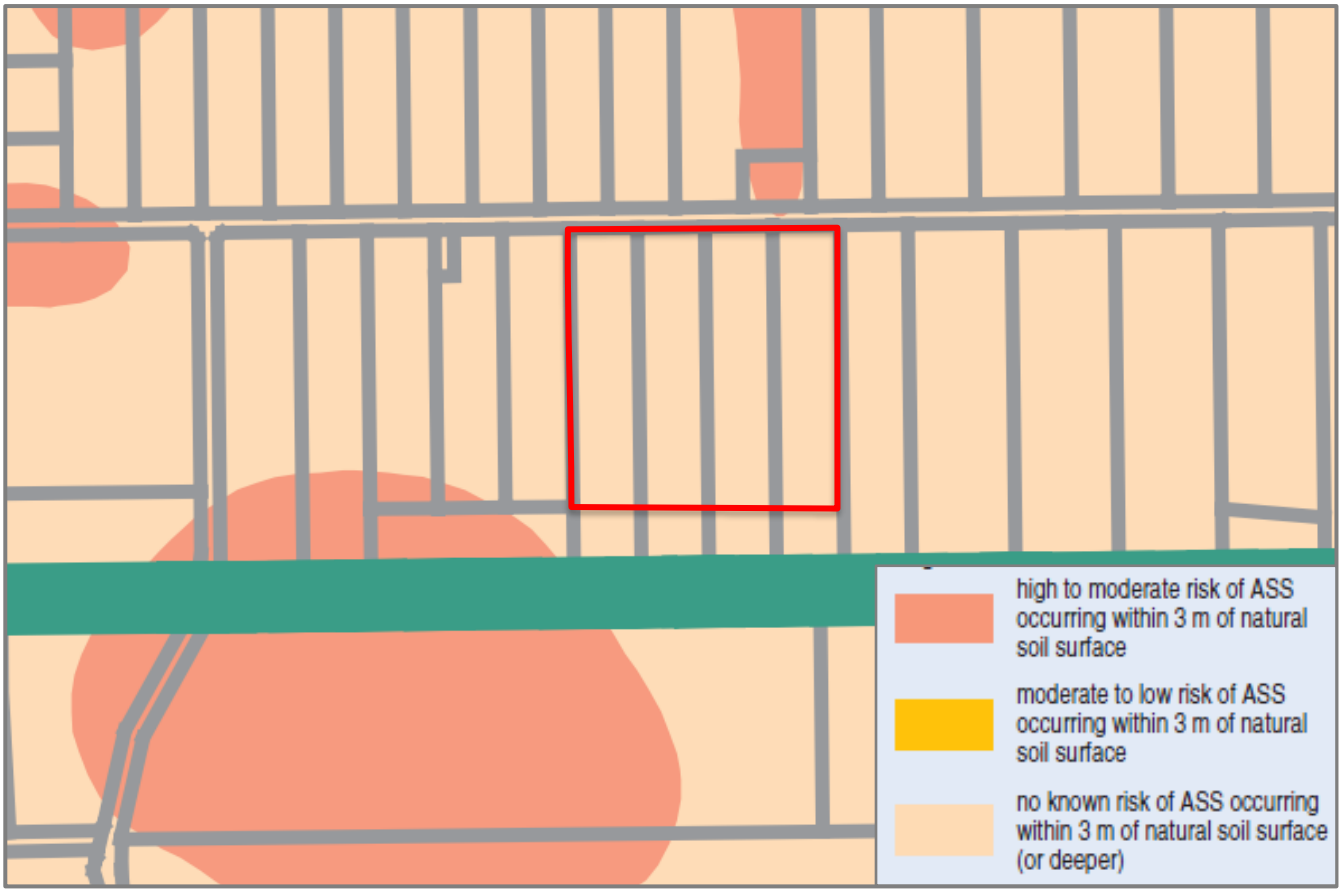


Figure 6: Acid Sulphate Soils Risk Mapping (April, 2024)

4. SITEWORKS & EARTHWORKS

Siteworks for urban development will generally comprise clearing of existing vegetation and, where necessary, earthworking the existing ground, to facilitate the required form of the development.

The extent of siteworks will be dictated by the density and nature of development. Increased densities and decreasing lot sizes has led to a current trend for the development areas to be fully earthworked to create level lots which are terraced between retaining walls.

This approach provides a number of positive outcomes:

- It reduces house building costs,
- It rationalises retaining wall layouts and designs consistent with Local Authority specifications,
- It enables lots to be terraced up natural slopes to maintain elevation and views.

We intend to earthwork the Site to provide a cut-to-fill balance across the development. This will generally involve cutting the southern higher areas of the Site and filling the lower areas at the north of the future development.

We will ensure earthworks levels tie in to existing levels at Wattleup Road, the existing rural lot to the west, proposed development levels to the east and the Rowley Road proposed levels to the south.

The site grades will also ensure grades across the site are within typical tolerances for roads, drainage and sewerage reticulation.

An earthworks plan has been included in the appendix of this report. The plan demonstrates that no batters encroach onto third-party landholdings, with the exception of an encroachment onto MRWA PCA land. MRWA has confirmed that the proposed earthworks will not preclude the future delivery of Rowley Road.

5. DRAINAGE AND GROUNDWATER MANAGEMENT

The landform through the area is generally steep with good separation from the groundwater table.

An Urban Water Management Plan (UWMP) has been prepared by Hyd20. The UWMP confirms the proposed storage and disposal strategy for stormwater runoff generated from the proposed development of the Site.

5.1 Stormwater Management

Groundwater recharge will be maximised through the adoption of 'Best Management Practices' that promote the dispersion and infiltration of run off as close to source as possible. This will include incorporation of inter-allotment drainage soakwells to infiltrate runoff from building roofs and private open space areas and the disposal of road runoff into infiltration basins within the POS area adjacent to Wattleup Road. Roadside swales along the southern and western boundaries may be considered to reduce drainage storage in the central POS.

5.2 Water Quality Management

Recharge water quality will be improved through the adoption of 'Best Management Practices' which promote the disposal of runoff via water pollution control facilities (including vegetated swales and basins, detention storages and gross pollutant traps) and the implementation of non-structural source controls (including urban design, street sweeping, community education, low fertiliser landscaping regimes, etc).

5.3 Stormwater Collection & Disposal

Drainage from public roads and lanes would be collected via conventional gullies or open swales depending on the nature of the adjacent land uses and the extent of traffic and pedestrian activity.

The drainage collection and conveyance system will be designed to cater for the runoff from storms with up to a 20% Average Exceedance Probability (AEP). A series of detention basins will be designed to store runoff to the pre-development peak flow rates for the 20%, 10% and 1EY AEP events in accordance with the UWMP. In all cases roads and POS would be designed to cater for the surface overflow for more severe storms with building pad levels set at least 300 millimetres above the 1% AEP level in roadways and 500 millimetres above the 1% flood level for storage detention basins.

The dispersion of stormwater disposal throughout the site will maximise the area of recharge down through the soil profile to the shallow aquifer, thereby maximising the potential for nutrient stripping and water quality improvements.

6. WATER RETICULATION

The subject land is located within the current boundary of the Water Corporation's Water Supply Scheme and overall planning for the scheme has made provision for residential development over the subject land.

The current planning indicates the Site will ultimately be serviced via the extension of an existing 610mm distribution main in Hammond Road that currently terminates at the intersection of Hammond Road and Gaebler Road. The extension of this main further south to Wattleup Road will be a Water Corporation capital project, as demand requires, however the Water Corporation has advised that the implementation of the project is in part dependent upon the extension and upgrade south of Hammond Road along Frankland Avenue, as the alignment and profile of the main will be dictated by final road levels and embankments.

The Water Corporation has confirmed the Site can be serviced off the existing DN150 main in Wattleup Road.

7. SEWERAGE RETICULATION

The Site forms part of the Water Corporation's Thompson's Lake Waste Water Reticulation System and preliminary planning occurred to develop strategies for providing reticulated sewerage to all proposed urban land within the subject area. An excerpt of the Water Corporation's catchment plan for the area is presented below in *Figure 7*.

The Site is proposed to be serviced by connection to the reticulation sewer that runs along the Wattleup Road north of the Site. This new line grades to a Type 40 Waste Water Pumping Station (WWPS) "Thomsons Lake Pump Station G", located at the natural low point within Lot 74. The pump station was commissioned in 2023 and is now in use. There are no impediments to the provision of sewerage infrastructure to service the Site.

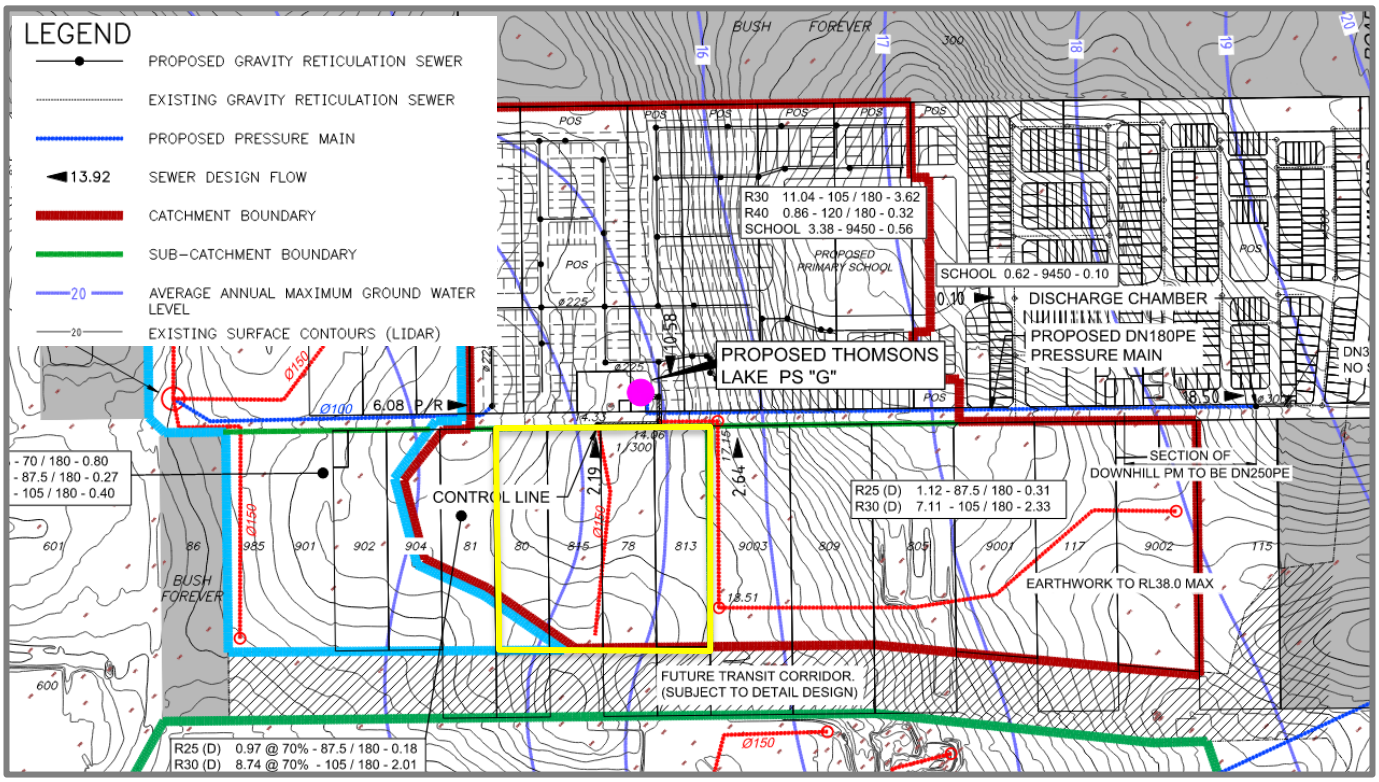


Figure 7: Sewer Reticulation Planning (Water Corporation 9 March 2023)

8. POWER

The Site can readily be serviced via the existing overhead high voltage cable located on the southern side of Wattleup Road.

Based on Western Power's predicted Network Capacity in October 23, there is sufficient capacity in this existing network to support the proposed development. All power to the proposed development will be underground and fed from transformers located strategically within the development.

9. GAS SUPPLY

ATCO Gas has advised the existing network has the capacity to supply the development from the existing frontal main in Wattleup Road.

10. TELECOMMUNICATIONS

10.1 NBN

The Site is within the fixed line footprint of the NBN, and hence can be serviced with optic fibre under their roll-out scheme for greenfield developments via connection to the existing network in Wattleup Road.

Under the Federal Government's Telecommunications in New Developments Policy, developers are responsible for contributing to the cost of delivering the NBN network in new developments. This includes contributing to part of the costs of the build (civils and any backhaul required) as well as a $600 per lot deployment change.

The current design practice for road reserves, pavement and verge provisions will make adequate allowance for services including broadband in accordance with the agreed Utilities Service Providers handbook. There will be some local land requirements for equipment sites, similar to current provisions which will be accommodated at detailed subdivision stage.

10.2 Existing Telecommunications Infrastructure

Telecommunications providers Optus, Telstra and TPG have been consulted on the coverage, capacity and quality of the existing infrastructure surrounding the Site and its ability to service the proposed development.

Telstra has advised the development is not likely to significantly impact on the coverage, capacity and quality of the existing Telstra Wireless services in the area, all of which are currently well within normal KPIs. Further to this, Telstra has advised no Telstra Wireless infrastructure upgrades are likely to be required as a result of the development.

Optus has advised the existing infrastructure has adequate coverage and capacity to service the Site from existing network sites and have confirmed they do not require any additional network infrastructure sites to provide coverage/capacity to the proposed subdivision. It is also noted that Optus are planning on coverage and capacity improvements as part of their new P0955 Wandi North infrastructure, which is forecast for completion in March 2024.

TPG were contacted for comment however have not provided a response.

11. ROADWORKS & FOOTPATHS

11.1 Abutting Roads and Access Points

The Site will be well serviced with good transit options to the broader regional network. Wattleup Road abuts the Site to the north, and a transit corridor for the future extension of Rowley Road abuts the southern boundary.

Wattleup Road has been identified by Main Roads WA as a "Regional Distributor Road" and forms part of the MRWA RAV network for heavy vehicles and is currently being upgraded to an urban standard including kerbing drainage, paths and lighting. We note that the existing vertical geometry of Wattleup Road cannot be amended due to tying in with existing dwellings that will be retained, and the existing k values do not comply with Austroad Standards for Safe Stopping Distance for the current speed zoning.

Upon completion of the upgrades, Wattleup Road will consist of twin 3.5m carriageways with a 3m median. A Traffic Impact Assessment has been completed to inform the ultimate design of Wattleup Road by Stantec.

A Traffic Impact Assessment has also been completed by PTG to accompany this Amendment to the Hammond Quarter Structure Plan and confirms that the Wattleup Road intersection proposed at the eastern boundary of the Site will have sufficient capacity to accommodate proposed traffic from this project.

Rowley Road will be extended across the south boundary of the Site in the future, and will provide improved transport route options between Kwinana Freeway and the coast, as well as relieving the traffic burden from Wattleup Road.

11.2 Internal Road Network

Internal road designs will comply with Liveable Neighbourhoods and the City of Cockburn Standards.

In all cases the road cross-sections will be designed to cater for utility services, on standard verge alignments, street trees, parking embayments where appropriate and footpaths. Where roads abut public open space, verges can be reduced to a minimum of 0.5m if no parking is required.

11.3 Footpaths

Footpaths will be provided in accordance with *Liveable Neighbourhoods* and the City of Cockburn standards and will consist of one path in every road.

12. STAGING

It is anticipated that development will begin at the eastern boundary for connection to the existing road and service infrastructure. Stages will progress westwards as per market demands.

13. CONCLUSION

Based on the advice received from various servicing authorities, consultants and the City of Cockburn, we consider there are no impediments to the development of the Site. The ground conditions and past uses will not limit the proposed urban development, and the Site can be easily incorporated into the existing and planned future road network. Water supply, sewerage and other public utility services are available and are currently being upgraded along Wattleup Road.

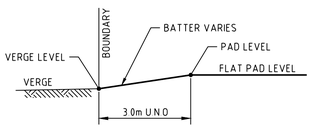
The investigation for this report is largely based on preliminary advice from the various service authorities, and is current at June 2026.

LEGEND

DESCRIPTION	SYMBOL
LIMIT OF WORKS BOUNDARY	
FINISHED SURFACE CONTOUR MAJOR	25.0
FINISHED SURFACE CONTOUR MINOR	24.5
EXISTING SURFACE CONTOUR	25.0
FINISHED LOT PAD LEVEL	25.00
FINISHED LOT SPOT LEVEL	×25.00
PROPOSED RETAINING WALL	
EXISTING RETAINING WALL	
FUTURE RETAINING WALL	
BUILDING SETBACK LINE	
EXISTING TREE (AND NUMBER) TO BE RETAINED	100
DWER HISTORICAL MAXIMUM GROUND WATER LEVEL	14.0

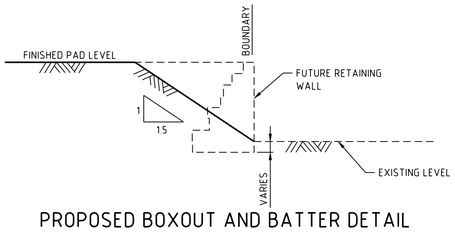
NOTES

1. ALL LEVELS IN METRES TO AHD. SURVEY BY MNG.
2. BATTERS TO EXISTING SURFACE AT 1:3 (CUT) 1:4 (FILL) UNLESS NOTED OTHERWISE.
3. BATTER POSITION FOR FUTURE WALLS TO ENSURE CUT TO FILL EARTHWORKS BALANCE.
4. ALL UNSUITABLE MATERIAL TO BE REMOVED BY THE CONTRACTOR TO APPROVED TIPPING SITE PRIOR TO COMMENCEMENT OF CONSTRUCTION. ALL FEES TO BE PAID BY CONTRACTOR.
5. EXTENT OF CLEARING AND EARTHWORKS TO BE LIMITED TO THE STAGE CLEARING BOUNDARY UNLESS AGREED WITH THE SUPERINTENDENT.
6. ALL CLEARED MATERIAL TO BE MULCHED AND STOCKPILED ON SITE AS DIRECTED BY THE SUPERINTENDENT.
7. CONTRACTOR TO LOCATE ALL EXISTING SERVICES PRIOR TO COMMENCEMENT OF WORKS ON SITE.
8. CONTRACTOR TO GRADE EVENLY BETWEEN DESIGN CONTOURS AND MATCH INTO EXISTING SURFACE AT LIMIT OF EARTHWORKS BOUNDARY WHERE APPROPRIATE.
9. EXCESS CUT FROM EARTHWORKS SHALL BE PLACED ON SITE AS DIRECTED BY THE SUPERINTENDENT.
10. WHERE LIMESTONE IS WITHIN 600mm OF THE FINAL SURFACE LEVEL THE CONTRACTOR SHALL TREAT THE SITE IN ACCORDANCE WITH THE SPECIFICATION.
11. DESIGN LEVELS SHOWN SHALL BE ON THE FINISHED SURFACE INCLUDING TOPSOIL WHERE SPECIFIED.
12. THE CONTRACTOR SHALL LIMIT THE MOVEMENT OF EQUIPMENT AND MANPOWER TO THE MINIMUM AREA NECESSARY AND PROTECT ALL VEGETATION AND EXISTING SERVICES ON SITE.
13. ADJACENT RESIDENTS TO BE NOTIFIED OF THE WORKS AT LEAST TWO WEEKS IN ADVANCE. CONTRACTOR TO PROVIDE MOBILE NUMBER FOR SUPERVISOR AS PART OF NOTIFICATION.



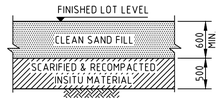
TYPICAL BATTER TO FRONT OF TRADITIONAL LOTS

SCALE: N.T.S



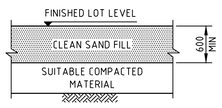
PROPOSED BOXOUT AND BATTER DETAIL FOR FUTURE RETAINING WALLS

SCALE: N.T.S



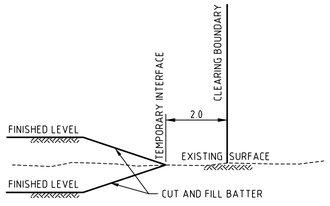
TYPICAL CUT SECTION FOR LOTS IN LIMESTONE AREAS

SCALE: N.T.S



TYPICAL FILL SECTION FOR LOTS IN SAND AREAS

SCALE: N.T.S



TEMPORARY EARTHWORKS INTERFACE

SCALE: N.T.S

NOTICE TO CONTRACTOR

IT IS THE CONTRACTOR'S RESPONSIBILITY TO INVESTIGATE THE NATURE AND LOCATION OF ALL SERVICES WHICH MAY BE ENCOUNTERED AND TO CONSULT WITH THE RELEVANT SERVICE AUTHORITIES PRIOR TO COMMENCEMENT OF EXCAVATIONS. FAILURE TO DO SO OR TO TAKE DUE CARE SHALL NOT LIMIT THE CONTRACTOR'S LIABILITY FOR REPAIR OF ALL SERVICES DAMAGED BY HIM DURING CONSTRUCTION WORKS. THE CONTRACTOR SHALL TAKE ALL PRECAUTIONS NECESSARY FOR THE PROTECTION OF ALL EXISTING SERVICES.

REV	DATE	DRN	CKD	APP	AMENDMENT
2	25.05.26	MT	RC	A. THOMSON	PRECAL UPDATED
1	13.05.26	WBR	RC	A. THOMSON	ROAD AND PAD LEVELS REVISED, HOLD CLOUDS REMOVED FROM BASINS
0	01.05.26	WBR	RC	A. THOMSON	ISSUED FOR CONSTRUCTION
D	23.04.26	WBR	RC	A. THOMSON	ISSUED FOR APPROVAL
C	12.03.26	MT	RC	A. THOMSON	UNDERGROUND POWER AND EXISTING COMMS ADDED

N

BEFORE YOU DIG www.byda.com.au

1:1000 0m 20 40 60m

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CLIENT: QUBE

APPROVED: AVRIL THOMSON

DESIGNED: MT

SCALE: 1:1000

PROJECT: HAMMOND CORNER - STAGE 14

TITLE: EARTHWORKS PLAN SHEET 1 OF 2

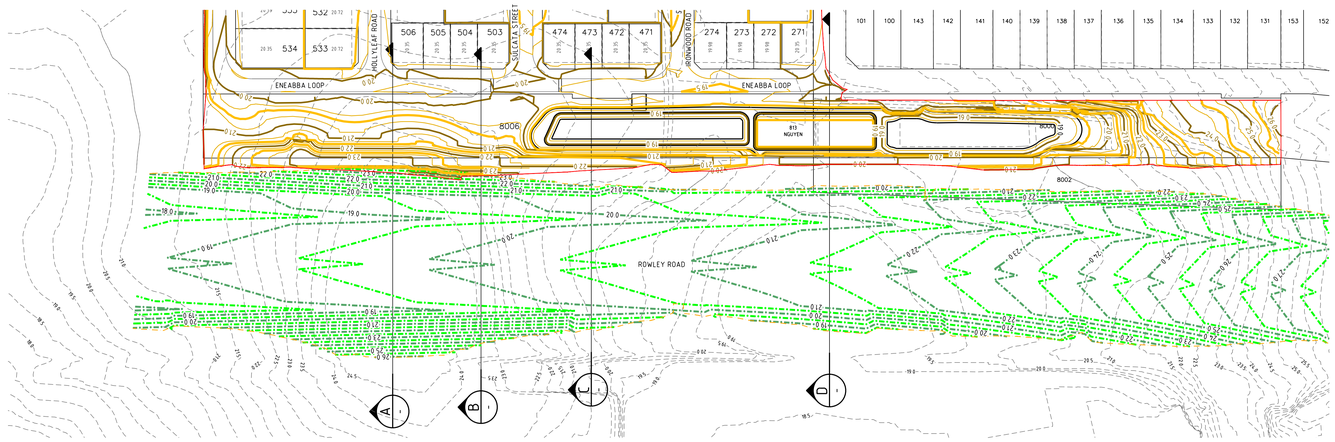
WAPC No. 202211

DRAWING No. 5910-14-200

REVISION 2

ORIGINAL SIZE A1

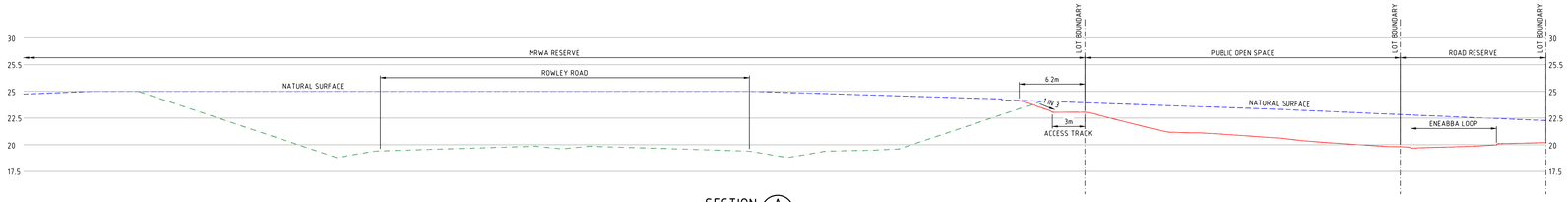
P:\5910 Wattleup\5910-HC\5910-14\Acad\5910-14-200.dwg, 25/05/2026 11:56:32 AM, mattiat, Digital Signing PDF.pc3, 1:1, - CW Reference



PLAN
1:1000

LEGEND

- NATURAL SURFACE LEVEL (0.5m INTERVAL)
- ROWLEY ROAD DESIGN CONTOURS (1.0m INTERVAL)
- ROWLEY ROAD DESIGN CONTOURS (0.5m INTERVAL)
- HAMMOND CORNER DESIGN CONTOURS (1.0m INTERVAL)
- HAMMOND CORNER DESIGN CONTOURS (0.5m INTERVAL)



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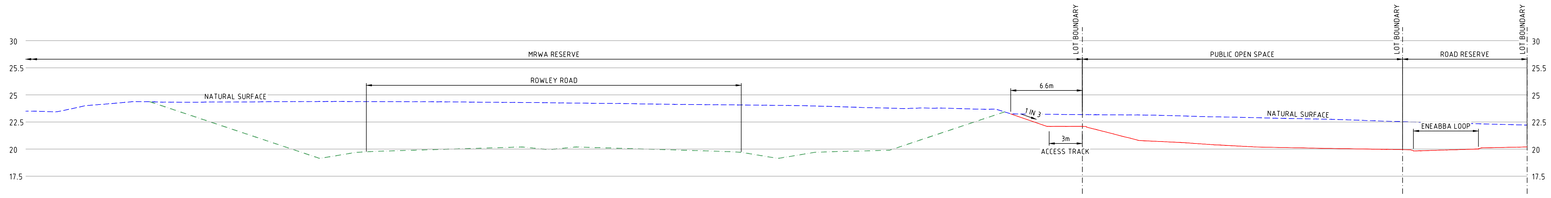
1:200



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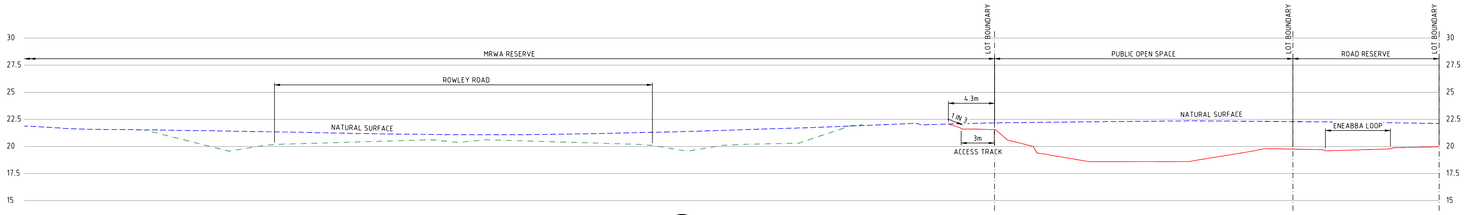

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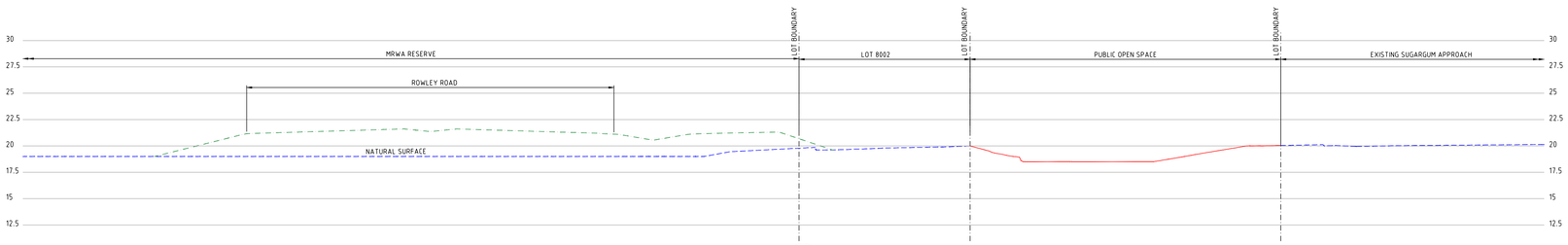

SECTION D
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REV	DATE	DRN	CKD	APP	AMENDMENT
A	15.04.26	A	-		ISSUED FOR REVIEW

N

1:200 0m 4 8 12
1:1000 0m 20 40 60

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CLIENT: QUBE

APPROVED:

DESIGNED: WBR

SCALE: 1:200 1:1000

PROJECT: HAMMOND CORNER - STAGE 14

TITLE: ROWLEY ROAD AND HAMMOND CORNER CROSS SECTIONS

WAPC No.

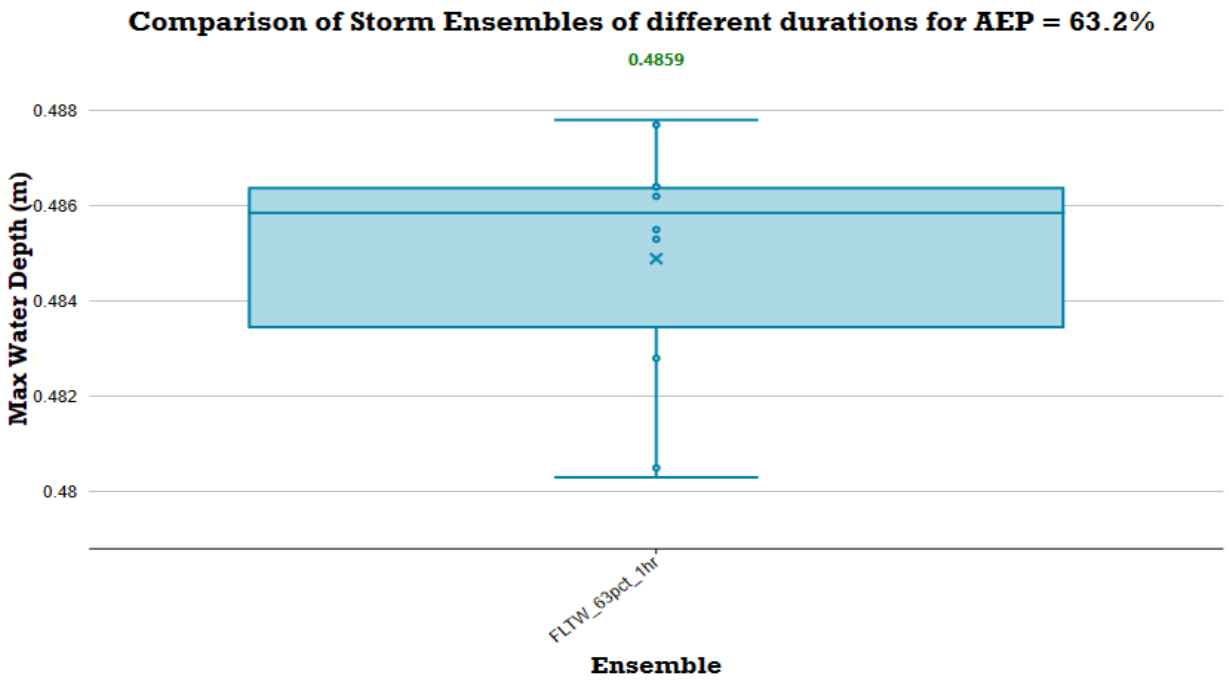
DRAWING No. 5910-14-SK103

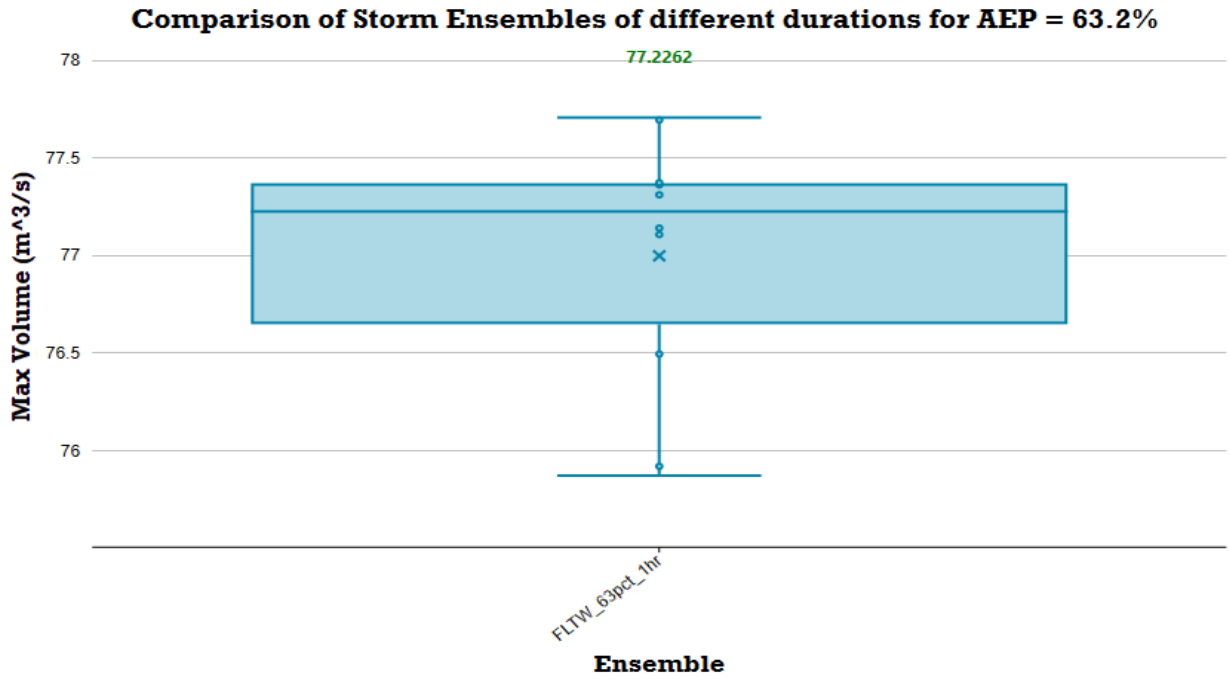
REVISION A

ORIGINAL SIZE A0

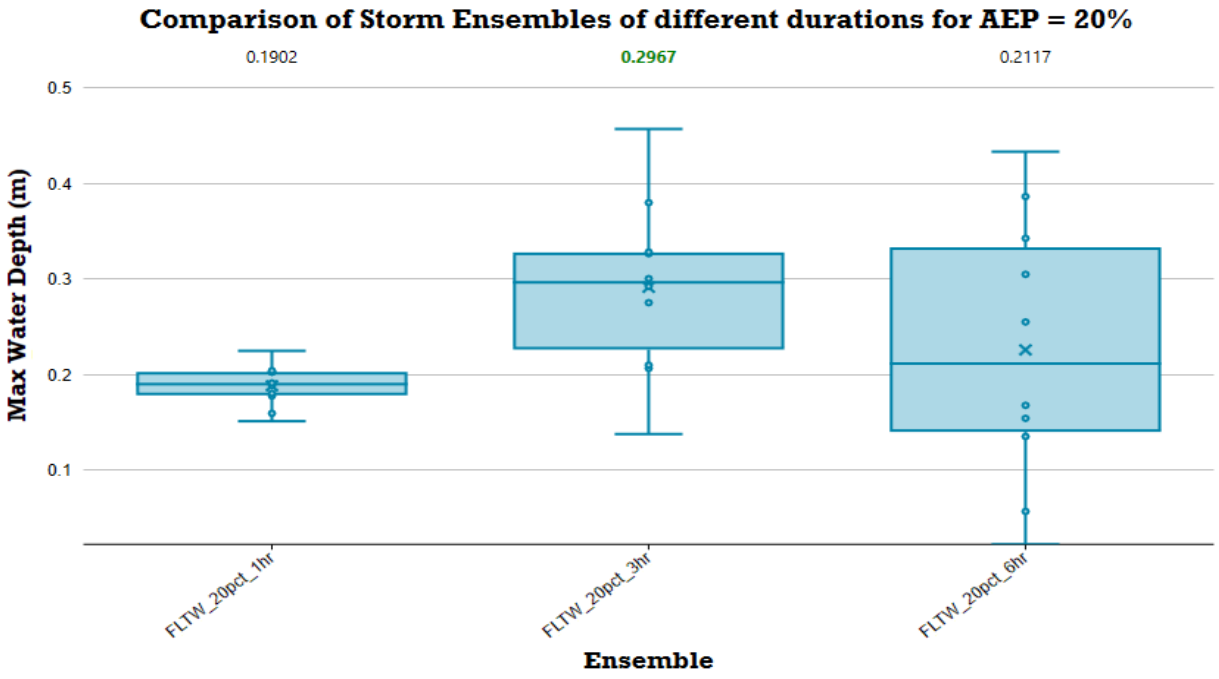
ATTACHMENT E

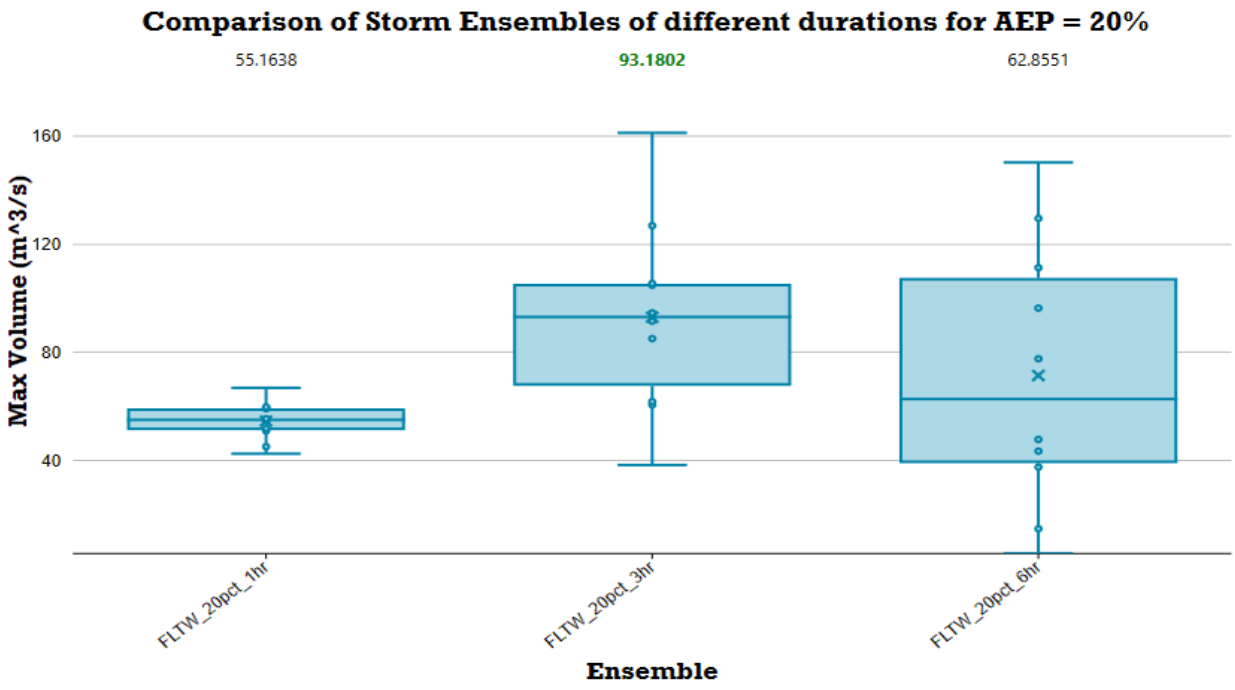
Stormwater Modelling Outputs


Comparison of Storm Ensembles of different durations for AEP = 63.2%
0.4859
0.488
0.486
0.484
0.482
0.48
Max Water Depth (m)
FLTW_63pct_1hr
Ensemble


Comparison of Storm Ensembles of different durations for AEP = 63.2%
77.2262
78
77.5
77
76.5
76
Max Volume (m^3/s)
FLTW_63pct_1hr
Ensemble

Date: 2/07/2024 Job No. H24019





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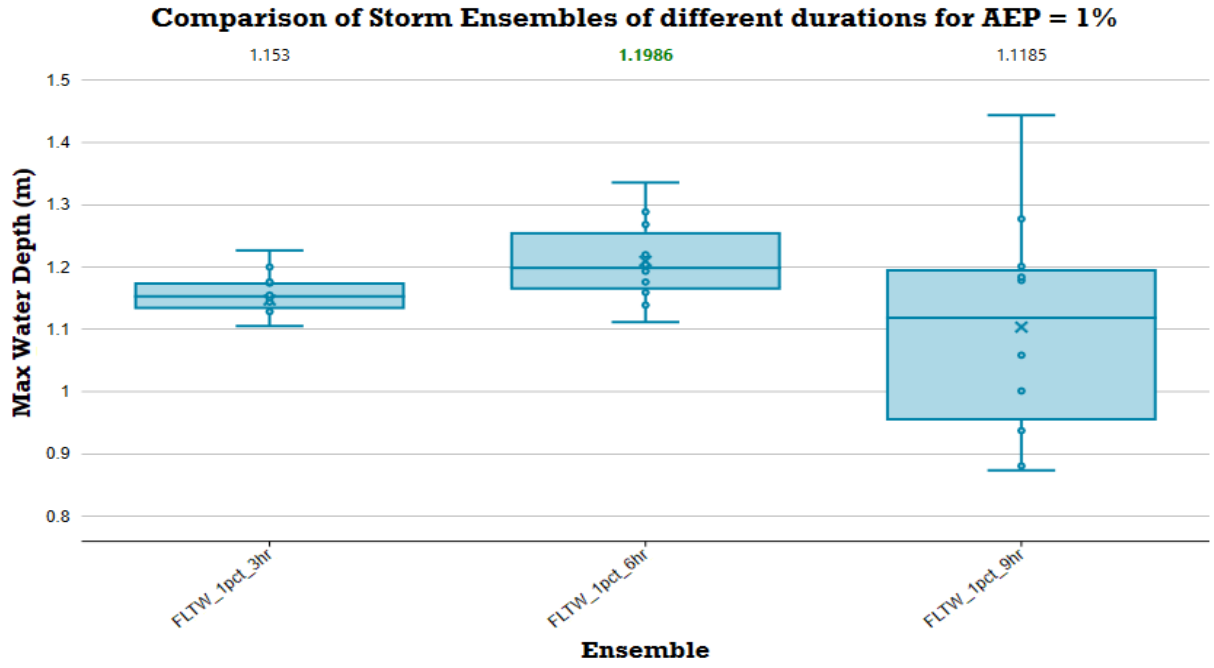
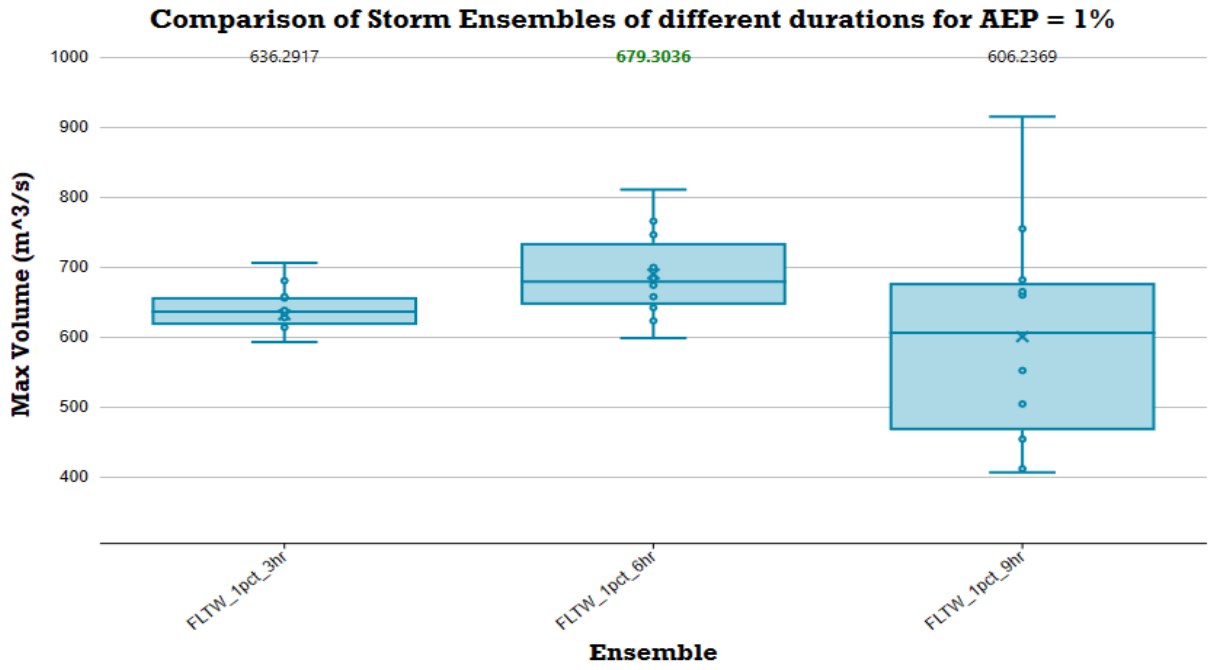
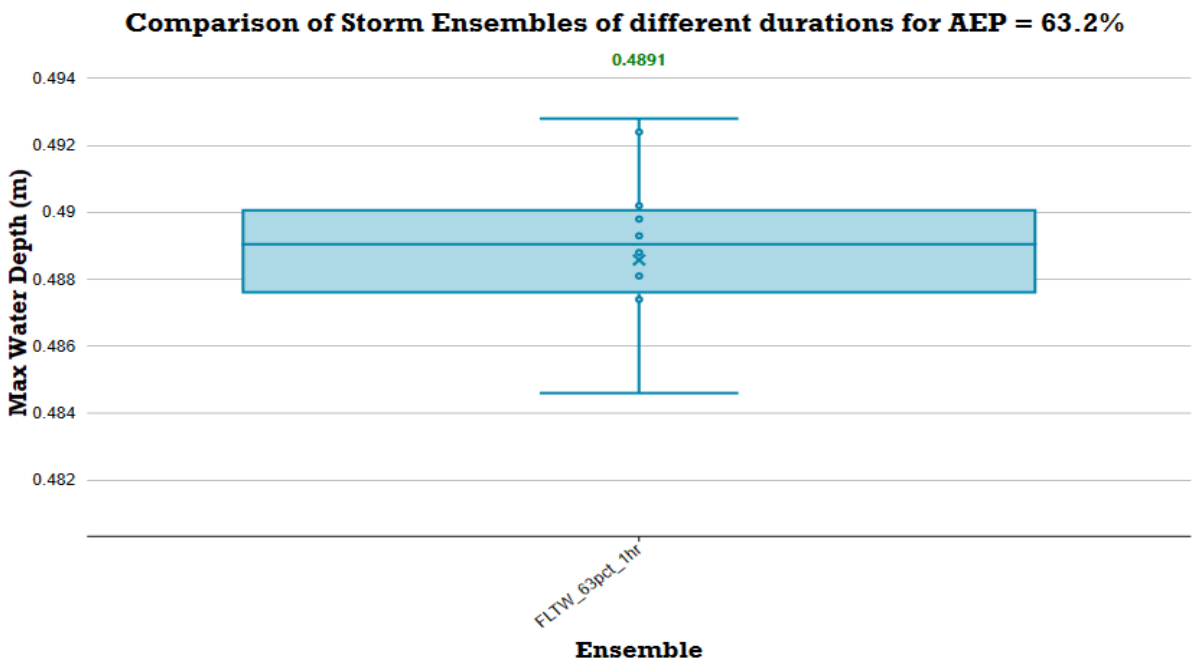
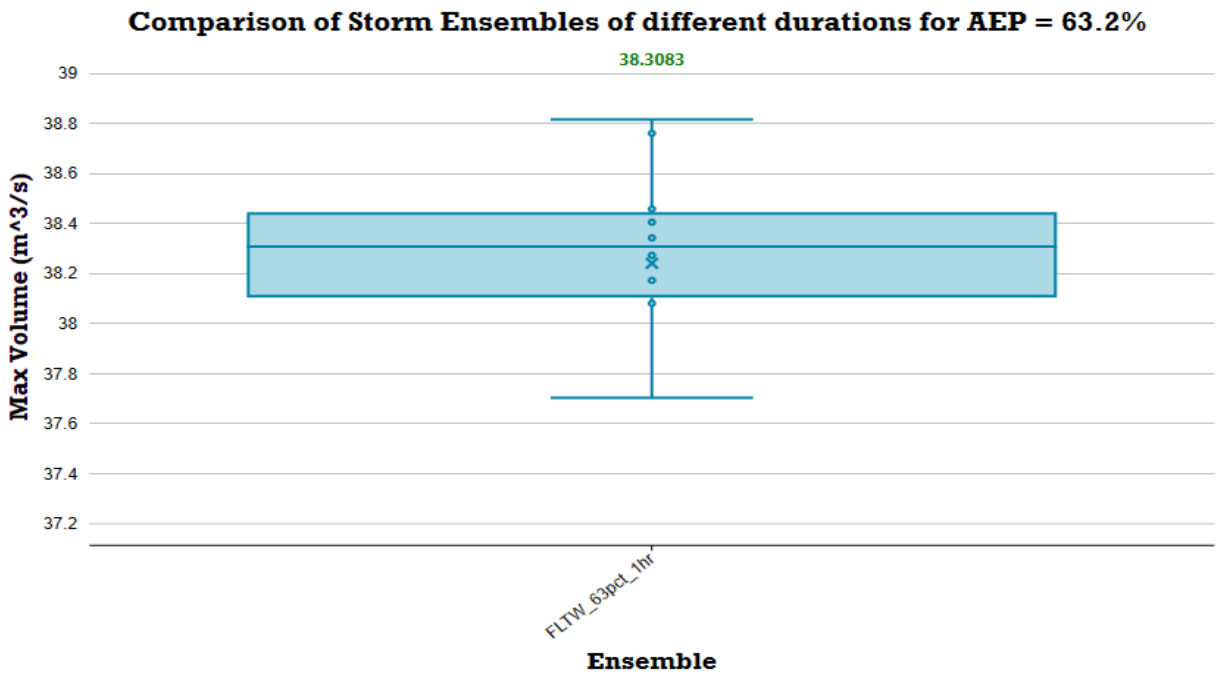
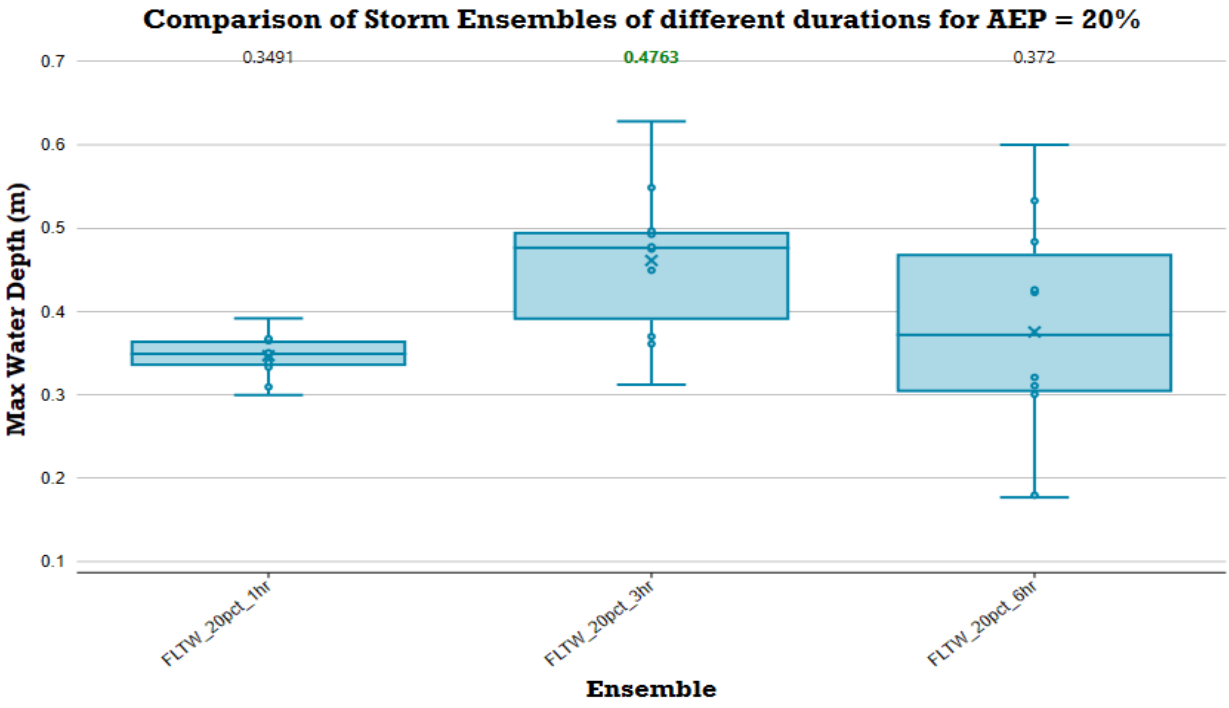


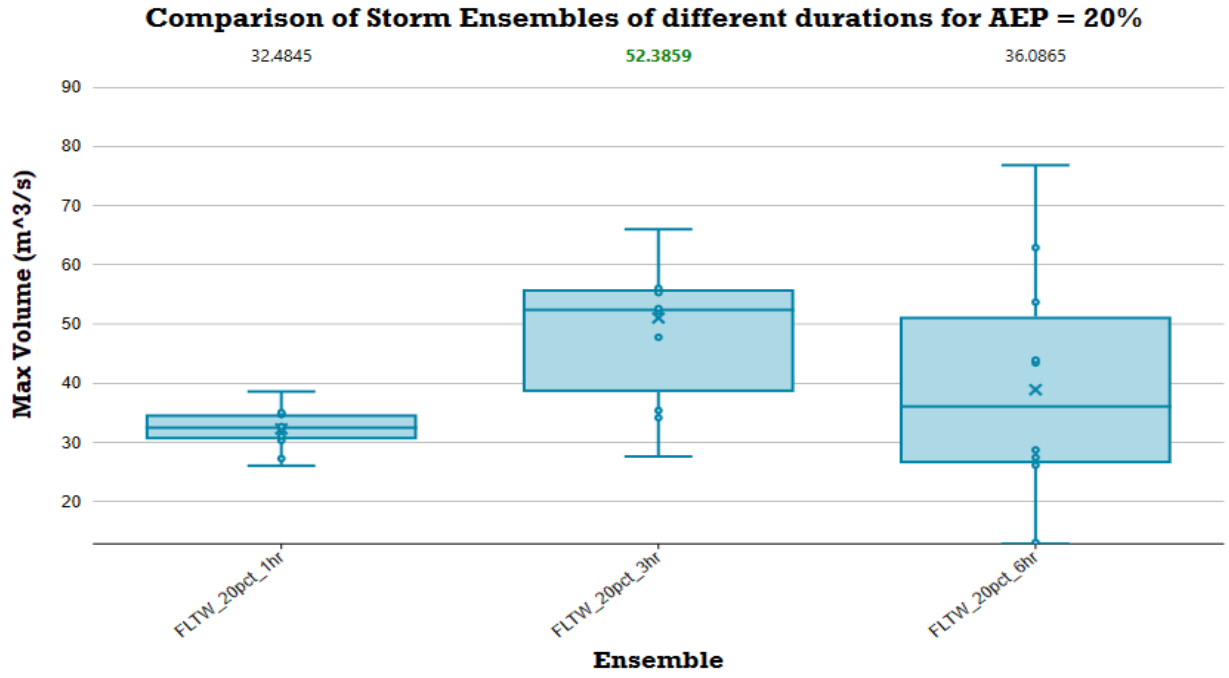



Comparison of Storm Ensembles of different durations for AEP = 63.2%
0.4891
0.494
0.492
0.49
0.488
0.486
0.484
0.482
Max Water Depth (m)
FLTW_63pct_1hr
Ensemble


Comparison of Storm Ensembles of different durations for AEP = 63.2%
38.3083
39
38.8
38.6
38.4
38.2
38
37.8
37.6
37.4
37.2
Max Volume (m^3/s)
FLTW_63pct_1hr
Ensemble

Date: 2/07/2024 Job No. H24019





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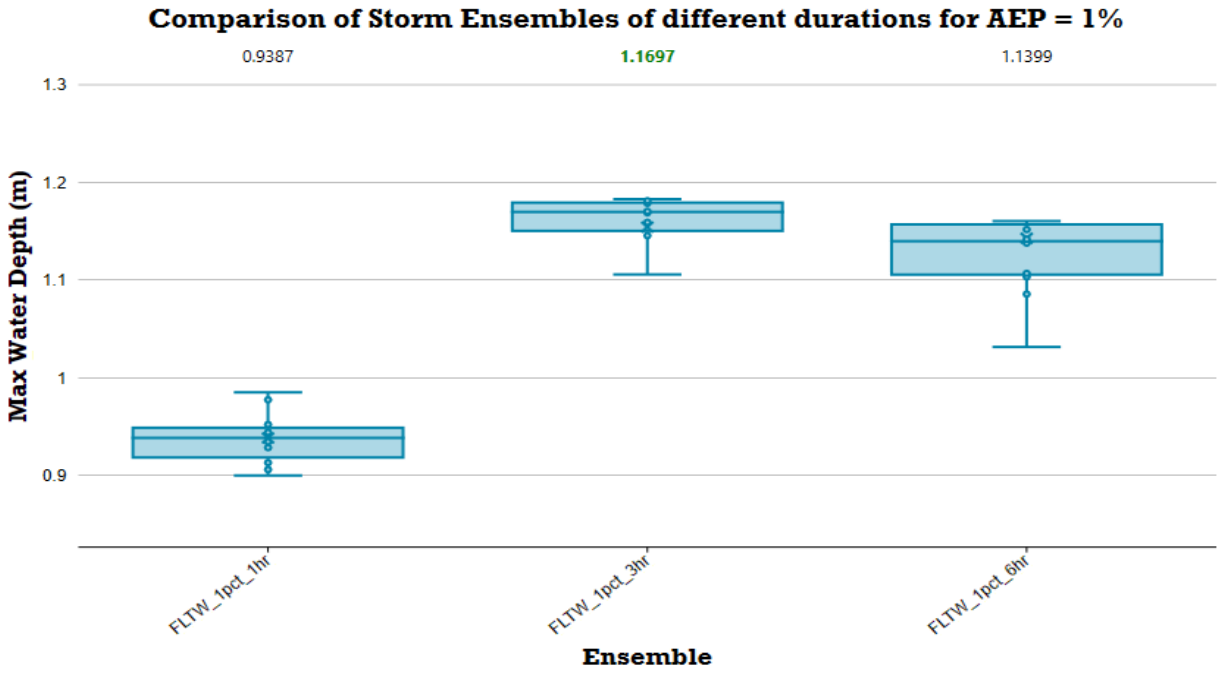
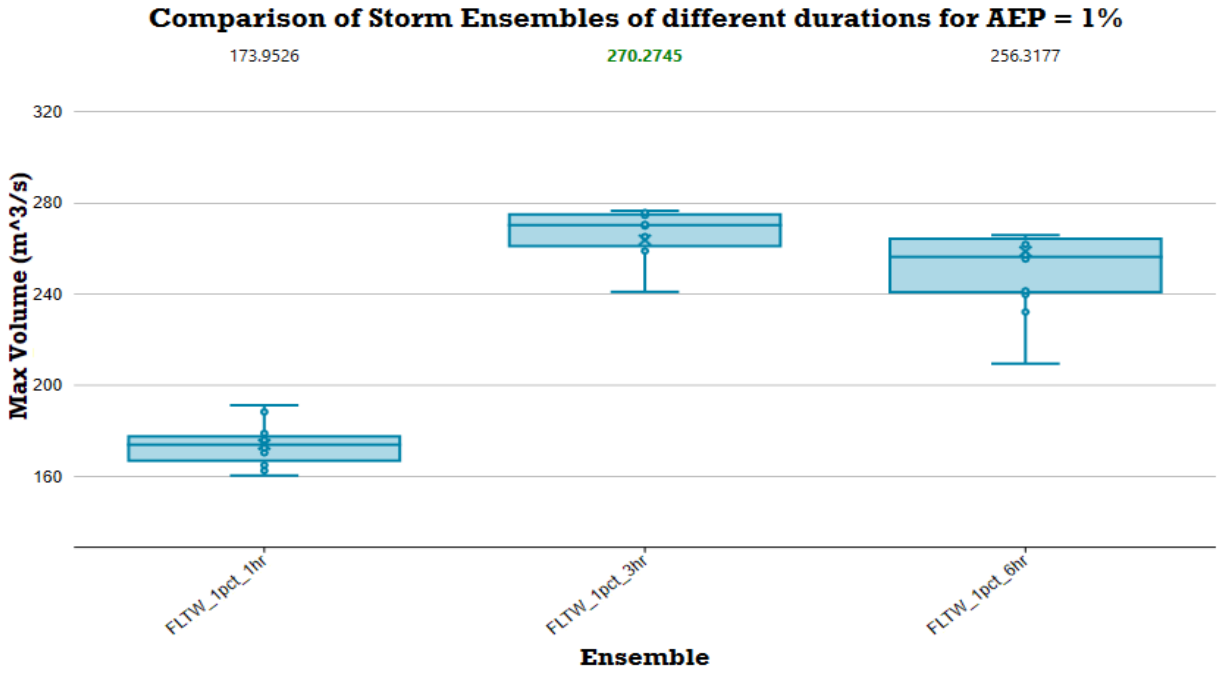
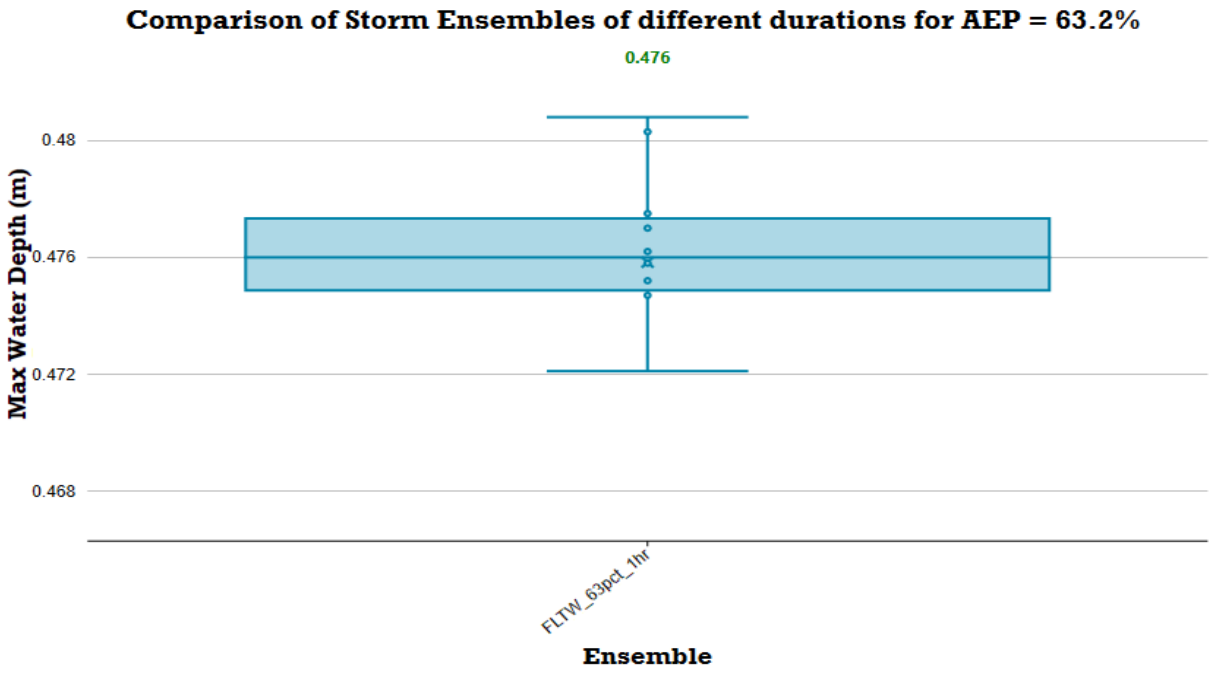
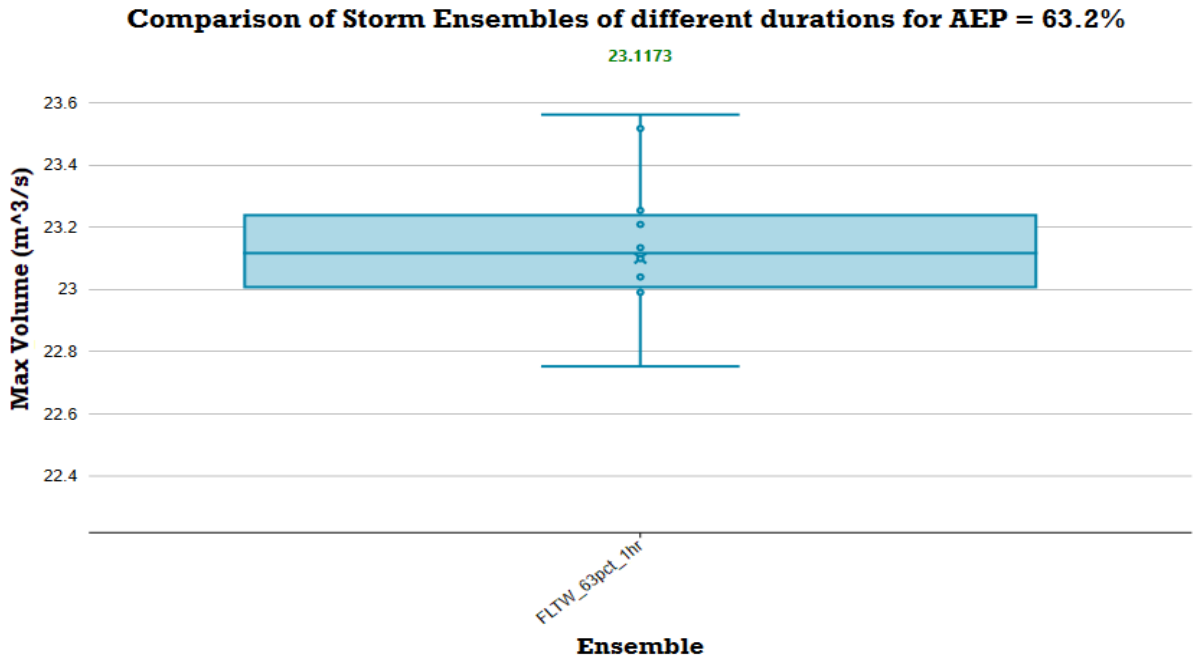
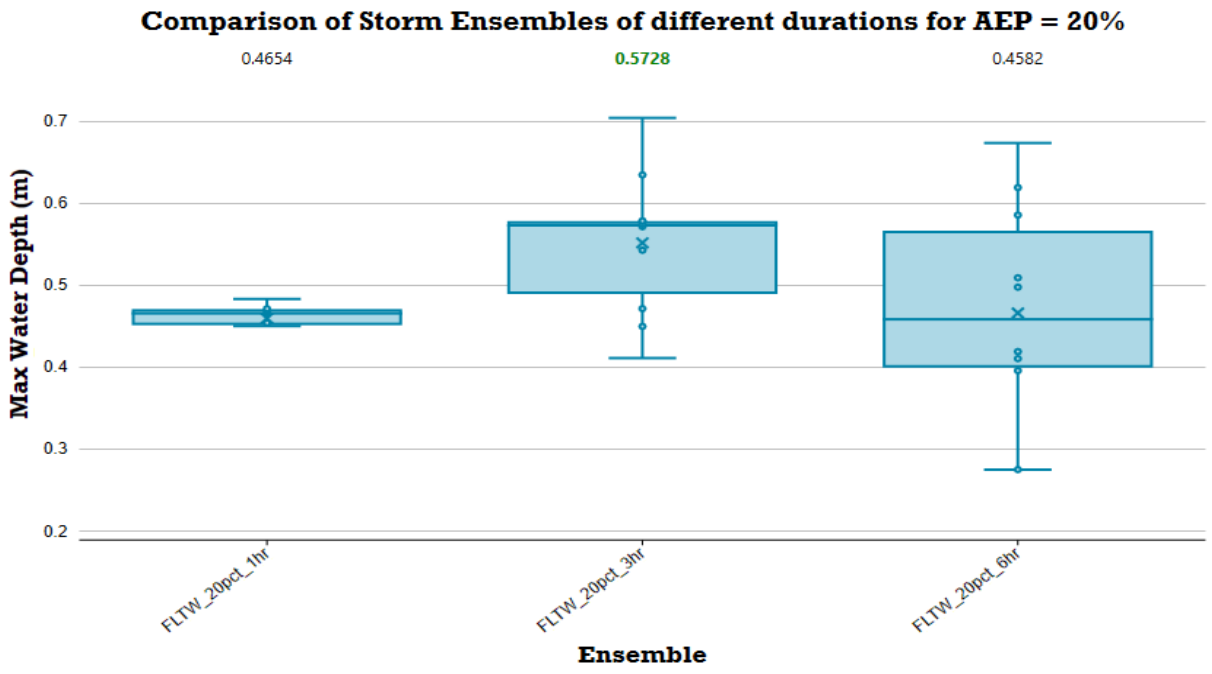


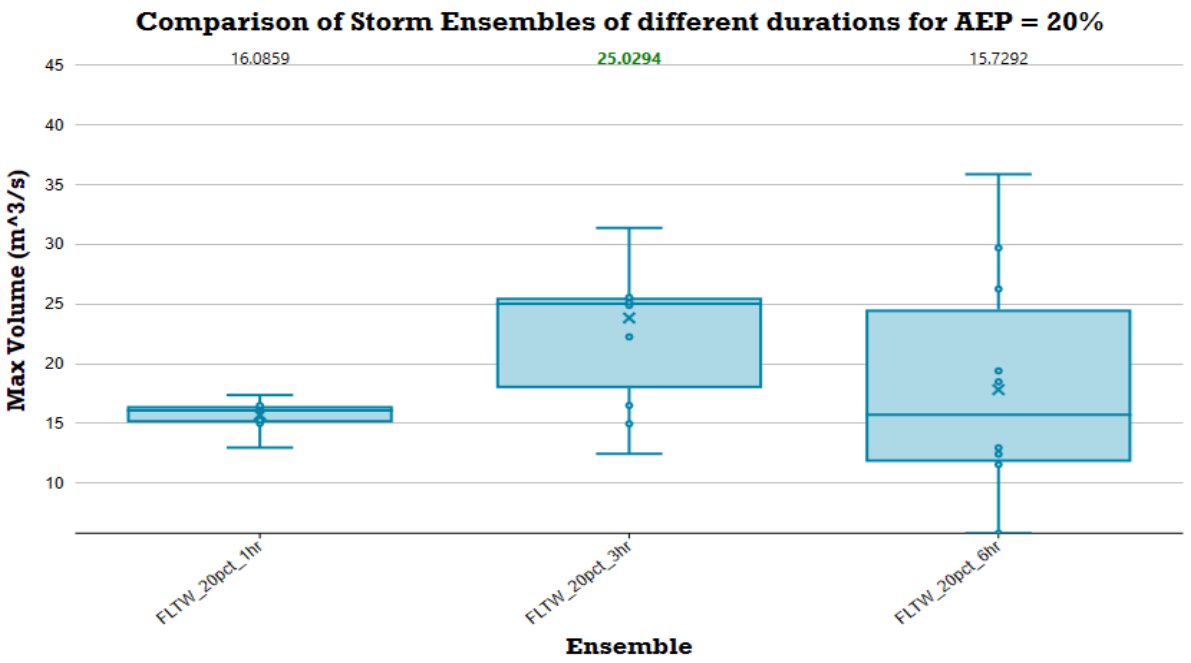



Comparison of Storm Ensembles of different durations for AEP = 63.2%
0.476
Max Water Depth (m)
0.48
0.476
0.472
0.468
FLTW_63pct_1hr
Ensemble


Comparison of Storm Ensembles of different durations for AEP = 63.2%
23.1173
Max Volume (m^3/s)
23.6
23.4
23.2
23
22.8
22.6
22.4
FLTW_63pct_1hr
Ensemble

Date: 2/07/2024 Job No. H24019





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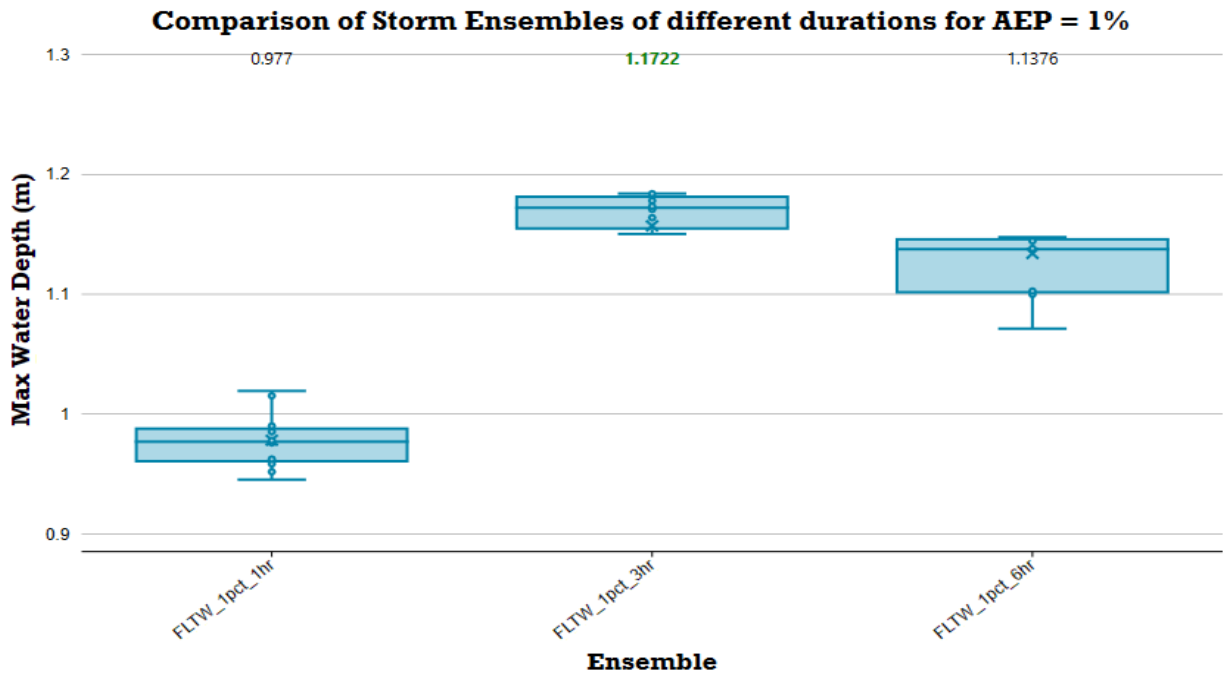
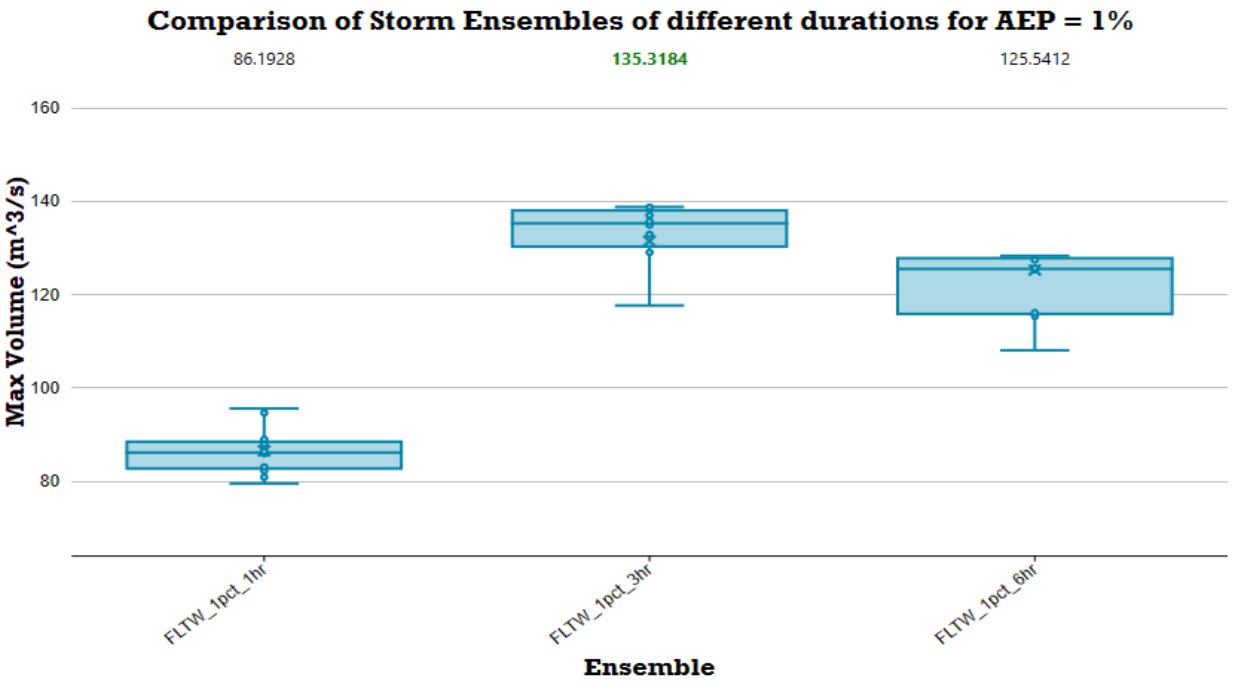
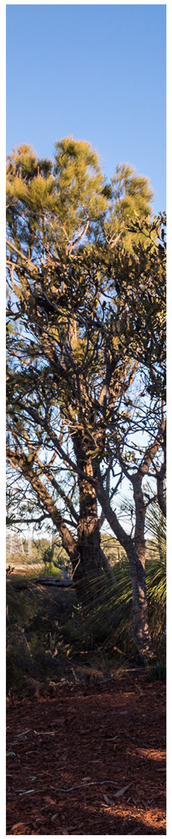
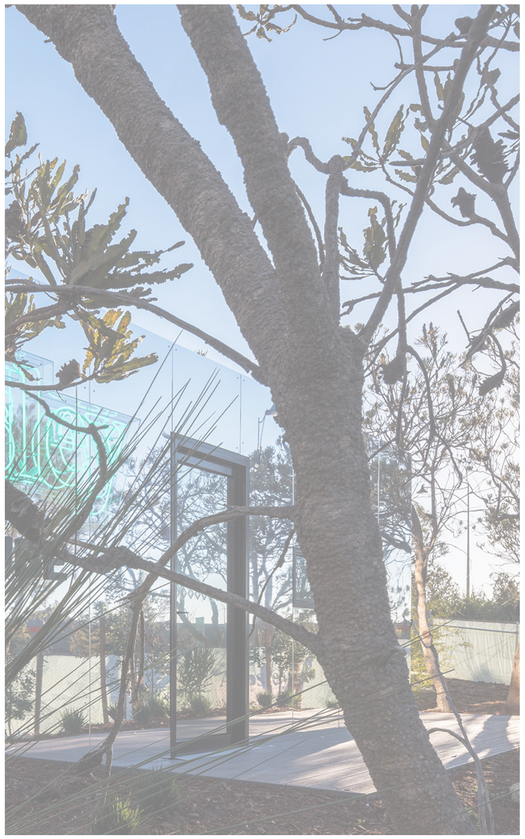




ATTACHMENT F
Landscape Plans





HAMMOND QUARTER LSP AMENDMENT

landscape masterplan | July 2026 [E]

PLAN E

LANDSCAPE ARCHITECTS

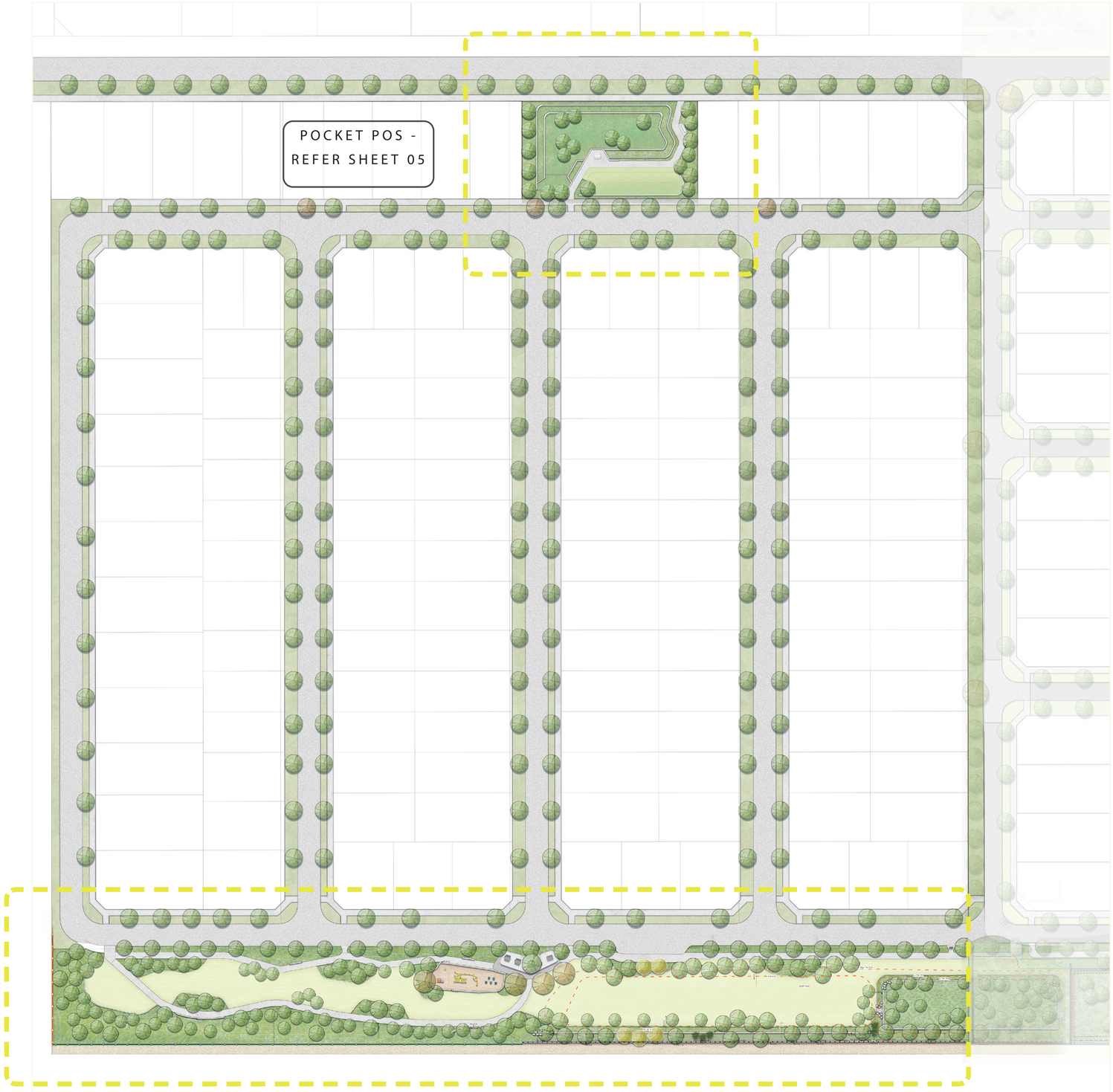
LEVEL 1 278 RAILWAY PDE WEST LEEDERVILLE WA 6007
T: (08) 9388 9566 E: mail@plane.com.au

QUBE

01 | MASTERPLAN

TERRACING

MANUFACTURED SHADE



PLAN E

LANDSCAPE ARCHITECTS

LEVEL 1 278 RAILWAY PDE WEST LEEDERVILLE WA 6007
T: (08) 9388 9566 E: mail@plane.com.au

HAMMOND CORNER - HAMMOND QUARTER
LSP AMENDMENT
PREPARED FOR QUBE MANDOGALUP PTY LTD
JULY 2026

M1.102

REV E
1:700 @ A1

0 7 14 28 42 70m

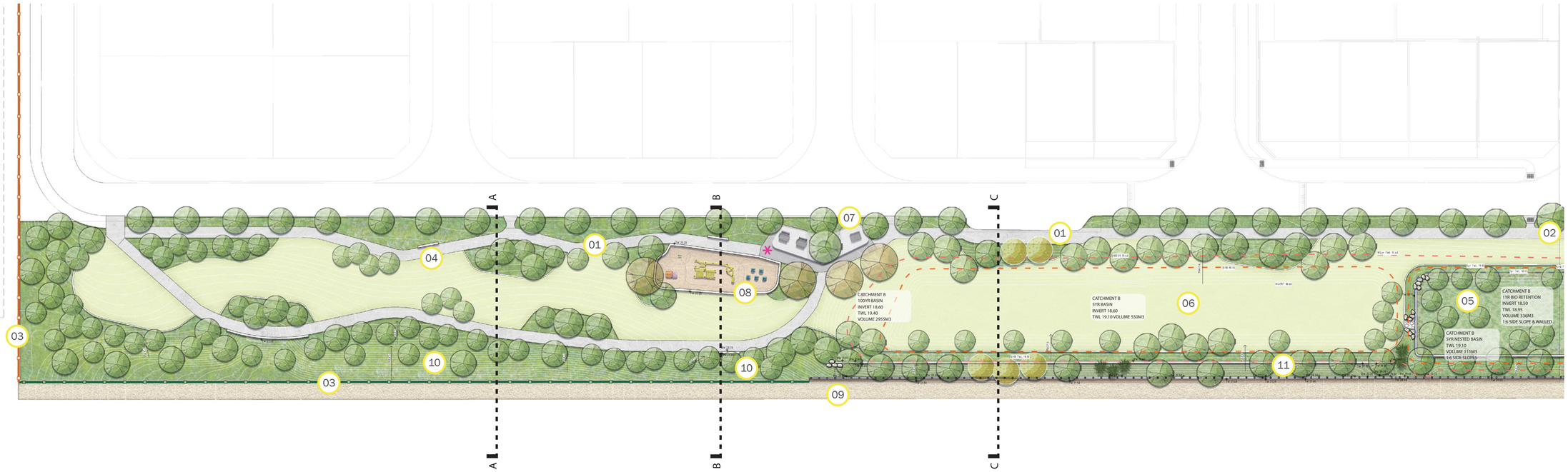
2102805 HAMMOND CORNER- landscape concept

© PLAN E

02 LINEAR POS
PLAN

LEGEND

- PROPOSED TREE PLANTING
- 01 CONCRETE FOOTPATH EXTENDS LINEAR POS WALKABLE NETWORK
- 02 FUTURE PATH CONNECTION WITH HAMMON SOUTH LINEAR POS
- 03 CONSERVATION FENCE
- 04 SEATING WALLS OVERLOOKING TURF & PLANTING
- 05 PLANTED BIORETENTION BASIN WITH WINTER-WET NATIVE TREES AND PLANT SPECIES.
- 06 TURFED 1:100 BASIN AREA
- 07 SHADE STRUCTURE WITH SEATING AND BBQ
- 08 PLAYGROUND AREA WITH SHADE TREES
- 09 CRUSHED GRAVEL ACCESS TRACK THROUGH POS
- 10 1:4 MAX EARTHWORKS BATTER
- 11 1:6 MAX EARTHWORKS BATTER
- ALL-AGES FITNESS EQUIPMENT NODE



PLAN E

LANDSCAPE ARCHITECTS

LEVEL 1 278 RAILWAY PDE WEST LEEDERVILLE WA 6007
T: (08) 9388 9566 E: mail@plane.com.au

HAMMOND CORNER - HAMMOND QUARTER
LSP AMENDMENT
PREPARED FOR QUBE MANDOGALUP PTY LTD
JULY 2026

M1.103

REV E
1:400 @ A1

0 4 8 16 24 40m

2102805 HAMMOND CORNER- landscape concept

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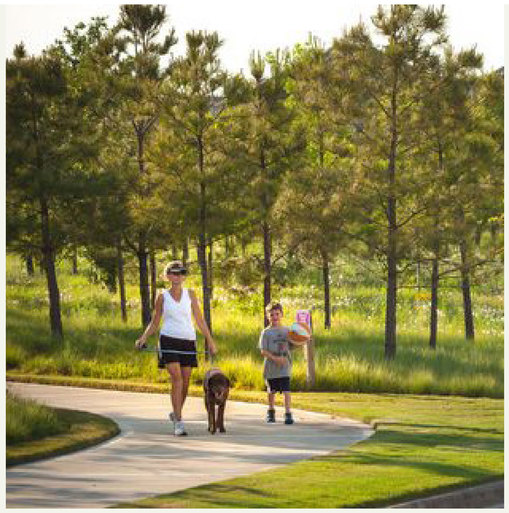
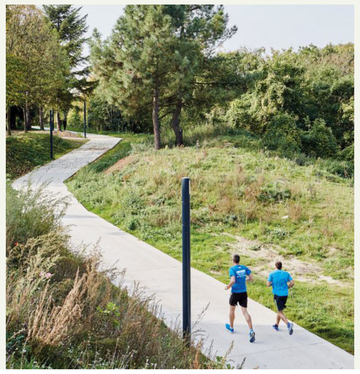
03 | IMAGERY





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M1.104

REV E
1:100 @ A1

0 1 2 4 6 10m

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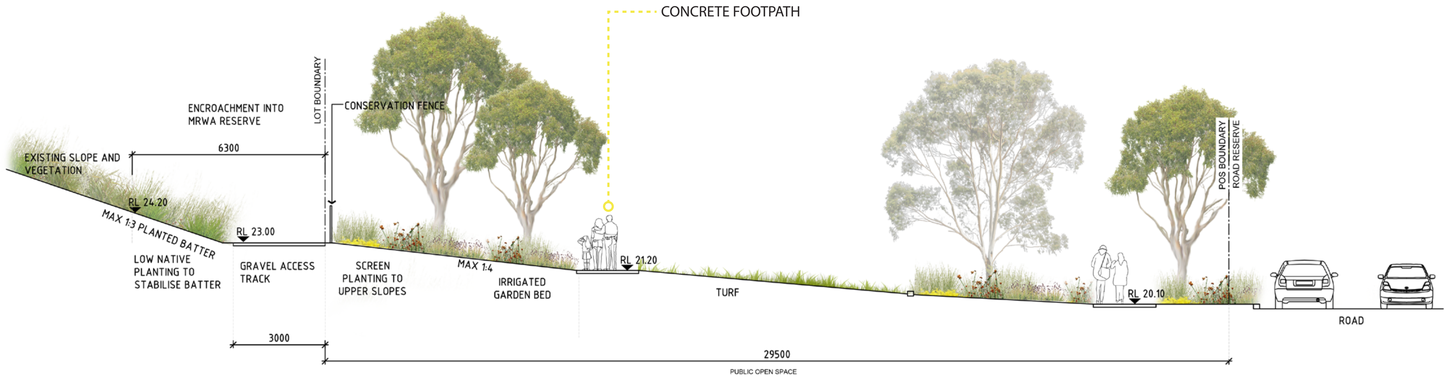
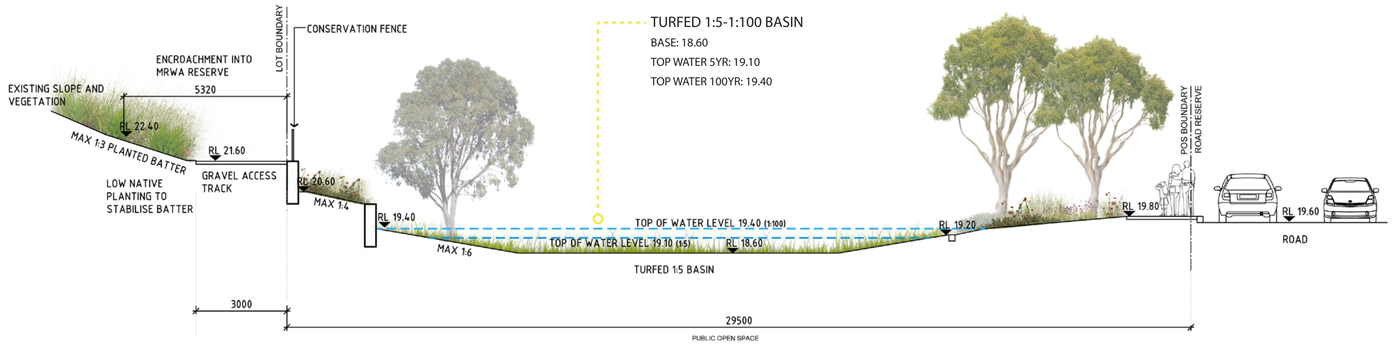
04 LINEAR POS
CROSS SECTIONS

SECTION A - A



SECTION B - B

SECTION C - C



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REV E
1:100 @ A1

0 1 2 4 6 10m

2102805 HAMMOND CORNER- landscape concept

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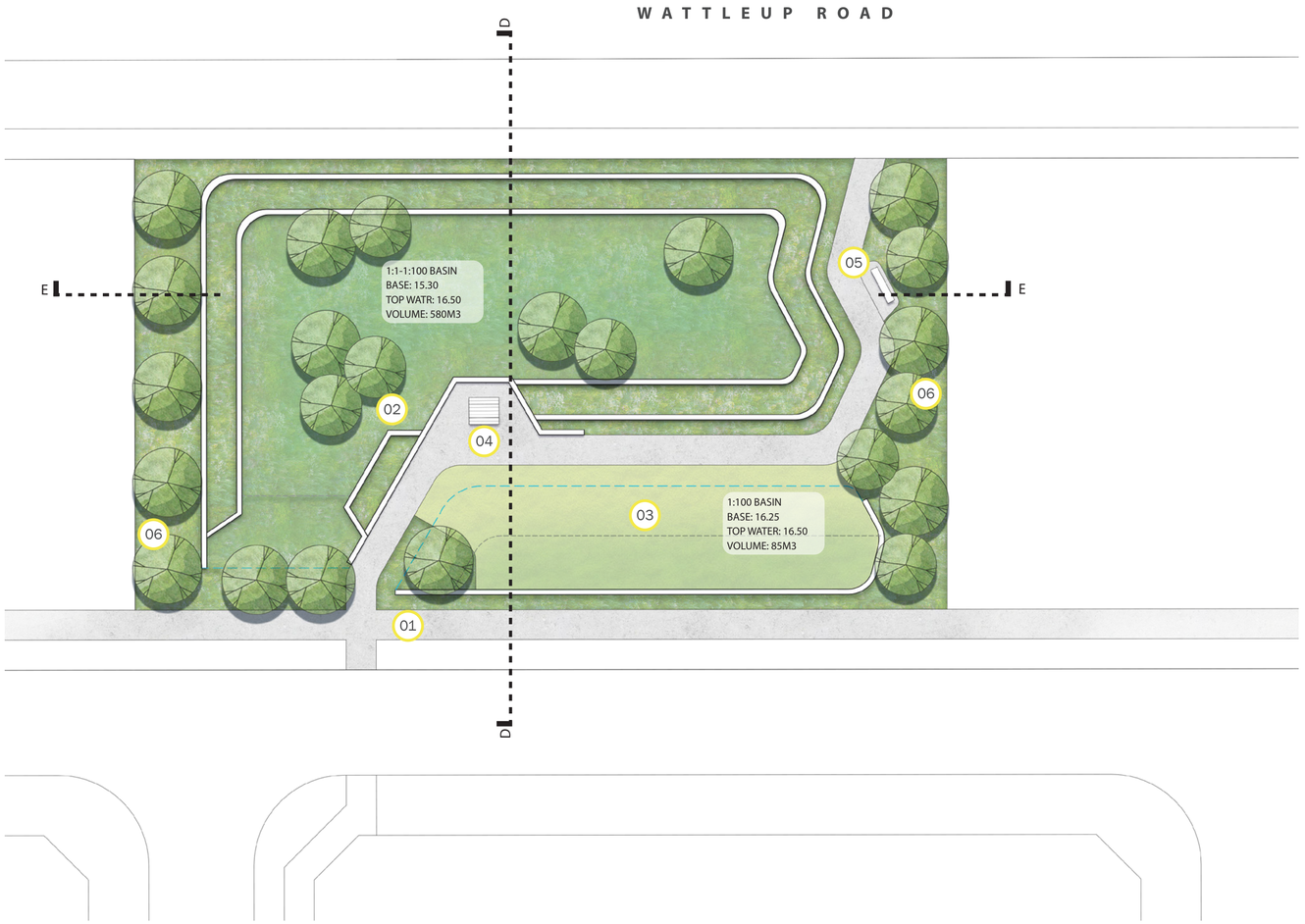
05 POCKET PARK
PLAN

LEGEND

- PROPOSED TREE PLANTING.
- 01 CONCRETE FOOTPATH CONNECTS TO WATTLEUP ROAD
- 02 PLANTED 1:1-1:100 BASIN
- 03 TURF 1:100 OVERFLOW BASIN
- 04 RAISED SEATING PLATFORM OVERLOOKING BASIN
- 05 SEATING NODE
- 06 SCREENING TREES AND PLANTING ALONG LOT BOUNDARY



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REV E
1:200 @ A1

0 2 4 8 12 20m

2102805 HAMMOND CORNER- landscape concept

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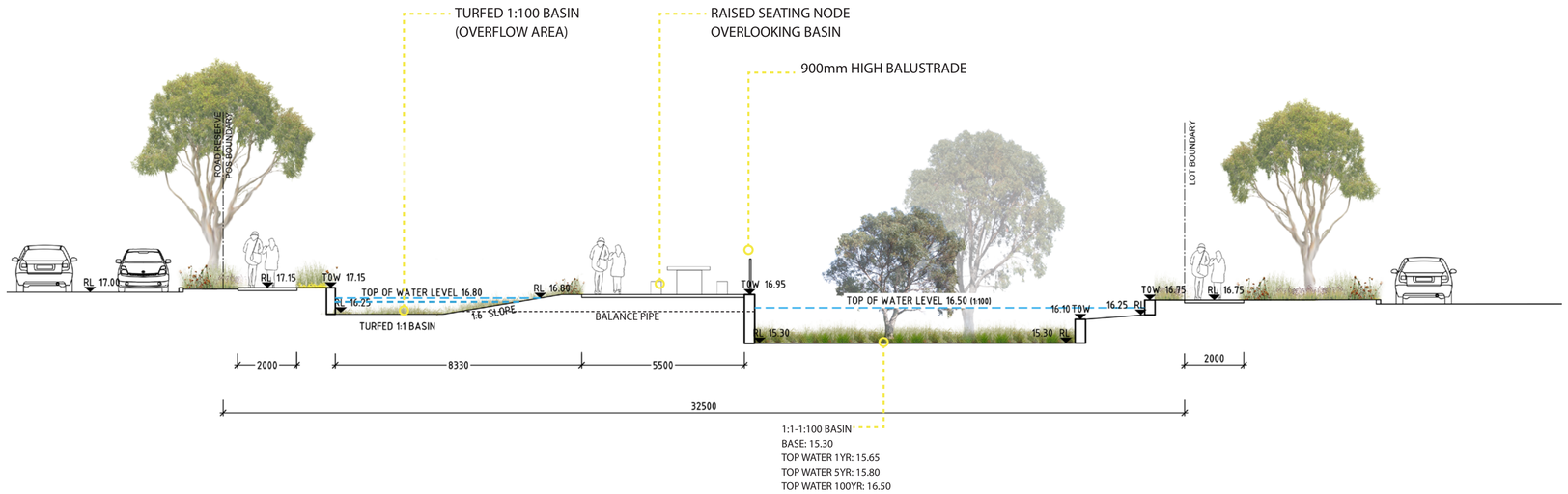
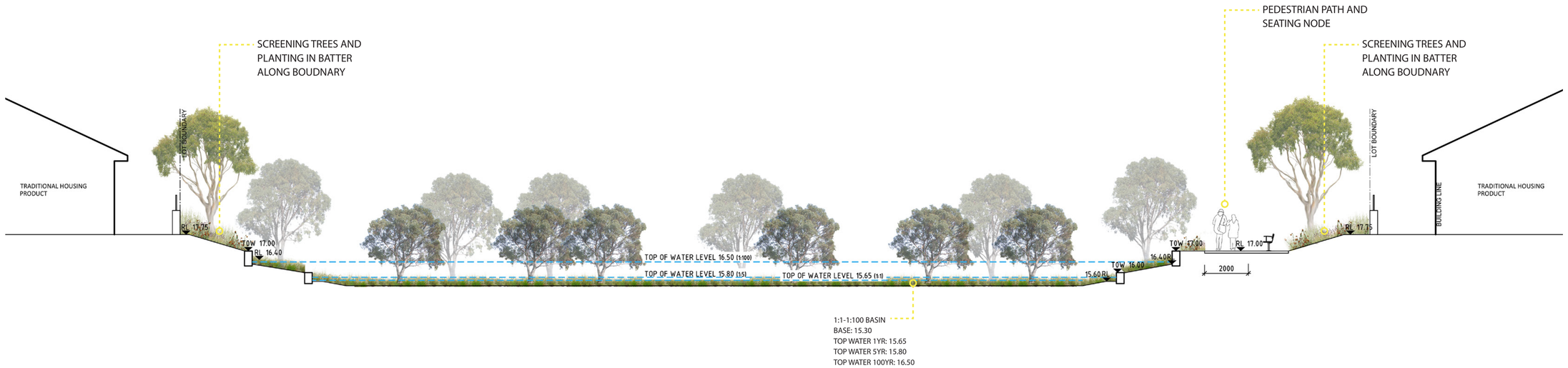
06 POCKET PARK
PLAN

SECTION D - D



SECTION E - E



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REV E
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0 2 4 8 12 20m

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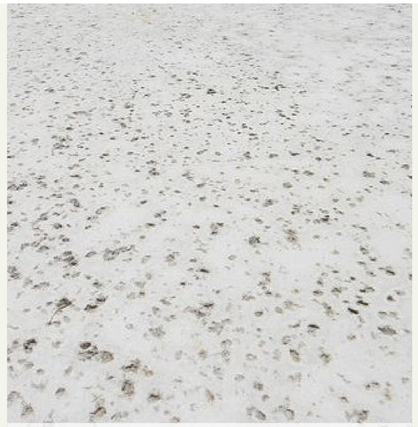
07 MATERIALS PALETTE
HARDWORKS

EXPOSED CONCRETE



ROCK SALT CONCRETE

COMPOSITE DECKING

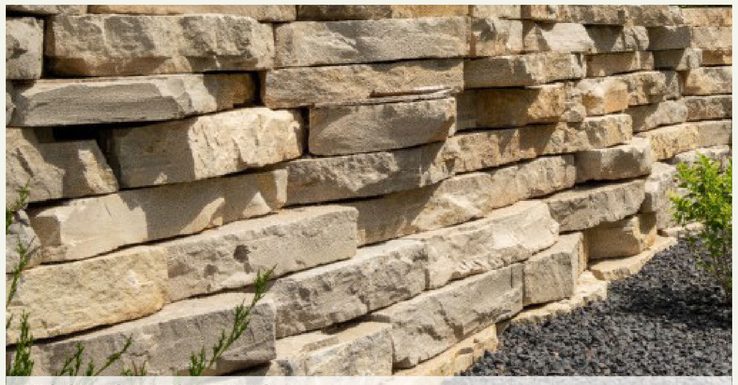
LIMESTONE RETAINING WALLS

POWDER COATING

FEATURE BRICK

EXPOSED CONCRETE

RAMMED EARTH WALL



LIMESTONE BOULDERS RETAINING

© PLAN E

08 PLANTING PALETTE
TREES

BANKSIA WOODLAND

BANKSIA ATTENUATTA

BANKSIA GRANDIS

BANKSIA ILLICIFOLIA

BANKSIA MENZIESSII

MACROZAMIA RIEDLEI

XANTHORRHOEA PRIESSII

SMALL TREES

ACACIA SALIGNA

CALLISTEMON KING S PARK SPECIAL

EUCALYPTUS VICTRIX

HAKEA LAURINA

KUNZEA GLABRASCENS

MELALEUCA LANCEOLATA

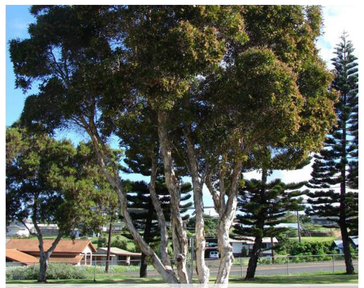
LARGE TREES

ALLOCASUARINA FRASERIANA

EUCALYPTUS GOMPHOCEPHALA

EUCALYPTUS MARGINATA

MELALEUCA LEUCADENDRA


MELALEUCA RHAPHIOPHYLLA

TRISTANIOPSIS LAURINA

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REV E

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09 PLANTING PALETTE
SHRUBS

GROUNDCOVERS

ACACIA SALIGNA GREEN CARPET

CONOSTYLIS CANDICANS

CALOTHAMNUS QUADRIFIDUS PROSTRATE

DAMPIERA LINEARIS

KENNEDIA PROSTRATA

MYOPORUM PARVIFOLIUM FINE LEAF

SHRUBS LOW

ANIGOZANTHOS HUMILIS

BANKSIA NIVEA PROSTRATE

CALOTHAMNUS CLEAN AND GREEN

CONOSTYLIS ACULEATA

DIANELLA REVOLUTA

PATTERSONIA OCCIDENTALIS

SHRUBS

ANIGOZANTHOS MANGLESSII

HAKEA PROSTRATA

HIBBERTIA HYPERICOIDES

MELALEUCA HUEGELII

SCAEVOLA CRASSIFOLIA

VERTICORDIA DENSIFLORA

PLAN E

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REV E

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ENVIRONNIVATE

WATTLEUP RD, HAMMOND PARK: LOTS 9003, 805, 809, 9001, 117 AND 9002

URBAN WATER MANAGEMENT PLAN

QUBE Wattleup Development Pty Ltd, QUBE Hammond Quarter Pty Ltd & Primewest (Wattleup) Pty Ltd

15 November 2022

Revision Control

3	15/11/2022	Revision	SW	SW	SW
2	09/08/2022	Final Report	SW	SW	SW
1	08/08/2022	Draft Report	SW	SW	SW
Rev	**Date**	**Description**	**By**	**Checked**	**Appr.**
Document Number	**C0118 R01v03**				

Executive Summary

Summary of Development Design and Compliance Guiding Principals

Key Guiding Principals
Facilitate implementation of best practice urban water management design.
Provide integration with planning processes and clarity for agencies involved with the implementation.
Preserve the built environment from flooding and waterlogging, minimising public risk, including any risk of injury or a loss of life.
Encourage environmentally responsible development to protect ecosystem health, while maintaining or improving surface and groundwater quality relative to pre- development conditions.
Ease the adaptive management responses to the monitored outcomes of the development.

Summary of Development Design and Compliance Criteria

Item	Key Criteria	Compliance
Stormwater Management	○ Landscape design measures to reduce applied nutrient loads. ○ At source infiltration of at least small storm events (15mm). ○ Infiltration of stormwater runoff on lots and in road reserves where possible, with excess stormwater infiltrated within the POS. ○ Water quality treatment systems and water sensitive urban design structures designed in accordance with the Stormwater Management Manual for Western Australia (DoW, 2009a) Chapter 9 (Structural Controls) and Australian Runoff Quality (Engineers Australia, 1997)	○ The small storm event retained on - site through bioretention basins to store and infiltrate the event. ○ The 1% AEP will be retained and infiltrated on-site.
Groundwater Management	○ Manage fertiliser and pesticide application in streetscapes and POS areas by using appropriate application rates specified in maintenance operation plans. ○ Favour local native plants and trees for garden beds.	○ Gardens beds will be vegetated with native and drought tolerant plant species.

Item	Key Criteria	Compliance
Water Conservation and Sustainability	○ Household Scheme water target use of 110 kL/person/year. ○ Ensure that non-potable water supply systems are considered as part of an integrated water supply. ○ Use of waterwise landscaping practices both at a neighbourhood and lot scale. ○ Adopt stormwater harvesting and reuse options were feasible and cost effective.	○ A household water use target of 110 kL/person/yr. ○ Area of vegetated biofilters 2% of the connected impervious area. ○ All irrigation infrastructure will be 5-Star WELS rated water efficient devices. ○ A SMART irrigation system will be used to ensure irrigation is running only at times of need. ○ Irrigation water will be supplied by fit-for purpose groundwater.
Water Quality	○ Adopt nutrient load reduction design objectives for stormwater runoff. ○ Use of biofilters to treat stormwater.	○ Waterwise irrigation system with uniform coverage and soil moisture sensors to avoid excess watering and potential leaching of nutrients. ○ Fertiliser application schedule based on soil and plant testing with fertilisers selected for slow release of nutrients appropriate to the growth phase of the turf.

Summary of Responsibilities and Funding

	Responsibility and Funding	
Management Item	**QUBE/Primewest**	**City of Cockburn**
Construction of biofilters.	✓	
Construction of detention storages.	✓	
Construction of irrigation system.	✓	
Construction of street drainage.	✓	
Stormwater Drainage Pipe Network Maintenance ○ 12 months (period between a successful Practical Completion Inspection and a defects inspection with a written confirmation of City acceptance): ○ Ongoing (from notification of City acceptance):	✓	✓
Stormwater Storage Landscaping and Maintenance ○ 2 years (period between a successful Practical Completion Inspection and a successful handover meeting with written confirmation of City acceptance): ○ Ongoing (from notification of City acceptance):	✓	✓
Irrigation System Management ○ 2 years (period between a successful Practical Completion Inspection and a successful handover meeting with written confirmation of City acceptance): ○ Ongoing (from notification of City acceptance):	✓	✓
Street Sweeping ○ Ongoing (from successful Practical Completion Inspection):		✓

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Appendix B Subdivision Concept Plan (Hatch, 2022)
Appendix C Landscape Concepts (Plan E, 2022)
Appendix D PC Sump Results

1. INTRODUCTION

1.1 Proposed Development

The Wattleup South Development in Hammond Park (Lots 9003, 805, 809, 9001 117 and 9002 Wattleup Rd) is located west of Kwinana Freeway and approximately 23 km south of the Perth CBD (Figures 1 and 2).

This Urban Water Management Plan (UWMP) has been prepared to address all stages of the development, herein referred to as the Study Area (Figure 1). The Study Area is 19.56 ha and consists of 237 Residential lots. The subdivision concept is presented in Appendix B.

A summary of the proposed land use areas is provided in Table 1.

Table 1: Land Use Areas

Land Use	Area (ha)
Lots	12.22
Roads	4.92
POS	2.42
Total	**19.56**

1.2 Statutory Framework

The Study Area is entirely classified as Urban under the MRS, and as 'Urban Development' under the City's Local Planning Scheme.

In May 2013, the Wattleup Road Development Company Pty Ltd lodged an application (WAPC Ref: 148010) with the Western Australian Planning Commission (WAPC) seeking approval under s. 135 of the PD Act to subdivide Lot 809, Lot 9002 and Lot 9003 Wattleup Road, Hammond Park (which have a total area of 9.4749 hectares). The application proposes that these lots be subdivided into 147 residential lots, two public open space reserves (with a total area of 8,207 m2) and new local road reserves.

Also in May 2013, Primewest (Wattleup) Pty Ltd lodged an application (WAPC Ref: 147098) with the WAPC seeking approval under s. 135 of the PD Act 14 / 37 Hammond Quarter Structure Plan to subdivide Lot 117 and Lot 9001 Wattleup Road, Hammond Park (which have a total area of 7.2974 hectares). The application proposes that these lots be subdivided into 93 residential lots, two public open space reserves (with a total area of 6,571 m2), new local road reserves and two balance lots - one (of 3,874 m2) containing the original homestead, the second (of 6,908 m2) containing land required for the western extension of Rowley Road.

Both these applications were subject to review under S.251 (1) of the Planning and Development Act 2005 (P&D Act) by the State Administrative Tribunal (SAT). Recognising the strategic importance of the subject lots, and taking the view that the applications raise issues of such State or regional importance that it would be appropriate for the application to be determined by the Minister, the then Minister for Planning called in the application to SAT under S.246 and S.247 of the P&D Act, whilst directing the SAT to hear the applications but, without determining them, refer them with recommendations to the Minister for determination.

The then Minister for Planning approved the applications (WAPC ref 147098 & 148010) in November 2020 with conditions. Refer to Appendix A for the approved concept plan and subdivision plan (which are conditioned to be updated and approved by the WAPC).

In addition to the land subject to the Ministerial decision, Lots 200, 805, 1000, & 1001 form the balance of the subject site. Lots 200, 1000 and 1001 are within the existing approved Structure Plans 27A and 27B, and Lot 805, now controlled by QUBE, has been included at the request of the City of Cockburn in accordance with the requirements of the SSDSP3 which identifies that future structure planning be undertaken over the subject lots.

Subdivision application No. 147098 & 148010 for the Study Area has been approved by Western Australian Planning Commission (WAPC) with conditions. This UWMP has been prepared to satisfy Condition 9 which states:

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

This UWMP fully addresses the water management requirements of the entire Structure Plan area, whilst also addressing the relevant conditions of the ministerial subdivision approvals. The LSP area is internally draining (with no external stormwater catchments or impacted landowners outside the SP area) the UWMP is adequate to address the water management plan for the LSP and subdivision approvals. This report completes the urban water management planning and reporting process.

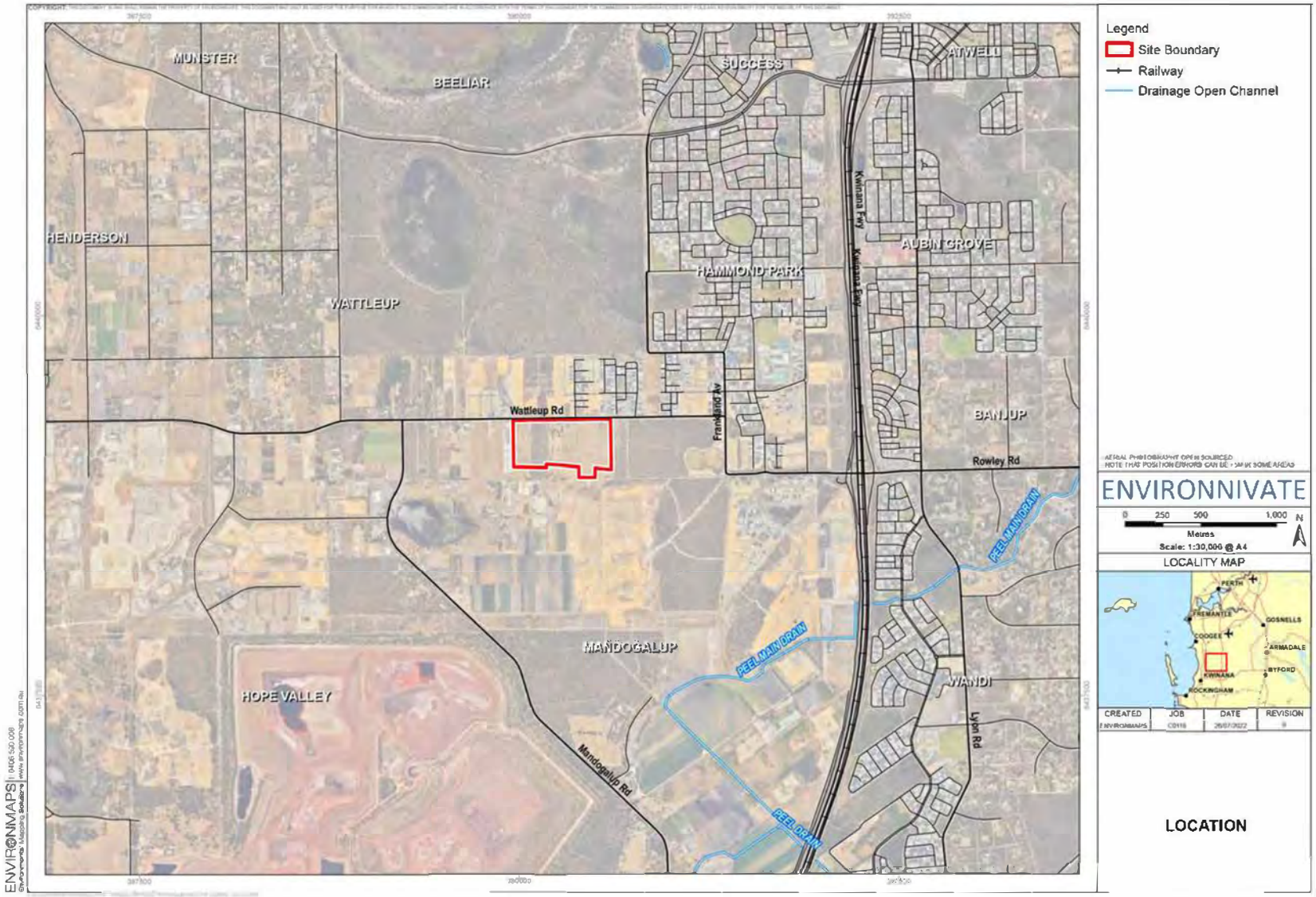

Figure 1. Site location plan

Figure 2. Property lot numbers

2. EXISTING SITE CHARACTERISTICS

2.1 Existing Land Use

Historically, development has consisted of a mixture of semi-rural and agricultural uses resulting in the clearing of majority of the site. The Structure Plan ensures an adequate separation distance from the market garden to the west in accordance with WAPC Statement of Planning Policy 2.5 Rural Planning. Prospective purchasers will be made aware of the market garden via a Notification on Title.

Lot 809 has been approved for clearing under the EPBC Act (refer to Appendix A). With regard to dust and the proximity to Alcoa's RDA, the Minister for Planning approved the subdivision applications (to facilitate development of the site).

2.2 Climate

The Hammond Park area is characterised by a Mediterranean climate with warm dry summers and cool wet winters.

The nearest Bureau of Meteorology station with long-term rainfall records is Jandakot Aero, located approximately 9 km northeast of the Study Area. The long-term average annual rainfall is 816 mm (1973 to 2020). This has decreased to an average of 759 mm over the last two decades (1998 to 2020), reflecting a 7% reduction compared to the long-term average.

The average annual pan evaporation is approximately 1,900 mm (Luke et al, 1987).

2.3 Topography

The Study Area generally slopes from east to west, with a high point of 46 m AHD in the south-east and a low point of 20 m AHD to the south-west.

2.4 Geology and Soils

The Study Area is situated at the transition boundary between the Bassendean Sand (S8) and Spearwood Sand (S7) systems but is wholly located within the Spearwood Sands (Figure 3). The Spearwood Sands are formed by the weathering of the Tamala limestone and are characterised as "pale yellowish brown, medium to coarse grained, sub-angular quartz moderately with traces of felspars, moderately sorted of residual origin" (Gozzard, 1983).

Two geotechnical investigations have been completed by Douglas Partners (2021) separately covering Lots 809, 1000 and 9003, and Lots 117, 9001 and 9002. The two investigations included a total of 12 test pits (TP01 to TP8 and TP110 to TP 113) and 4 soil permeability testing locations. Locations within the Study Area are shown on Figure 3. The results were generally in accordance with Gozzard (1983) mapping and are summarised as:

- "Topsoil (SP-SM): generally dark grey sand with silt, rootlets and roots, to depths of 0.1 m.
- Fill (Sand SP): fine to medium grained, grey and dark grey, trace silt, medium dense, encountered at test locations 2 and 3 to depths of between 0.3 m and 0.4 m. Inferred to be soils disturbed by previous agricultural activity.
- Sand (SP): fine to medium grained, yellow-brown or grey-brown becoming yellow-brown with depth, trace silt, generally medium dense, underlying the topsoil and/or fill to the base of the test pits at all test locations at depths of up to 3.0 m, and to the base of the borehole at location 13 to 7.0 m depth. The sand is loose and loose to medium dense at some locations, to tested depths of up to 2 m."

Regional Acid Sulphate Soil (ASS) mapping is shown in Figure 2-1(DWER, 2018), with the Study Area located outside of any risk areas.

2.4.1 Permeability Testing

In-situ permeability testing was undertaken by Golder (2021) at four locations within the Study Area at approximately 1 m below the surface. The tests were performed using the falling head method, with the soil permeability estimated using a calculation derived from a method based on Hvorslev (1951). The test results are summarised in Table 2.

Table 2: Summary of Permability Analysis

	Estimated Permeability	
Test Location	**(m/s)**	**(m/day)**
1	9.0×10^{-4}	>20
2	3.0×10^{-4}	>20
3	1.9×10^{-4}	16
4	4.0×10^{-4}	>20
5	8.0×10^{-4}	>20

As specified by Douglas Partners, a design permeability (Ksat) of 8 m/day will be used for design of the stormwater infiltration basins and 4m/day for lot soak wells.

2.5 Wetlands

There are no wetlands within the Study Area (Figure 4). The nearest wetland is Wattleup Lake located approximately 500 m to the south-west of the Study Area and is a Resource Enhancement Category Wetland.

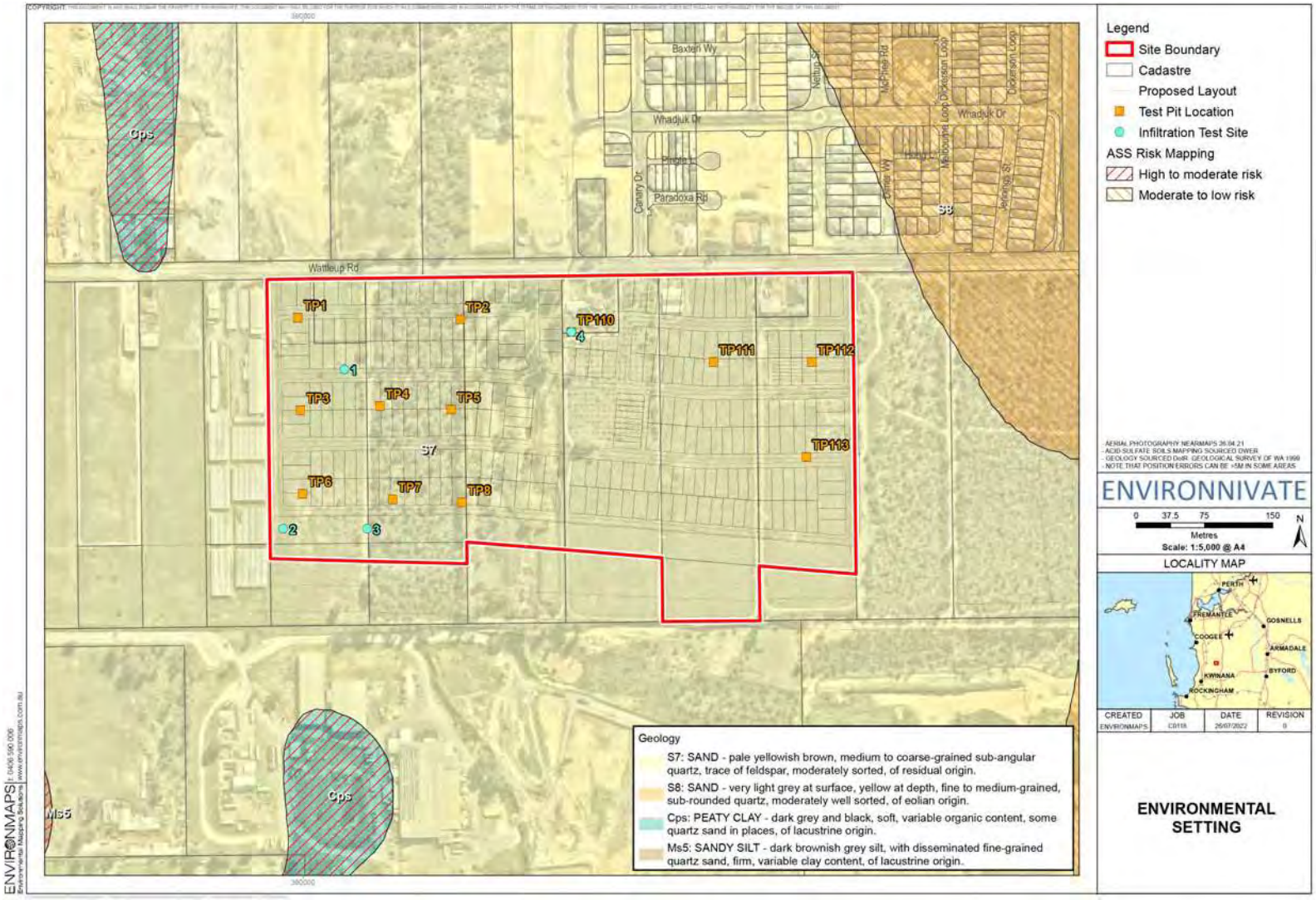

Figure 3. Environmental setting

2.6 Surface Water

Due to the highly permeable deep sand found across the Study Area, all rainfall currently soaks away. There are no surface water features within the Study Area.

The nearest surface drainage line is the Peel MD, which is located approximately 1.3 km south of the Study Area (Figure 4). The Study Area is outside of the Peel MD catchment.

2.7 Groundwater

The maximum historical surface contours of the Regional Superficial Aquifer water table are shown in Figure 5. Groundwater flow is from east to west towards the Indian Ocean, with the groundwater level approximately 18 m AHD at the eastern boundary of the Study Area, grading down to 16 m AHD at the western boundary. Relative to natural surface elevation, there is a minimum depth to groundwater of 4 m in the south-west corner of the Study Area, with a maximum depth of 28 m in the north-east and south-east corners of the Study Area.

To confirm groundwater levels within the Study Are relative to the historical maximum contours, monitoring bore 1 was installed by hand auger on 29 April 2021. The bore encountered brown, yellow and white, medium to fine quartz sand to the full depth of 7.0 m. The water level measured on 29 April 2021 was 13.37 m AHD. A second reading was taken on the 12 August 2021, with the recorded level 14.38 m AHD (Figure 5).

2.8 Groundwater Supply for Irrigation

QUBE Wattleup Development Pty Ltd currently holds GWL63325 with an allocation of 141,915 kL/yr from the Superficial Aquifer for Lots 9002, 9003 and 809. Subject to agreement between the various parties, this allocation will be sufficient as an irrigation supply for all of the future Public Open Spaces and streetscapes presented in this UWMP. Table 3 provides an estimate of the irrigation demand based on the landscape concept.

Table 3: Estimated Irrigation Demand

Landscape Treatment	Irrigation Area (ha)	Water Allocation (kL/yr)
Streetscape	0.98	6,615
Garden Bed	1.62	10,935
Turf	1.20	9,000
Total	**3.80**	**26,550**

Department of Water Hydrogeochemical assessment of the Superficial aquifer (2010) shows groundwater quality is suitable for irrigation with salinity between 250 to 500 mg/L, bicarbonate of 100 to 200 mg/L and pH of 5 to 6. The report also indicates high iron and phosphate concentrations in the area (DoW, 2010).

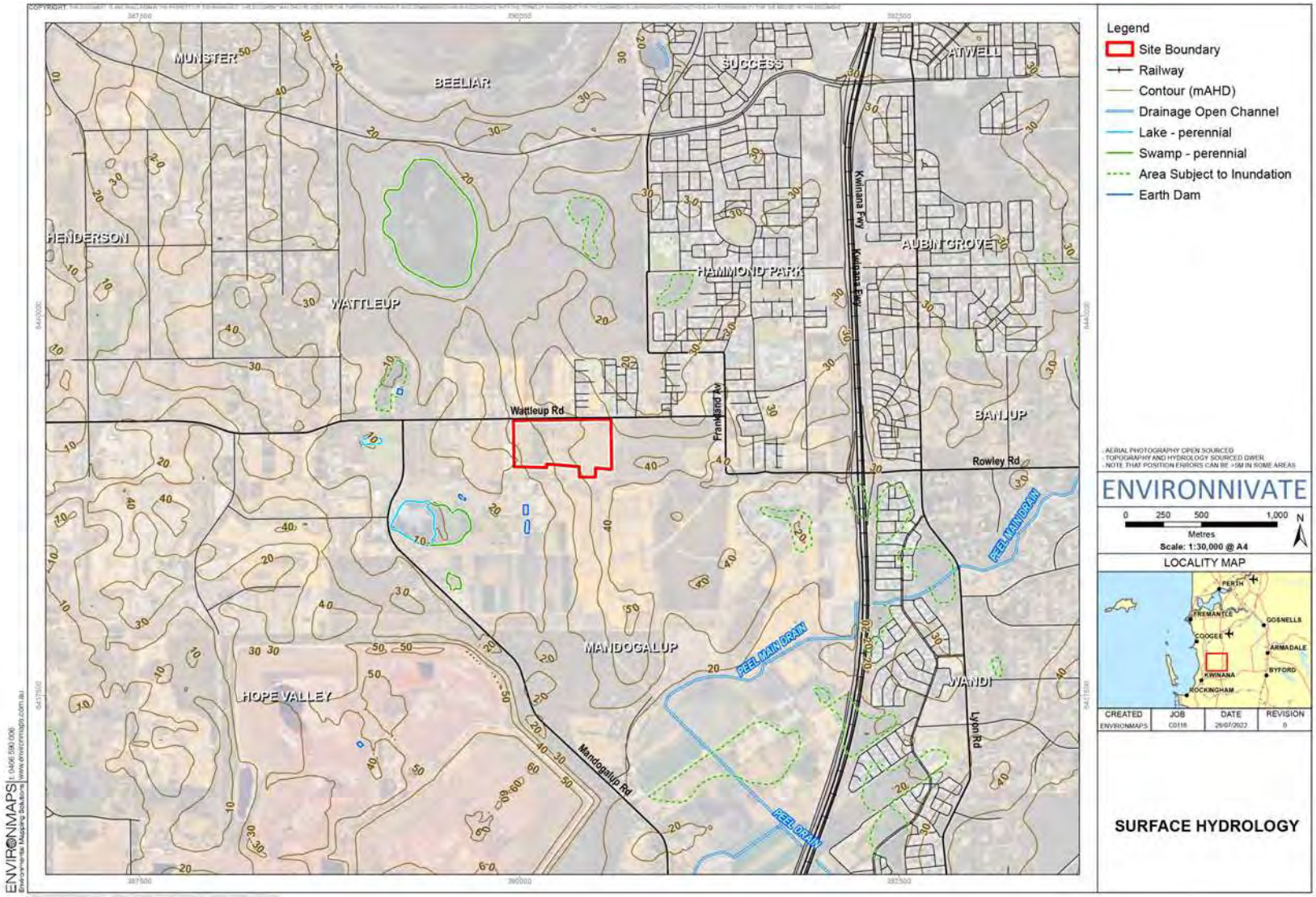

Figure 4. Surface hydrology

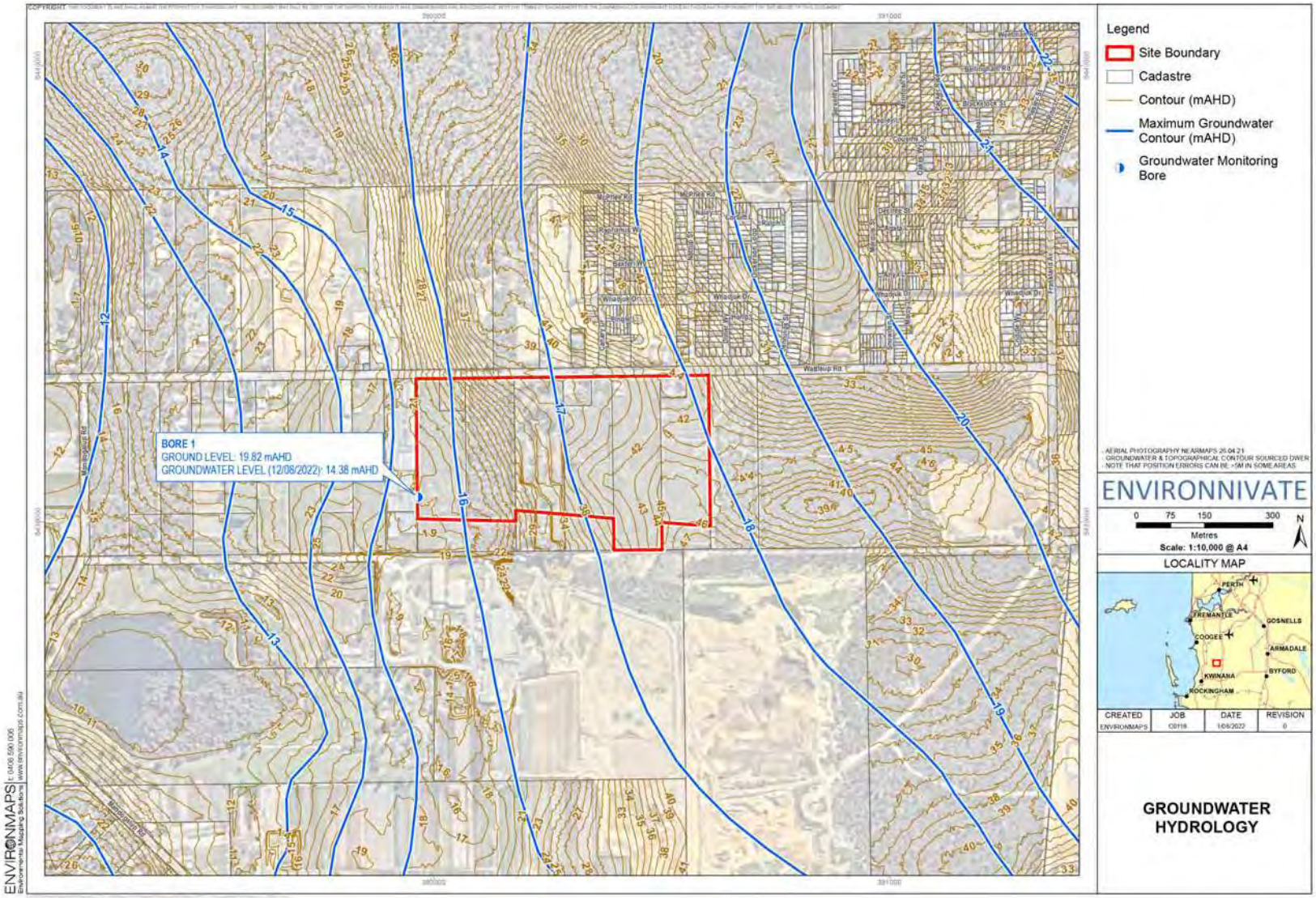

Figure 5. Groundwater hydrology

3. STORMWATER MANAGEMENT

3.1 Design Capacity

The stormwater drainage system is designed to manage a range of rainfall events up to the 1% Annual Exceedance Probability (AEP), and this is achieved by adopting the small storm, minor and major stormwater management system design approach outlined in ARR 2016 (Ball et al., 2016) and the Decision process for stormwater management in WA (DWER, 2017).

The small storm event is the first 15 mm of rainfall and is required to be retained and treated at source (DWER, 2017). Small events are retained in local depression storage, trapped low points and vegetated treatment biofilters.

The minor drainage system has capacity for frequent rainfall events up to the 20% AEP and is conveyed by the piped drainage system. The major drainage system is designed for rainfall events greater than the 20% AEP, up to the 1% AEP. A pit and pipe drainage system will be used to convey stormwater from the roads to a series of bioretention and detention basins. The major system uses overland flow paths for conveyance to local catchment low points.

The stormwater drainage system has been modelled using PC-SUMP and is based on ARR 2016 (Ball et al., 2016) methodology and the Bureau of Meteorology 2016 Intensity-Frequency-Distribution (IFD) rainfall data. Storms include pre-bursts and have been modelled with durations ranging from 30 mins to 168 hours.

3.2 Water Sensitive Urban Design Opportunities

The opportunity for the stormwater design is to integrate stormwater infiltration within the residential lots and public realm, and also respect the significant mature trees which characterise the open spaces.

Key elements of the UWMP related to water sensitive urban design include:

- Infiltration at-source at lot scale (soak wells) and in bio-retention areas, with the bio-retention areas sized to hold and treat runoff from the first 15 mm of rainfall from road reserves.
- Use of Best Management Practices (BMPs) including a stormwater treatment train utilising tree pits and flush kerbs around POS areas to improve water quality.
- Use of Public Open Space for management of stormwater up to the 1% AEP storm event.
- Use of native and drought tolerant exotic street tree species in streetscapes to reduce water demand.

3.3 Catchment Parameters

All six development lots, including Lot 805, make up two stormwater drainage catchments (Figure 6 and Table 4). The stormwater catchments also pick up the southern carriageway of Wattleup Rd for the length of the subdivision frontage. Details of the catchment areas and runoff parameters used for sizing of the drainage system are summarised in Table 4.

Residential lots with an area greater than 350 m^2 will have sufficient space for soak wells to be installed at the front and rear of the property, with adequate space in the backyard to store any overflow (rainfall excess) from the rear soak wells. For lots with an area smaller than 350 m^2 (referred to as compact lots), there is also sufficient space for soak wells, however, due to a small courtyard typically at the rear of the property, there is not sufficient space to store any overflow (rainfall excess) from the rear soak wells. Compact lots must have an overflow connection to the front soak wells to avoid any overflow into the back courtyard.

The soak wells must be sized to store the first 15 mm of rainfall according to the following formula:

Soak well storage capacity = $0.015Ac\ m^3$
(Where Ac is the connected impervious area in m^2).

Table 4: Catchment Runoff Parameters

Land Use	Study Area Catchment A (ha)	Study Area Catchment B (ha)	Initial Loss (mm)	Continuing Loss (mm/hr)	Proportional Loss
Residential Lots	7.22	4.92	15	8	-
Road Reserve	3.47	1.45	-	-	0.2
Public Open Space	2.06	0.36	-	-	0.9
Wattleup Rd Southern Carriageway	0.25	0.15	-	-	0.2
Total	13.00	6.88			

3.4 Small Event Drainage System

The small storm event drainage system is designed to manage frequent rainfall events (up to the 1EY AEP) and is primarily focused on the retention of stormwater in-situ and treatment prior to discharge to the groundwater aquifer.

There is sufficient depth to groundwater over the Study Area that all stormwater runoff from the small event (15 mm) will be retained on site.

Key design elements of the small storm event drainage system are as follows:

- Stormwater runoff from the first 15 mm of rainfall will be stored in soak wells on lots.
- Informal infiltration of stormwater at-source using tree pits installed upstream of drainage grates/side entry pits and flush kerbs around POS areas.
- Internal roads will drain via the pipe drainage system and discharge to the bio-retention basin located in Lots 9003 and 9001 Public Open Spaces (Figure 6). The stormwater will soak through an amended soil media and soak to the water table. The amended soil media is assumed to have a minimum saturated hydraulic conductivity (Ks) of 5 m/day. Details of the storage are presented in Table 5.

- The external road catchment (Wattleup Rd) will drain via the pipe drainage system and discharge to the Catchment A and Catchment B bio-retention basins located in the Public Open Space.
- Bio-retention basin has been sized using a soil hydraulic conductivity of 5 m/day, consistent with the amended soil specification (Section 3.6.2).

Table 5: Small Storm Bioretention Basin Details

Parameter	Catchment A	Catchment B
Catchment Details		
Connected Impervious Area (m^2)	2.97	1.28
Treatment Area (m^2)	530	220
Treatment Area as % of Connected Catchment	2	2
Storage Details		
Basin Invert (m AHD)	19.70	31.25
Base Area (m^2)	530	220
Storage Depth (m)	0.50	0.50
Hydraulic Results for Small Storm (15mm)		
Inflow Volume (m^3)	445	192
Peak Stored Volume (m^3)	376	164
Top Water Level (m AHD)	20.20	31.75
Water Depth (m)	0.50	0.50
Top Water Level Area (m^2)	954	448

Table 6: Minor and Major Event Basin Details

Parameter	Catchment A	Catchment B
Storage Details		
Basin Invert (m AHD)	18.50	30.00
Base Area (m^2)	950	540
Batter Slope (v:h)	1:6	1:6
Storage Depth (m)	1.20	1.20
Hydraulic Results for Minor Event 20% AEP		
Critical Storm Duration (hrs)	2	2
Rainfall Depth (mm)	32.9	32.9
Peak Stored Volume (m^3)	655	390
Top Water Level (m AHD)	19.00	30.50
Water Depth (m)	0.70	0.50
Top Water Level Area (m^2)	1,630	975
Hydraulic Results for Minor Event 1% AEP		
Critical Storm Duration (hrs)	2	2
Rainfall Depth (mm)	57.9	57.9
Peak Stored Volume (m^3)	2,157	1,280
Top Water Level (m AHD)	19.70	31.20
Water Depth (m)	1.20	1.20
Top Water Level Area (m^2)	2,685	1,666

3.5 Minor and Major Event Drainage System

The minor and major storm event drainage system is designed to less frequent rainfall events up to the 1% AEP and is primarily focused on the prevention of flooding and damage to people or property.

Key design elements of the minor and major storm event drainage system are as follows:

- Stormwater runoff from lots will be partially retained by soak wells, with excess stormwater conveyed to the street drainage system via overland flow.
- Stormwater runoff from internal roads will be conveyed by the pit and pipe drainage system. For rainfall events exceeding the capacity of the pipe system (nominally >20% AEP) excess stormwater will be conveyed by overland flow, with roads graded to the detention basin at the catchment low point.
- Internal roads will discharge to the infiltration basin located in Lots 9003, 809 and 9001 Public Open Spaces (Figure 6). Details of the storage are presented in Table 6.
- The external road catchment (Wattleup Rd) will drain via the pipe drainage system and discharge to the infiltration basin located in Lots 9003, 809 and 9001 Public Open Space.
- The infiltration basin has been sized using a soil hydraulic conductivity of 8 m/day, for the area outside of the bioretention basin.

The Stormwater Management Strategy is shown in Figure 6 with the landscape concept presented in Appendix C. The PC Sump modelling results are attached in Appendix D.

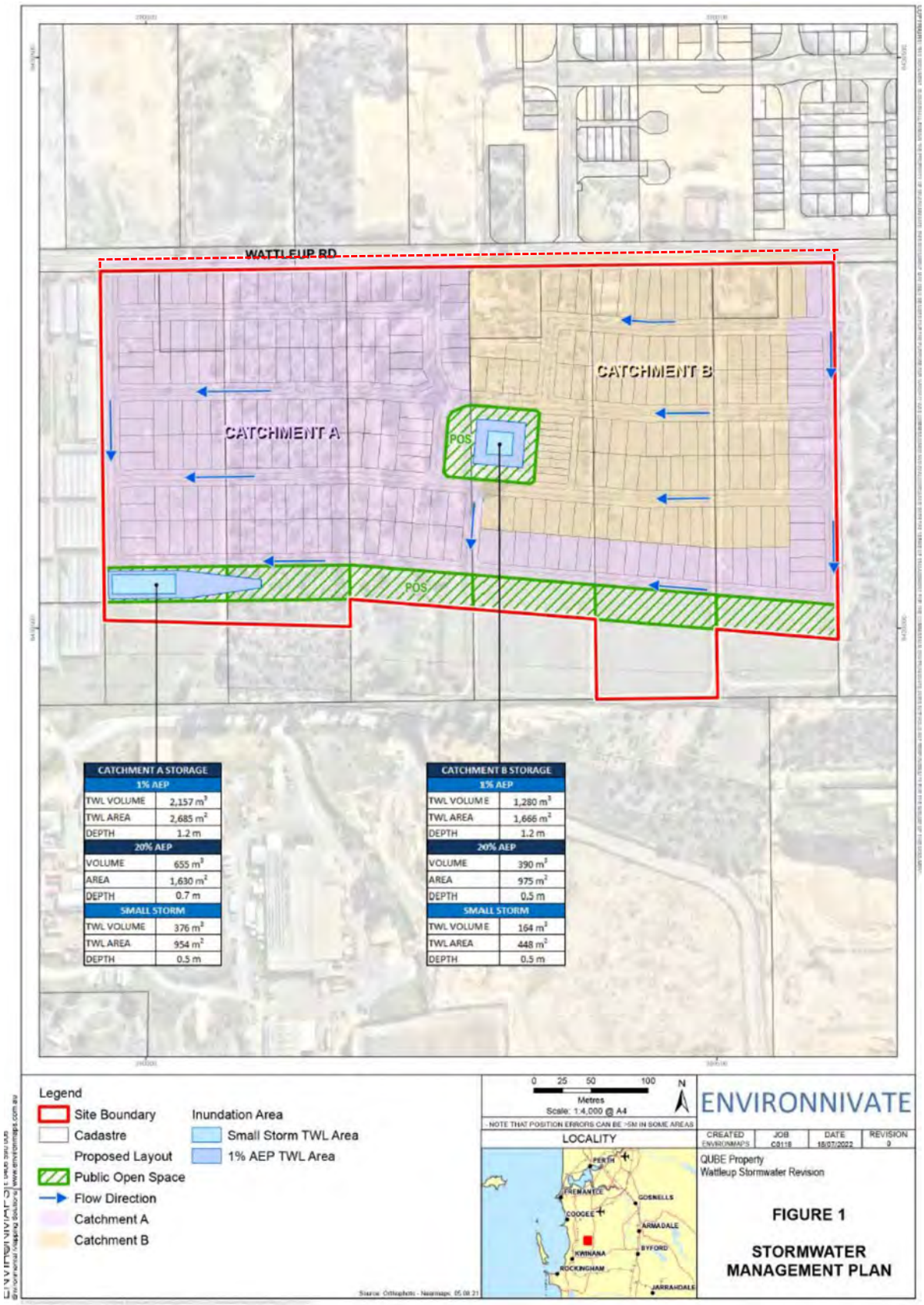

Figure 6. Stormwater management plan

3.6 Stormwater Quality Management

3.6.1 Non-Structural Controls

A non-structural control approach focuses on reducing nutrients, particularly nitrogen and phosphorous into the landscape in addition to pollutants before they are picked up by runoff. Below are the proposed water quality management strategies:

- Consider a minimum of 50% of the planted areas to include local native plants. For non-local species, selection will be based on the tolerance to drought and requiring low fertiliser.
- Swan River Trust (SRT) guidelines will be followed to establish a fertiliser and irrigation schedule for garden beds and turf areas. Adjustment may be necessary to reduce the leaching of fertiliser to the receiving groundwater.

3.6.2 Structural Controls

Structures to control water quality can be implemented alongside non-structural methods with the objective of treating water before it is discharged from the site. The proposed strategies are listed below:

- Vegetated bioretention basins (biofilters) with an area equivalent to 2% of the interconnected impervious area have been proposed.

Additional information is provided in *The Adoption Guidelines for Stormwater Biofiltration Systems* (Payne, et al., 2015). The minimum specifications required for the bioretention basins are shown in Figure 7.

A minimum of 300mm of amended soil media has been proposed for treatment in all areas with the objective of supporting vegetation and treating nutrients. To allow stormwater infiltration meanwhile retaining moisture to support vegetation growth, the desired Ksat should be in the range of 200 to 300 mm/hr (5.0 to 7.2 m/day).
It is important to note, that clogging is expected to occur in the first few years, once vegetation is established, conductivity will be conserved along with biological activity. For the amended soil media, Environnivate suggests Eclipse Soil's Phosphorous Retentive Filter Media or its equivalent.

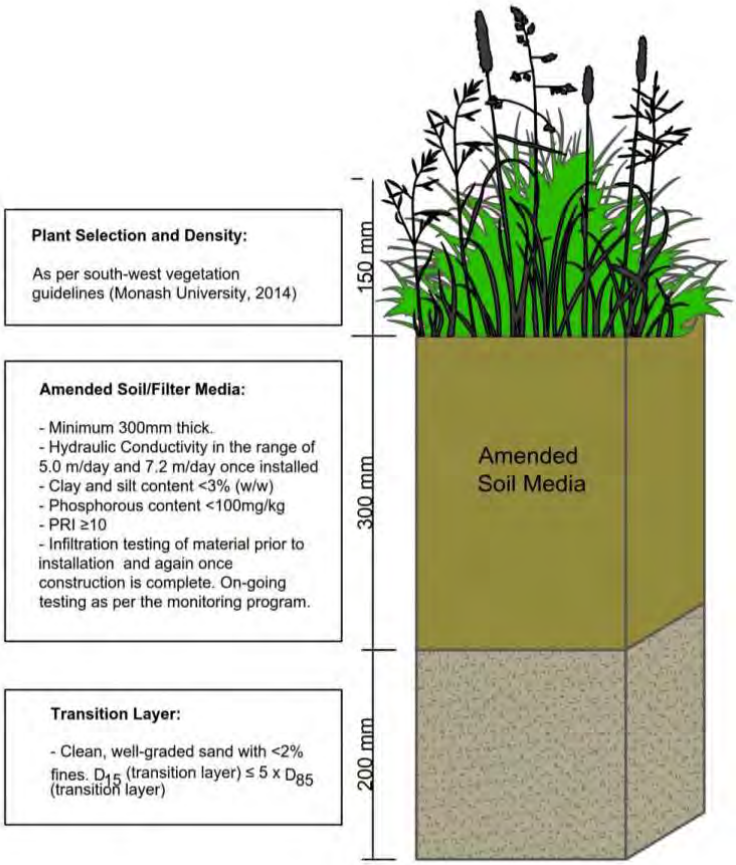

Figure 7. Biofilter specification

4. GROUNDWATER MANAGEMENT

4.1 Groundwater Levels

There are no areas within the Study Area where groundwater level controls are required.

4.2 Groundwater Quality Management

The native soils provide a significant profile (minimum of 4 m) of Spearwood sand above the water table offering an effective impediment to the movement of any phosphorus leached from the development precinct.

Strategies to further reduce nutrient export from private gardens and public open spaces include such actions as:

- Waterwise irrigation system with uniform coverage and rain sensors to avoid excess watering and potential leaching of nutrients.
- Fertiliser application schedule based on soil and plant testing with fertilisers selected for slow release of nutrients appropriate to the growth phase of the turf/garden bed.

5. DISEASE VECTOR MANAGEMENT

Stormwater systems should implement a design that minimises the risk of chironomid midge and mosquito breeding. By implementing infiltration, evapotranspiration or drawing down of water to prevent flooding (pooling) for longer than four days, with an

emphasis in late spring to early autumn, to prevent mosquito larval from completing their life cycle and minimising public health risk (Government of Western Australia - Department of Health, 2020).

The following strategies will be implemented to prevent stagnant water:

- A seep hole in the base of stormwater pits to allow water below the silt trap to drain away.
- Inspect the bio-retention storage, stormwater pits and infiltration storages for standing water one week after significant rainfall events and conduct maintenance as required.

6. WATER CONSERVATION

6.1 Residential Lots

Scheme and wastewater services will be extended from existing services with new connection for the Study Area. Water Corporation has adopted water and wastewater conveyance planning to guide servicing of the Study Area.

To achieve water efficiency targets, households are to be built consistent with current Building Code of Australia (BCA) water efficiency standards.

Traditionally in Perth, 50% of household water consumption is outside the home, primarily in garden irrigation. As such, measures that improve irrigation efficiency tend to yield the greatest cost-effective water savings. The developers will incentivise water wise front landscaping to buyers which encourages:

- No greater than 50% turf and the use of native plants.
- Use of electronically controlled irrigation systems with rain sensors.
- Hydro-zoning.
- Mulching of plant beds to retain moisture.
- Designing paved areas to direct runoff into planted areas.

6.2 Landscape Irrigation

Despite increasing scarcity of water for public realm use there remain pressures on parks and streetscapes to present to a high standard, function year-round and provide significant amenity, which can mean a reliance on water to irrigate turf and garden beds.

Approaches to managing this at Wattleup Rd include the following;

- All irrigation infrastructure will be 5-Star WELS rated water efficient devices;
- Automatic Irrigation system is proposed to minimise ongoing labour and maintenance;
- Design and installation to be undertaken by a qualified irrigation consultant and contractor to ensure best practise is achieved;
- A maintenance program is to be prepared to ensure the system is running optimally at all times;
- The superficial groundwater licence will be utilised as the ongoing water supply for the site; and
- A SMART irrigation system will be considered to ensure irrigation is running only at times of need.

It is expected that water usage can be significantly reduced after two years of establishment by undertaking the following actions:

- Undertake an annual audit of water usage on site and ensure that volumes are aligning with expected usage;
- Turn off irrigation to vegetated areas that are not in high presentation or use zones;
- Detailed design of soil profiles will be considered to ensure fertiliser and water uptake is maximised in root zones;
- Replacement planting with tube stock in winter to avoid added irrigation requirements;

Hydro-zoning will occur to all garden beds.

7. UWMP IMPLEMENTATION

7.1 Construction Management

7.1.1 Dewatering

Dewatering of the Superficial Aquifer is unlikely to be required for construction. The Rights in Water and Irrigation Exemption (Section 25C) (Dewatering) Order 2010 allows dewatering to occur up to 10 L/s for 30 consecutive days to a maximum of 25,000 kL. Any dewatering required is not expected to exceed the exemption order.

7.1.2 Acid Sulphate Soils

Management of Acid Sulphate Soils (ASS) will be addressed as a separate process to the urban water management document approval (UWMP). ASS will be investigated and managed in accordance with the approve ASS Management Plan for the site and the requirements of dewatering as they arise.

7.1.3 Sediment Control

Construction will occur in a manner consistent with the approved Erosion and Sediment Management Plan to be submitted to the City of Cockburn by the civil contractor.

7.2 Maintenance

The drainage structures will require regular maintenance to ensure efficient operation. The suggested maintenance schedule is presented in Table 7.

Table 7: Maintenance Schedule for Drainage Infrastructure

	Maintenance Interval			
	Monthly	**Quarterly**	**Six Monthly**	**As Required**
Biofilters				
Inspect for erosion			✓	
Weed removal		✓		
Assess health of vegetation, remove and replace any dead plants.			✓	
Inspect for standing water 1 week after significant rainfall.				✓
Remove sediment build-up above finished invert				Every 3 years
Street Drainage				
Street sweeping	✓			
Removal of debris to prevent blockages		✓		
Eduction of sediment and rubbish in pits			✓	

7.3 Monitoring

The monitoring program has been designed to allow a quantitative assessment of hydrological impacts of the proposed development.

The post-development monitoring program is designed to operate over a 2-year period. The program will be periodically reviewed to ensure suitability and practicality and the program may need to be modified as data is collected to increase or decrease the monitoring effort in a particular area or alter the scope of the programme itself.

The proposed post-development monitoring is to:

- Monitor groundwater levels and quality for 2 post-development groundwater monitoring bores located immediately down gradient of the two bioretention basins.
- Measure infiltration rates of the biofilters amended soil profile.
    - A summary of the proposed monitoring program and reporting schedule is shown in Table 8, with the frequency of water quality target review and the contingency action plan detailed in Table 9.

All sampling is to be conducted according to Australian Standards and all water quality sample testing will be conducted by a NATA approved laboratory.

Table 8: Summary of Post Development Monitoring Program

Monitoring Type	Location	Frequency and Timing	Parameter	Reporting	Responsibility
Groundwater Level	2 monitoring sites	Quarterly for 2 years (Jan, April, July, Oct)	Water Level (m AHD)	A final report to be provided at the end of the 3-year monitoring period. Report to be provided to DWER and CoC within 3 months of completion of the monitoring period.	Developer
Groundwater Quality	2 monitoring sites	Quarterly for 2 years (Jan, April, July, Oct)	In Situ: pH, EC, temp Lab: NOx, TKN, TN, FRP, TP, selected metals		
Bioretention Infiltration	Catchments A and B	Every 12 months for 2 years.	Hydraulic conductivity (m/day)		

Table 9: Summary of Contingency Plan

Monitoring Type	Assessment Criteria	Assessment Frequency	Contingency Action
Groundwater Level	Groundwater levels not to exceed the estimated post-development phreatic line by more than 2 m	After each monitoring occasion.	1. Review design and operation of subsoil and stormwater drainage system. 2. Perform maintenance as required.
Groundwater Quality	Nutrient concentrations at the top of the aquifer should not show an increasing trend over the monitoring period.	Annual review of target.	1. Identify and remove any point sources. 2. Consider reinforcement of Community Education/Awareness program. 3. Review operational and maintenance (e.g. fertilising, cleaning) practices. 4. Consider alterations to POS areas including landscape regimes and soil amendment. 5. Consider modifications to the stormwater system. 6. Consider initiation of community-based projects.
Bioretention Infiltration	Hydraulic conductivity should remain ≥2m/day.	After each monitoring occasion	1. Test additional sites per basin to validate results and depth of clogging. 2. Assess results to develop appropriate action to remediate clogged layer. 3. Repeat infiltration testing once remediation measures have been completed. 4. Repeat infiltration testing in 12 months to confirm rates and allow further establishment of vegetation.

7.4 Responsibilities and Funding

The key roles and responsibilities for the implementation of this UWMP are presented in Table 10 below, with details on the maintenance of the stormwater drainage system outlined in Table 7.

Table 10: Summary of Responsibilities and Funding

	Responsibility and Funding	
Management Item	**QUBE/Primewest**	**City of Cockburn**
Construction of biofilters.	✓	
Construction of underground infiltration storages.	✓	
Construction of irrigation system.	✓	
Construction of street drainage.	✓	
Stormwater Drainage Pipe Network Maintenance ○ 12 months (period between a successful Practical Completion Inspection and a defects inspection with a written confirmation of City acceptance): ○ Ongoing (from notification of City acceptance):	✓	✓
Stormwater Storage Landscaping and Maintenance ○ 2 years (period between a successful Practical Completion Inspection and a successful handover meeting with written confirmation of City acceptance): ○ Ongoing (from notification of City acceptance):	✓	✓
Irrigation System Management ○ 2 years (period between a successful Practical Completion Inspection and a successful handover meeting with written confirmation of City acceptance): ○ Ongoing (from notification of City acceptance):	✓	✓
Street Sweeping ○ Ongoing (from successful Practical Completion Inspection):		✓

8. REFERENCES

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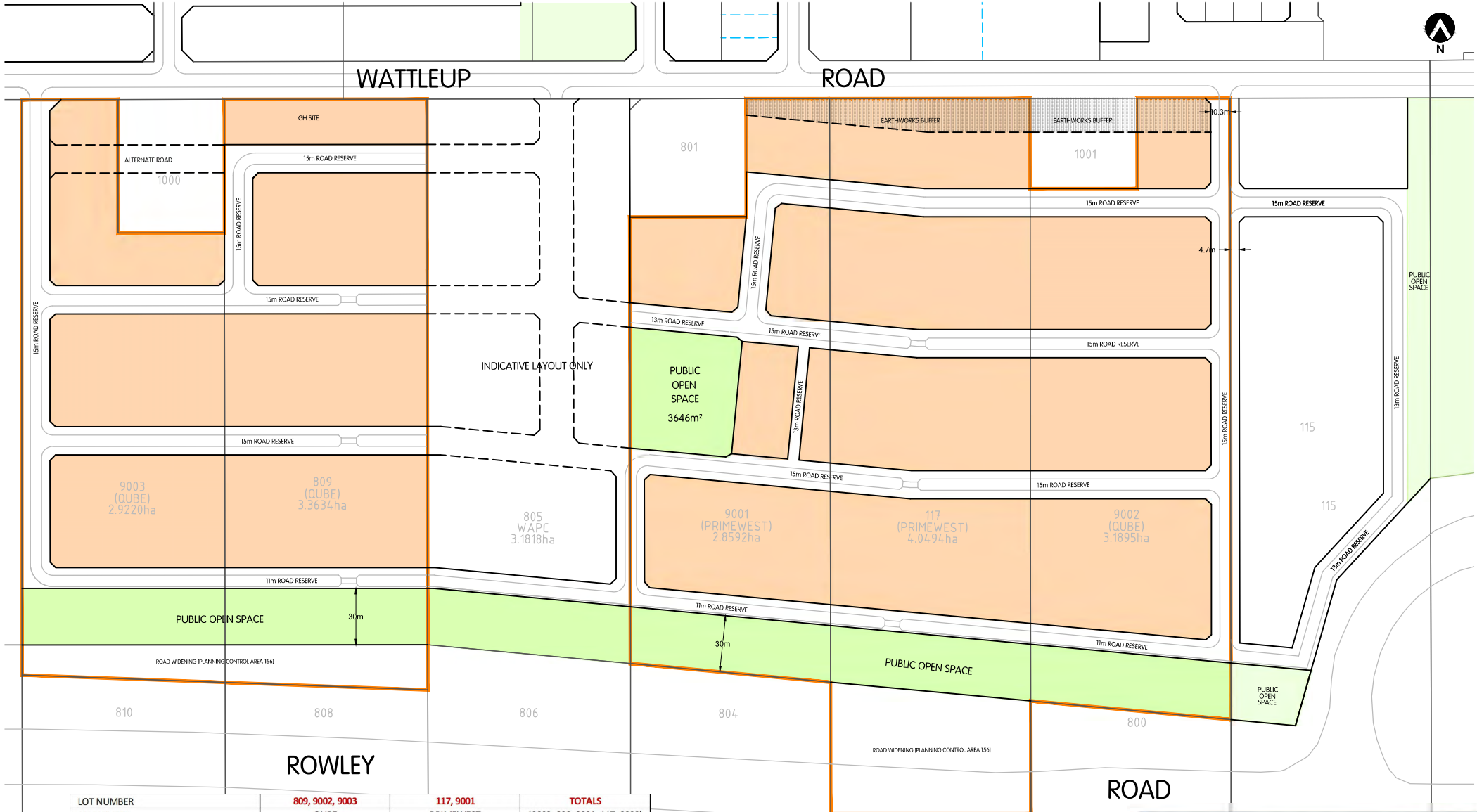
Appendix A Ministerial and EPBC Approval (Hatch, 2022)



LOT NUMBER	809, 9002, 9003		117, 9001		TOTALS	
OWNERSHIP	QUBE		PRIMEWEST		(9003, 809, 9001, 117, 9002)	
EXISTING LOT AREA (HA)	9.4749		6.9086		16.3835	
LESS PLANNING CONTROL AREA 156	0.4311		0.6917		1.1228	
GROSS DEVELOPABLE AREA (HA)	**9.0438**		**6.2169**		**15.2607**	
BREAKDOWN						
DEVELOPABLE AREA	5.7533	63.6%	3.9547	63.6%	9.708	63.6%
POS	0.9684	10.7%	1.006	16.2%	1.9744	12.9%
ROADS	2.3221	25.7%	1.2562	20.2%	3.5783	23.4%
	9.0438	100.0%	**6.2169**	100.0%	**15.2607**	100.0%

DEPARTMENT OF PLANNING, LANDS AND HERITAGE

DATE 06-Apr-2021

FILE 148010 & 147987

QUBE

primewest

CADASTRAL INFORMATION
SOURCE: LANDGATE
YYMMDD: 201125
DWG REF: 201125-cad.DWG
PROJECTION: PCG94

AERIAL PHOTOGRAPHY
SOURCE: NA
YYMMDD: NA

HATCH | RobertsDay

SIZE A3 1:2000

0 metres 20 40 60 80 100

REV	DESCRIPTION	YYMMDD	DRAWN	APPR'D
J	REVISE POS DESIGN	210331	SB	DW
I	CALCULATIONS TABLE	210323	TT	DW

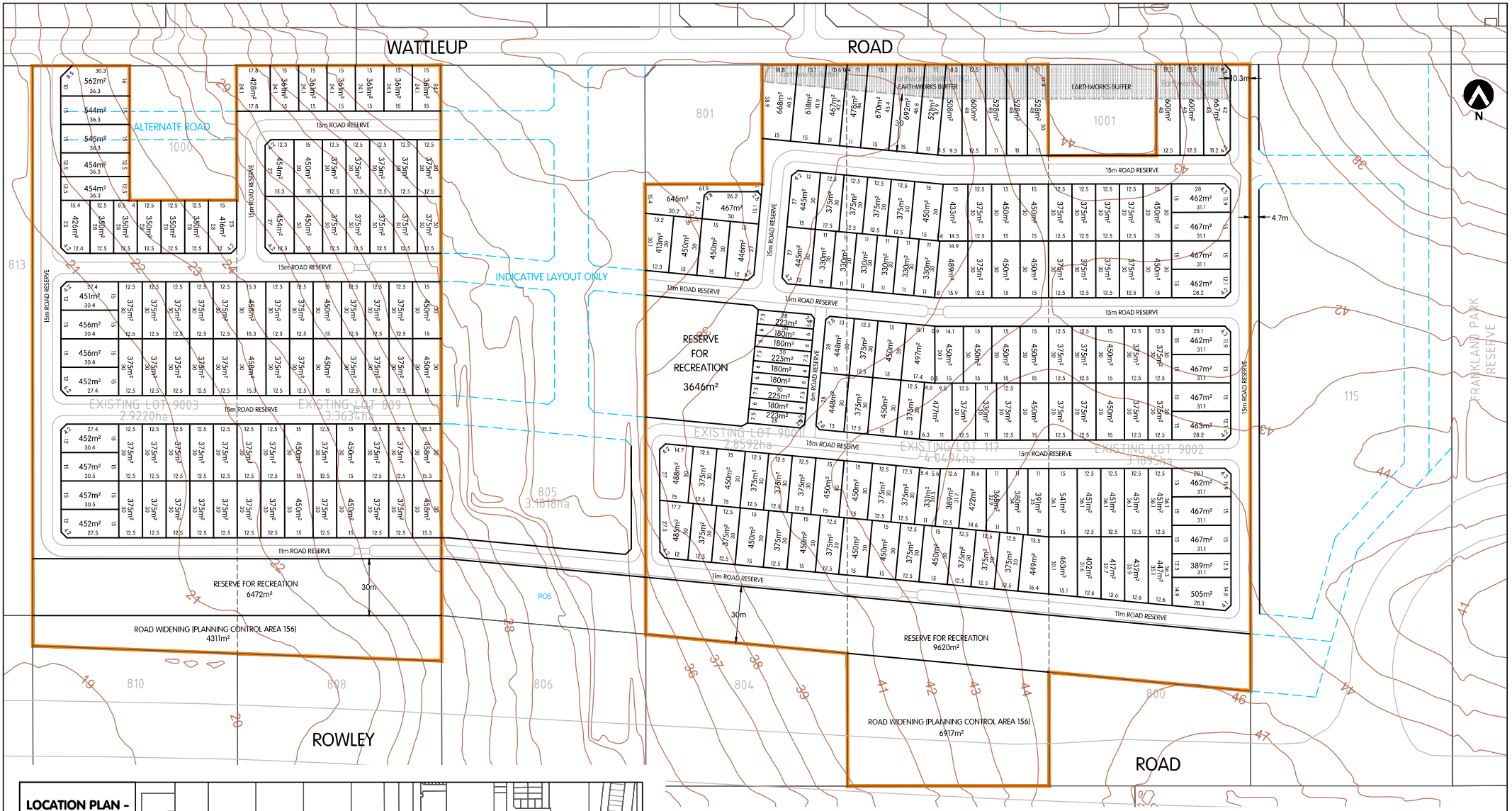
MODIFIED PLAN OF SUBDIVISION

Wattleup Road - Hammond Park

City of Cockburn

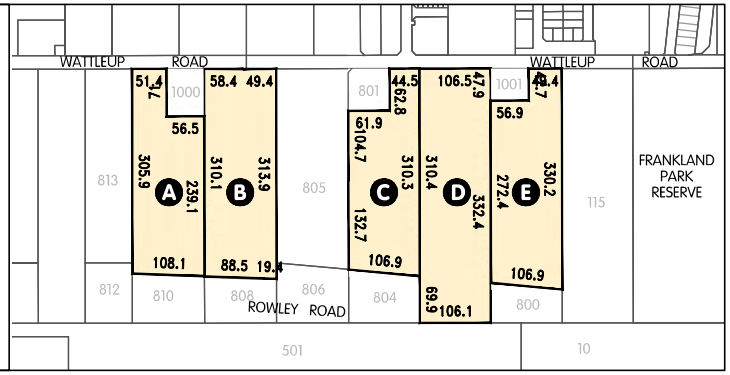
JOB CODE	DRAW NO.	REV.
QUB WAT	**RD1 008**	**J**

DISCLAIMER: ISSUED FOR DESIGN INTENT ONLY. ALL AREAS AND DIMENSIONS ARE SUBJECT TO DETAIL DESIGN AND SURVEY



LOCATION PLAN - EXISTING LOTS

- EXISTING LOTS
- A LOT 9003 (2.9220ha)
- B LOT 809 (3.3634ha)
- C LOT 9001 (2.8592ha)
- D LOT 117 (4.0494ha)
- E LOT 9002 (3.1895ha)



LEGEND

- EXISTING LOT BOUNDARY - COMBINED
- PROPOSED LOT BOUNDARY
- EXISTING LOT BOUNDARIES
- EXISTING LOT BOUNDARIES TO BE REMOVED
- 53 EXISTING CONTOURS
- 804 EXISTING LOT NUMBERS
- INDICATIVE FUTURE LOT BOUNDARIES

PROPOSED LAND USE/DEVELOPMENT

Zone	Lot Size	No. of Lots
Residential	180m² - 234m²	9
Residential	320m² - 449m²	131
Residential	450m² - 499m²	76
Residential	500m² - 549m²	9
Residential	550m² - 599m²	1
Residential	600m² - 699m²	9
	TOTAL	**235**

YIELD TABLE

Existing Lots	1
Proposed Lots	
Residential (Single)	235
TOTAL	**235**
Reserve for Recreation	3

QUBE primewest

HATCH | RobertsDay

SIZE A3 1:2000

0 metres 20 40 60 80 100

CADASTRAL INFORMATION
SOURCE: LANDGATE
YYMMDD: 201125
DWG REF: 201125-cad.DWG
PROJECTION: PCG94

REV	DESCRIPTION	YYMMDD	DRAWN	APPR'D
A	BASE QUB WAT RD1 008K	210504	SB	DW

SUBDIVISION PLAN

Lots 117, 809 9001-9003 Wattleup Road - Hammond Park

City of Cockburn

JOB CODE	DRAW NO.	REV.
QUB WAT	**RD1 011**	**A**

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Notification of approval

Residential Development of Lot 809 Wattleup Road, Hammond Park, WA (EPBC 2021/8933)

This decision is made under section 133(1) of the *Environment Protection and Biodiversity Conservation Act 1999* (Cth) (EPBC Act). Note that section 134(1A) of the EPBC Act applies to this approval. That provision provides, in general terms, that if the approval holder authorises another person to undertake any part of the Action, the approval holder must take all reasonable steps to ensure that the other person is informed of any conditions attached to this approval, and that the other person complies with any such conditions.

Proposed Action

Person to whom the approval is granted (approval holder)	QUBE Wattleup Development Pty Ltd
ACN of approval holder	117 433 084
Action	To clear vegetation and construct a residential development on Lot 809 Wattleup Road, Hammond Park, WA [See EPBC Act referral 2021/8933]

Approval Decision

Decision	My decision on whether or not to approve the taking of the Action for the purposes of the controlling provision for the Action is as follows.

Controlling Provision	Decision
Listed threatened species and communities (section 18 and section 18A)	Approve

Period for which the approval has effect	This approval has effect until 25 August 2027
Conditions of approval	The approval is subject to conditions under the EPBC Act as set out in **Annexure A**.

Person authorised to make decision

Name and Position	Kylie Calhoun Assistant Secretary Environment Assessments West (WA, SA, NT) Branch
Signature	Kylie Cal
Date of decision	13 September 2022

ANNEXURE A

Note: Words appearing in **bold** have the meaning assigned to them at PART C – DEFINITIONS.

PART A – CONDITIONS SPECIFIC TO THE ACTION

1. To avoid and mitigate impacts to **protected matters** the approval holder must not:
   a. **Clear** outside of the **project area**
   b. **Clear** more than 3.03 ha of **Banksia TEC**
   c. **Clear** more than 2.55 ha of **foraging habitat** for **black cockatoos**

PART B – ADMINISTRATIVE CONDITIONS

NOTIFICATION OF DATE OF COMMENCEMENT OF THE ACTION

2. The approval holder must notify the **department** electronically of the date of **commencement of the Action**, within 5 **business days** of **commencement of the Action**.

3. If the **commencement of the Action** does not occur within 5 years from the date of this approval, then the approval holder must not **commence the Action** without the prior written agreement of the **Minister**.

COMPLIANCE RECORDS

4. The approval holder must maintain accurate and complete **compliance records**.
5. If the **department** makes a request in writing, the approval holder must provide electronic copies of **compliance records** to the **department** within the timeframe specified in the request.

Note: **Compliance records** may be subject to audit by the **department**, or by an independent auditor in accordance with section 458 of the **EPBC Act**, and/or be used to verify compliance with the conditions. Summaries of the results of an audit may be published on the **department**'s website or through the general media.

6. The approval holder must ensure that any **monitoring data** (including **sensitive ecological data**), surveys, maps, and other spatial and metadata required under the conditions of this approval are prepared in accordance with the **department's** *Guidelines for biological survey and mapped data* (2018), or any subsequent official version or as otherwise specified by the **Minister** in writing.

7. The approval holder must ensure that any **monitoring data** (including **sensitive ecological data**), surveys, maps, and other spatial and metadata required under the conditions of this approval are prepared in accordance with the **department's** *Guide to providing maps and boundary data for EPBC Act projects* (2021), or any subsequent official version or as otherwise specified by the **Minister** in writing.

8. The approval holder must submit all **monitoring data** (including **sensitive ecological data**), surveys, maps, other spatial and metadata and all species occurrence record data (sightings and evidence of presence) electronically to the **department** within 12 months of the approval.

ANNUAL COMPLIANCE REPORTING

9. The approval holder must prepare a **compliance report** for each 12-month period following the date of this approval, or as otherwise agreed to in writing by the **Minister**.
10. Each **compliance report** must be consistent with the **department's** *Annual Compliance Report Guidelines* (2014), or any subsequent official version.
11. Each **compliance report** must include:

a. Accurate and complete details of compliance and any non-compliance with the conditions and the **plans**, and any **incidents**.

b. One or more **shapefile** showing all **clearing** of any **protected matters**, and/or their habitat, undertaken within the 12-month period at the end of which that **compliance report** is prepared.

c. A schedule of all **plans** in existence in relation to these conditions and accurate and complete details of how each plan is being implemented.

12. The approval holder must:

a. Publish each **compliance report** on the **website** within 60 **business days** following the end of the 12-month period for which that **compliance report** is required.

b. Notify the **department** electronically, within 5 **business days** of the date of publication that a **compliance report** has been published on the **website.**

c. Provide the weblink for the **compliance report** in the notification to the department.

d. Keep all published **compliance reports** required by these conditions on the **website** until the expiry date of this approval.

e. Exclude or redact **sensitive ecological data** from **compliance reports** published on the **website** or otherwise provided to a member of the public.

f. If **sensitive ecological data** is excluded or redacted from the published version, submit the full **compliance report** to the **department** within 5 **business days** of its publication on the **website** and notify the **department** in writing what exclusions and redactions have been made in the version published on the website.

Note: **Compliance reports** may be published on the **department's** website.

REPORTING NON-COMPLIANCE

13. The approval holder must notify the **department** electronically, within 2 **business days** of becoming aware of any **incident** and/or potential non-compliance and/or actual non-compliance with the conditions or commitments made in a **plan**.

14. The approval holder must specify in the notification:

a. Any condition or commitment made in a **plan** which has been or may have been breached.

b. A short description of the **incident** and/or potential non-compliance and/or actual non-compliance.

c. The location (including co-ordinates), date, and time of the **incident** and/or potential non-compliance and/or actual non-compliance.

Note: If the exact information cannot be provided, the approval holder must provide the best information available.

15. The approval holder must provide to the **department** in writing, within 12 **business days** of becoming aware of any **incident** and/or potential non-compliance and/or actual non-compliance, the details of that **incident** and/or potential non-compliance and/or actual non-compliance with the conditions or commitments made in a **plan**. The approval holder must specify:

a. Any corrective action or investigation which the approval holder has already taken

b. The potential impacts of the **incident** and/or non-compliance and/or non-compliance

c. The method and timing of any corrective action that will be undertaken by the approval holder.

INDEPENDENT AUDIT

16. The approval holder must ensure that an **independent audit** of compliance with the conditions is conducted for every five-year period following the **commencement of the Action** until this approval expires, unless otherwise specified in writing by the **Minister**.

17. For each **independent audit**, the approval holder must:

    a. Provide the name and qualifications of the nominated **independent** auditor, the draft audit criteria, and proposed timeframe for submitting the **audit report** to the **department** prior to commencing the **independent audit**.

    b. Only commence the **independent audit** once the nominated **independent** auditor, audit criteria and timeframe for submitting the **audit report** have been approved in writing by the **department**.

    c. Submit the **audit report** to the **department** for approval within the timeframe specified and approved in writing by the **department.**

    d. Publish each **audit report** on the **website** within 15 **business days** of the date of the **department's** approval of the **audit report**.

    e. Keep every **audit report** published on the **website** until this approval expires.

18. Each **audit report** must report for the five-year period preceding that audit report.

19. Each **audit report** must be completed to the satisfaction of the **Minister** and be consistent with the **department's** *Environment Protection and Biodiversity Conservation Act 1999 Independent Audit and Audit Report Guidelines* (2019), or any subsequent official version.

COMPLETION OF THE ACTION

20. The approval holder must notify the **department** electronically 60 **business days** prior to the expiry date of this approval, that the approval is due to expire.

21. Within 20 **business days** after the **completion of the Action**, and, in any event, before this approval expires, the approval holder must notify the **department** electronically of the date of **completion of the Action** and provide **completion data**.

PART C - DEFINITIONS

In these conditions any bolded use of a word or term refers to the below definition of that word or term:

Audit report means a written report of compliance and fulfilment of the conditions attached to this approval, objectively evaluated against the audit criteria approved by the **department**.

Banksia TEC means the **EPBC Act** listed threatened ecological community (TEC) Banksia Woodlands of the Swan Coastal Plain ecological community.

Black cockatoos means the **EPBC Act** listed threatened species Carnaby's Black Cockatoo (*Calyptorhynchus latirostris*), Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksii naso*) and Baudin's Black Cockatoo (*Calyptorhynchus baudinii*).

Business day means a day that is not a Saturday, a Sunday or a public holiday in the state or territory of the Action.

Clear, cleared or **clearing** means the cutting down, felling, thinning, logging, removing, killing, destroying, poisoning, ringbarking, uprooting, or burning of vegetation, but does not include control of specified weeds (see the *Australian weeds strategy 2017 to 2027*, Commonwealth of Australia 2017 for further guidance).

Commence the Action or **Commencement of the Action** means the date on which the first instance of any activity associated with the Action (including **clearing** and **construction**) is undertaken. **Commencement of the Action** does not include minor physical disturbance necessary to:

a. Undertake pre-clearance surveys or monitoring programs.

b. Install signage and /or temporary fencing to prevent unapproved use of the project area.

c. Protect environmental and property assets from fire, weeds, and feral animals, including use of existing surface access tracks.

d. Install temporary site facilities for persons undertaking pre-commencement activities so long as these are located where they have no impact on any **protected matter**.

Completion data means an environmental report and spatial data clearly detailing how the conditions of this approval have been met. The **department**'s chosen format for spatial data is a **shapefile**.

Completion of the Action means the date on which all activities associated with this approval have permanently ceased and/or been completed.

Compliance records means all documentation or other material in whatever form required to demonstrate compliance with the conditions of approval in the approval holder's possession, or that are within the approval holder's power to obtain lawfully.

Compliance report means a written report of compliance with, and fulfilment of, the conditions attached to the approval.

Construction means the erection of a building or structure that is, or is to be, fixed to the ground and wholly or partially fabricated on-site; the alteration, maintenance, repair or demolition of any building or structure; any work which involves breaking of the ground (including pile driving) or bulk earthworks; the laying of pipes and other prefabricated materials in the ground, and any associated excavation work; but excluding the installation of temporary fences and signage.

Department means the Australian Government agency responsible for administering the **EPBC Act**.

EPBC Act means the *Environment Protection and Biodiversity Conservation Act 1999* (Cth).

Foraging Habitat means habitat that provides food sources for a species.

Incident means any event which has the potential to, or does, impact on any **protected matter**.

Independent means a person or firm who does not have any individual, financial*, employment* or family affiliation or any conflicting interests with the project, the approval holder or the approval holder's staff, representatives or associated persons.

*Other than for the purpose of undertaking the role for which an independent person is required

Independent audit means an audit conducted by an **independent** and **suitably qualified person** as detailed in the *Environment Protection and Biodiversity Conservation Act 1999 Independent Audit and Audit Report Guidelines* (2019), or any subsequent official version.

Minister means the Australian Government Minister administering the **EPBC Act**, including any delegate thereof.

Monitoring data means the data required to be recorded under the conditions of this approval.

Plan means any action management plan or strategy that the approval holder is required by these conditions to implement.

Project Area means the location of the action, represented in Attachment A by the area enclosed by the red line labelled 'EPBC 2021/8933 boundary'.

Protected matter means a matter protected under a controlling provision in Part 3 of the **EPBC Act** for which this approval has effect.

Sensitive ecological data means data as defined in the Australian Government Department of the Environment *Sensitive Ecological Data – Access and Management Policy V1.0* (2016), or any subsequent official version.

Shapefile(s) means location and attribute information about the Action provided in an Esri shapefile format. Shapefiles must contain '.shp', '.shx', '.dbf' files and a '.prj' file that specifies the projection/geographic coordinate system used. Shapefiles must also include an '.xml' metadata file that describes the shapefile for discovery and identification purposes.

Suitably qualified expert (for the purpose of undertaking environmental surveys) means a person who has relevant professional qualifications and at least 3 years of work experience designing and implementing surveys for listed threatened species and communities and can give an authoritative assessment and advice on the presence of listed threatened species and communities using relevant protocols, standards, methods and/or literature.

Website means a set of related web pages located under a single domain name attributed to the approval holder and available to the public.

ATTACHMENTS

Attachment A – Site Map

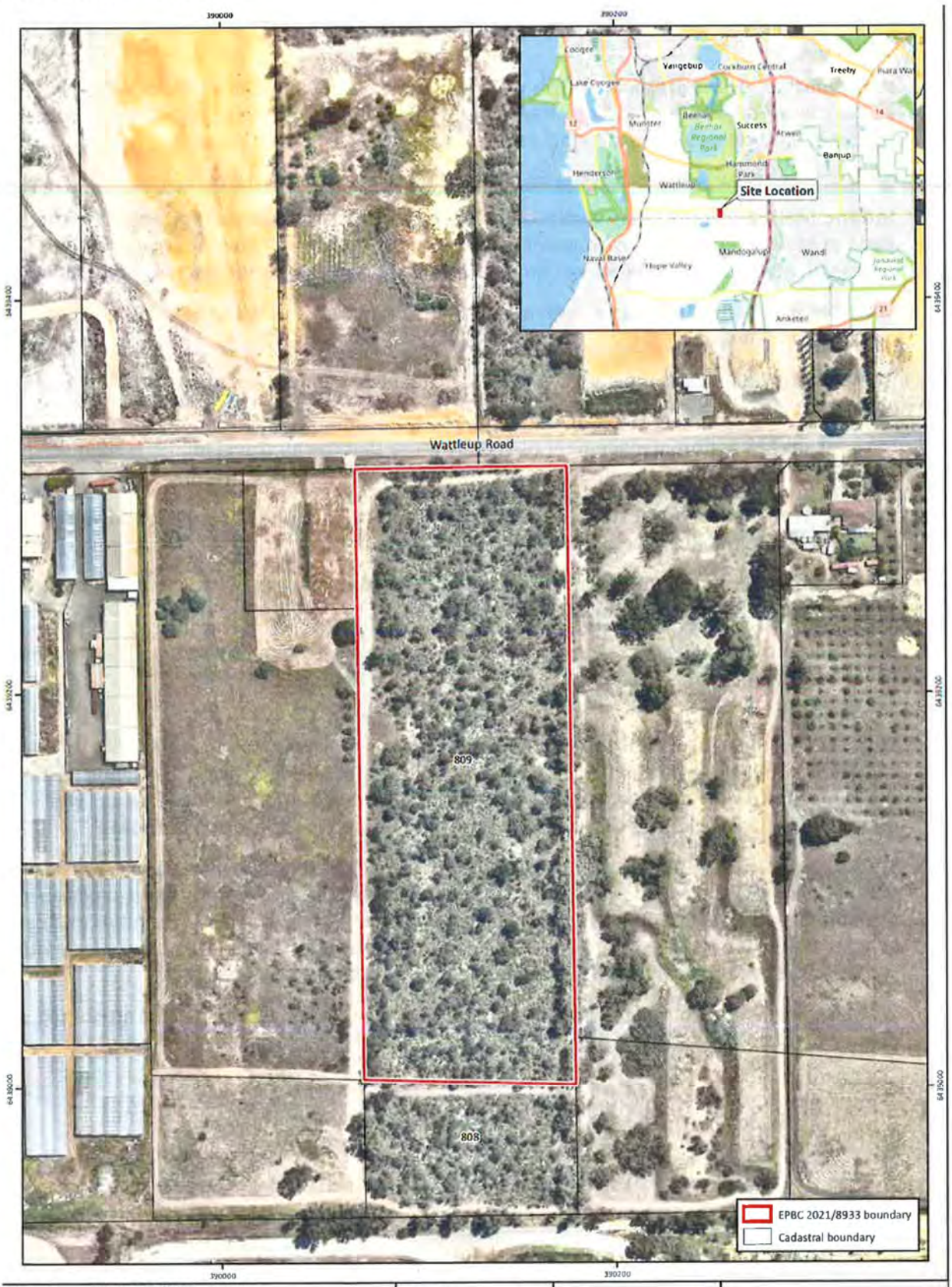


Figure 1: **EPBC 2021/8933 Location**

Project:	Preliminary Documentation Report EPBC 2021/8933
Client:	Qube Wattleup Road Development Company Pty Ltd

Plan Number: EP20-151(04)-F24

Drawn:	GAR
Date:	18/11/2021
Checked:	PPS
Approved:	JDH
Date:	09/12/2021

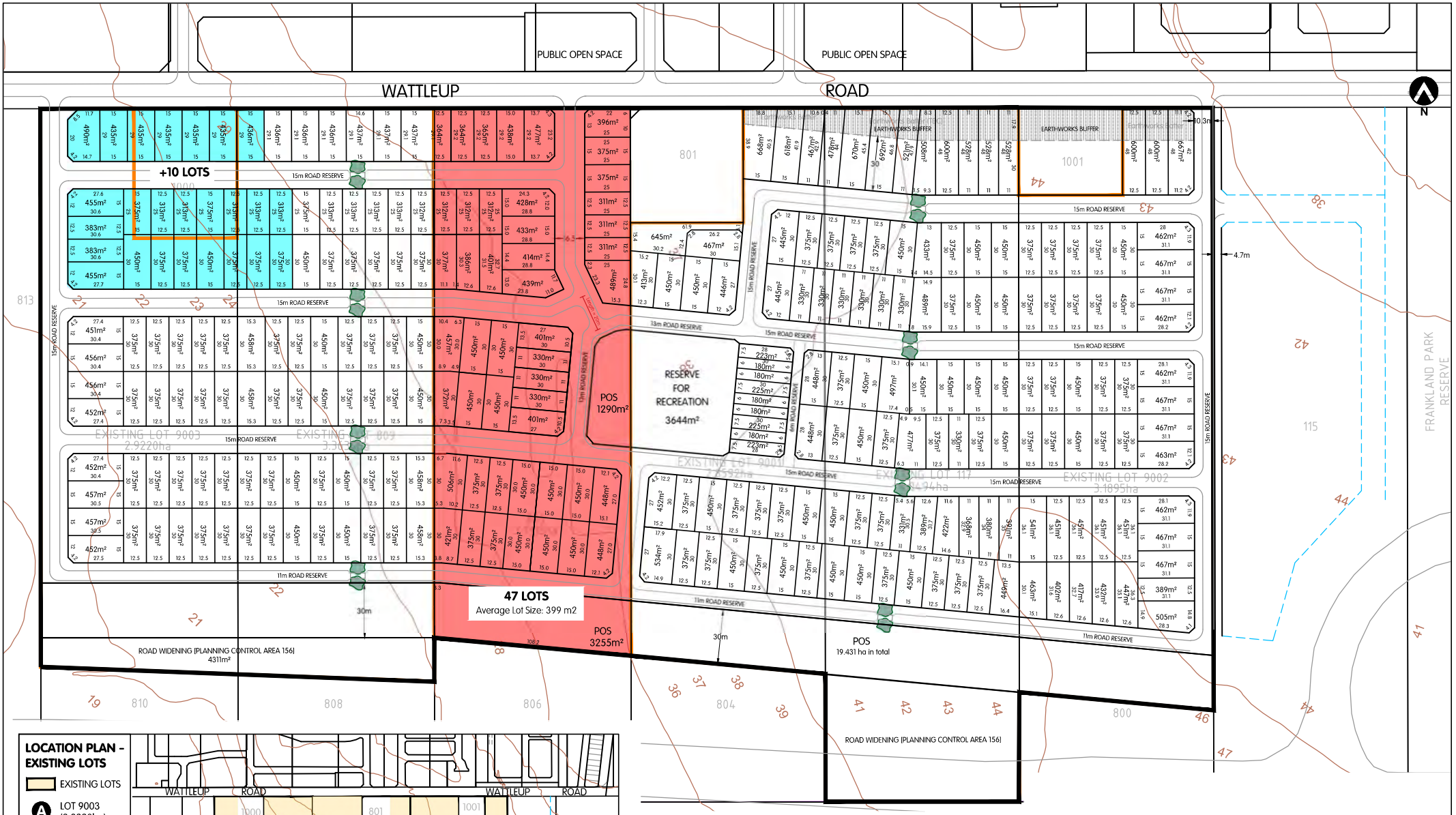
N

0 20 40 60
Metres
Scale: 1:2,500@A4
GDA 1994 MGA Zone 50

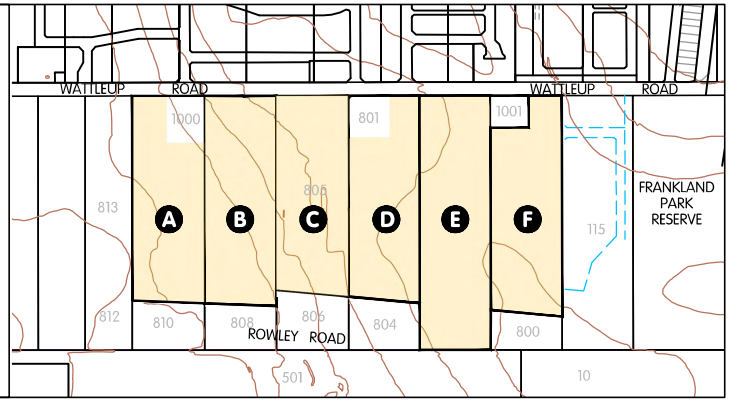
emerge ASSOCIATES

While Emerge Associates makes every attempt to ensure the accuracy and completeness of data, Emerge accepts no responsibility for externally sourced data used.
©Landgate (2020). Nearmap Imagery date: 24/10/2021

Appendix B Subdivision Concept Plan (Hatch, 2022)



LOCATION PLAN - EXISTING LOTS



LEGEND

- EXISTING LOT BOUNDARY - COMBINED
- PROPOSED LOT BOUNDARY
- EXISTING LOT BOUNDARIES
- EXISTING LOT BOUNDARIES TO BE REMOVED
- INDICATIVE FUTURE LOT BOUNDARIES
- PUBLIC OPEN SPACE
- PROPOSED TREES ON SLOW POINTS
- 53 EXISTING CONTOURS
- 804 EXISTING LOT NUMBERS

QUBE primewest

CADASTRAL INFORMATION
SOURCE: LANDGATE
YYMMDD: 201125
DWG REF: 201125-cad.DWG
PROJECTION: PCG94

HATCH | RobertsDay

SIZE A3 1:2000

0 metres 20 40 60 80 100

REV	DESCRIPTION	YYMMDD	DRAWN	APPR'D
I	STREET DESIGN MOD	220610	TG	DW
H	STREET DESIGN MOD	220610	TG	DW
G	DESIGN MOD, LOT YIELD	220609	TG	DW
F	UPDATE NORTHERN AREA	220601	TG	DW

SUBDIVISION CONCEPT PLAN

Lots 117, 809 9001-9003 Wattleup Road - Hammond Park

City of Cockburn

JOB CODE	DRAW NO.	REV.
QUB WAT	**RD1 011**	**I**

DISCLAIMER: ISSUED FOR DESIGN INTENT ONLY. ALL AREAS AND DIMENSIONS ARE SUBJECT TO DETAIL DESIGN AND SURVEY

Appendix C Landscape Concepts (Plan E, 2022)

LEGEND

- PROPOSED TREES.
- PROPOSED FEATURE TREES.
- RETAINED TREES FOR PROTECTION (SUBJECT TO ABORIST REPORT AND SURVEY)
- 01 ENTRY WITH LARGE DECIDUOUS FEATURE TREES.
- 02 CONCRETE FOOTPATH.
- 03 FEATURE PAVING TO STREET INTERSECTIONS TO SLOW TRAFFIC AND ENHANCE CONNECTION TO POS.
- 04 FEATURE DECIDUOUS TREES TO SLOW POINTS.
- 05 SCREEN PLANTING WITH TREES.

HAMMOND SOUTH

PREPARED FOR QUBE MANDOGALUP PTY LTD AND PRIMEWEST

LANDSCAPE MASTERPLAN

AUGUST 2022

JOB NO. 2102804

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M1.101

REV F

0 10 20 40 60 100m

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LANDSCAPE ARCHITECTS

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LEGEND

- PROPOSED TREE PLANTING
- PROPOSED FEATURE TREES.
- RETAINED TREES FOR PROTECTION (SUBJECT TO ABORIST REPORT AND SURVEY)
- 01 CONCRETE FOOTPATH
- 02 PLANTED BIORETENTION BASIN WITH WINTER WET NATIVE TREES AND PLANT SPECIES. 1:1 ARI, BASE AREA: 740 M2, VOLUME: 376 M3
- 03 PLANTED DETENTION BASIN - 1:100 ARI, BASE AREA: 1640 M2 , VOLUME: 2157 M3
- 04 PASSIVE TURF AREA
- 05 KICKABOUT TURF AREA
- 06 INFORMAL PLAYGROUND EQUIPMENT IN MULCH
- 07 SHELTER WITH TABLE SEATINGS & BBQ.
- 08 NATIVE PLANTING WITH GROVES OF TREES
- 09 ALL-AGES FITNESS EQUIPMENT NODE
- 10 ACTIVE ZONE WITH HIT UP WALL, BASKETBALL HOOP, SOCCER AND COLOURED LINEMARKING
- 11 SEATING NODE
- 12 REFLECTIVE NODE - TERRACED TIMBER SEATING.
- 13 TERRACED SEATING WITH CLIMBING OPPORTUNITIES
- 14 SMALL PLAY EQUIPMENT NODE WITH MULCH SOFTFALL
- 15 EARTHWORKS BATTER
- 16 3M MAINTENANCE ACCESS (OFF SITE)
- 17 OVERFLOW SPILLWAY FROM 1:1 TO 1:100 BASIN

HAMMOND SOUTH

PREPARED FOR QUBE MANDOGALUP PTY LTD AND PRIMEWEST

LINEAR POS

AUGUST 2022

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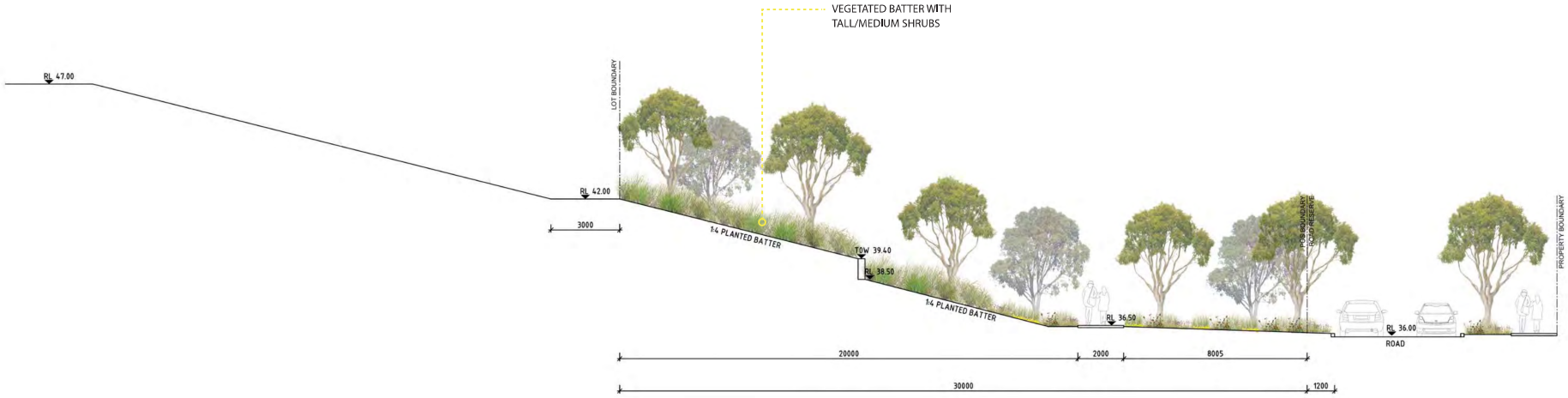
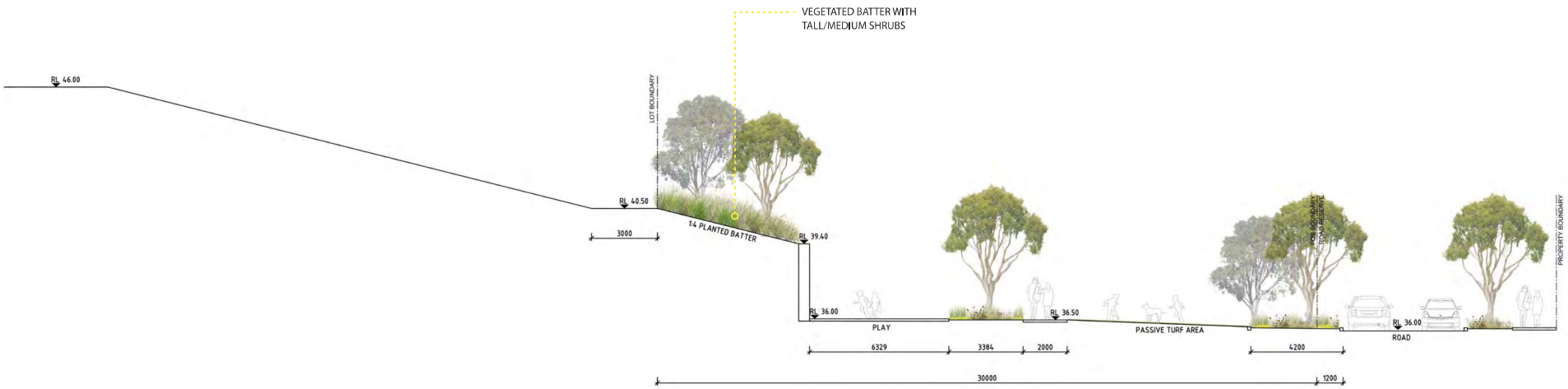
SECTION A



SECTION B



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LINEAR POS - SECTIONS

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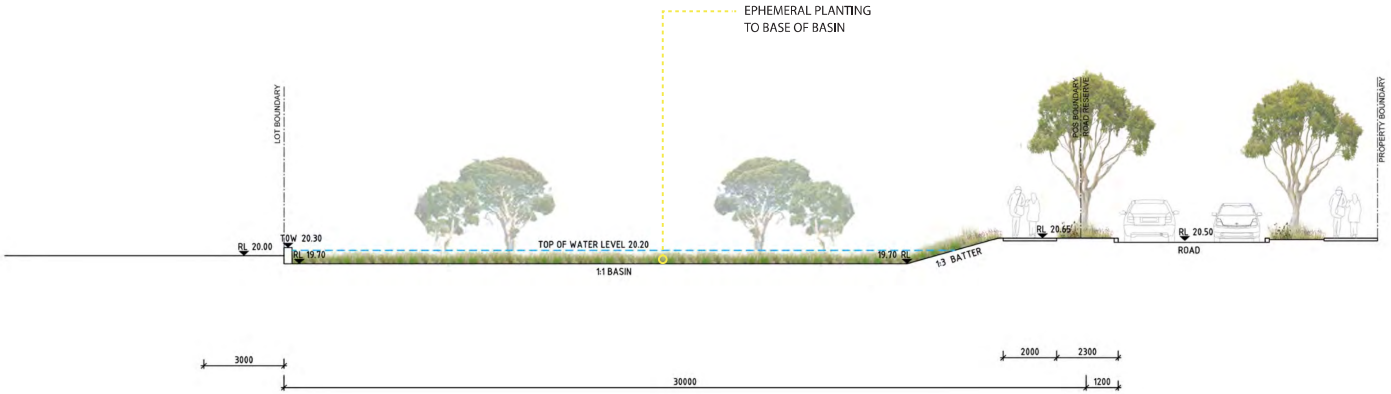
SECTION C

SECTION D



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LEGEND

- PROPOSED TREE PLANTING.
- 01 FEATURE TREE PLANTING / VISUAL GREEN CONNECTION FROM ENTRY ROAD
- 02 OPPORTUNITY FOR ENTRY / WAYFINDING ARTWORK
- 03 TURF KICKABOUT AREA
- 04 MOUNDED TURF
- 05 SHADE STRUCTURE WITH SEATING, BBQ AND AMENITY
- 06 PLAYGROUND EQUIPMENT IN SAND PIT
- 07 TIERED RETAINING WALLS WITH PLANTING
- 08 1:100 ARI DETENTION BASIN
- 09 PLANTED 1:1 ARI BIORETENTION BASIN WITH WINTER-WET NATIVE TREES AND PLANT SPECIES.
- 10 CULVERT AND HEADWALL TO CONNECT 1:1 AND 1:100 BASINS
- 11 COMMUNITY ORCHARD
- 12 CONCRETE FOOTPATH
- 13 FEATURE CONCRETE PAVING
- 14 PATH CONNECTION TO ADJACENT LOTS
- 15 TREES AND PLANTING TO INTERFACE WITH OVERWATCH PRODUCT
- 16 POS PARKING BAYS

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HAMMOND SOUTH

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CONCEPT PLAN

JOB NO. 2102804

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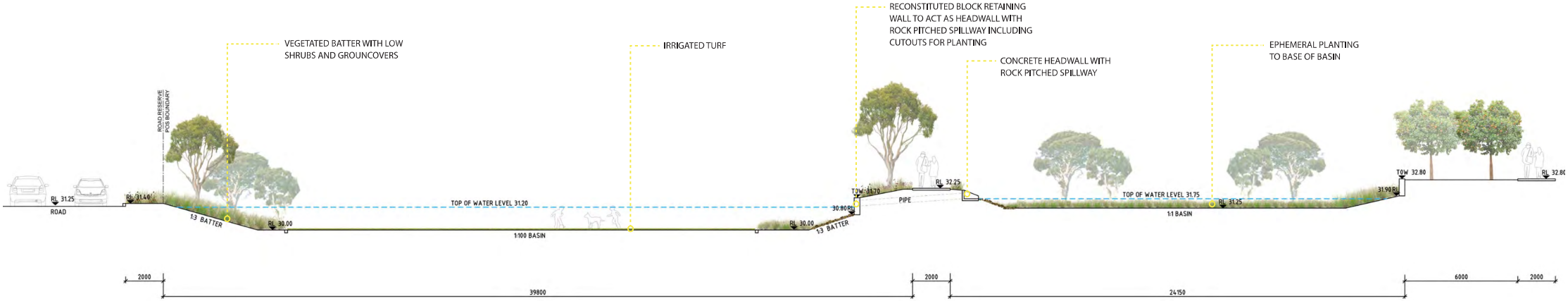
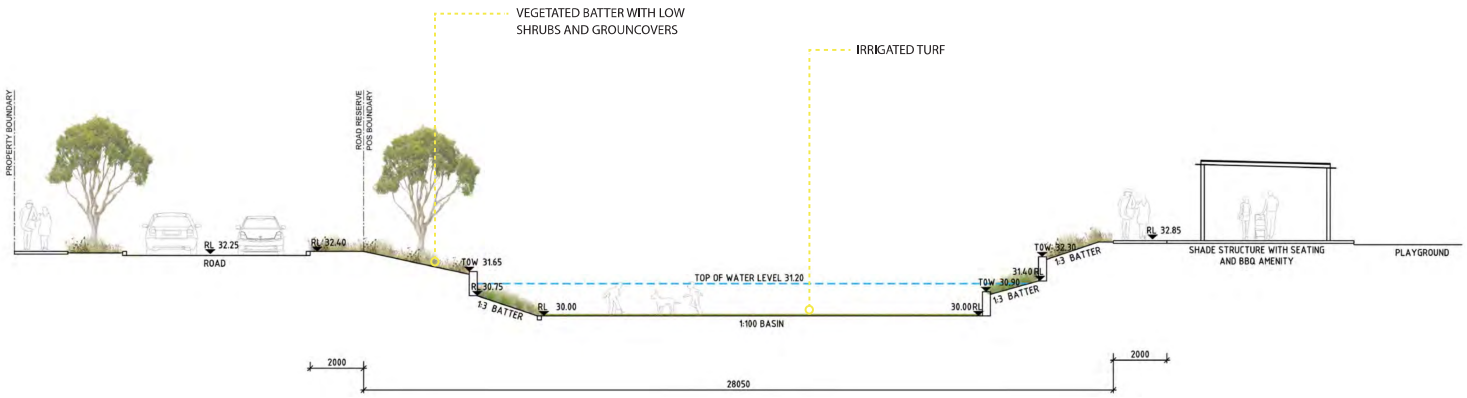
SECTION E



SECTION F



HAMMOND SOUTH

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CENTRAL POS - SECTIONS

AUGUST 2022

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CENTRAL POS

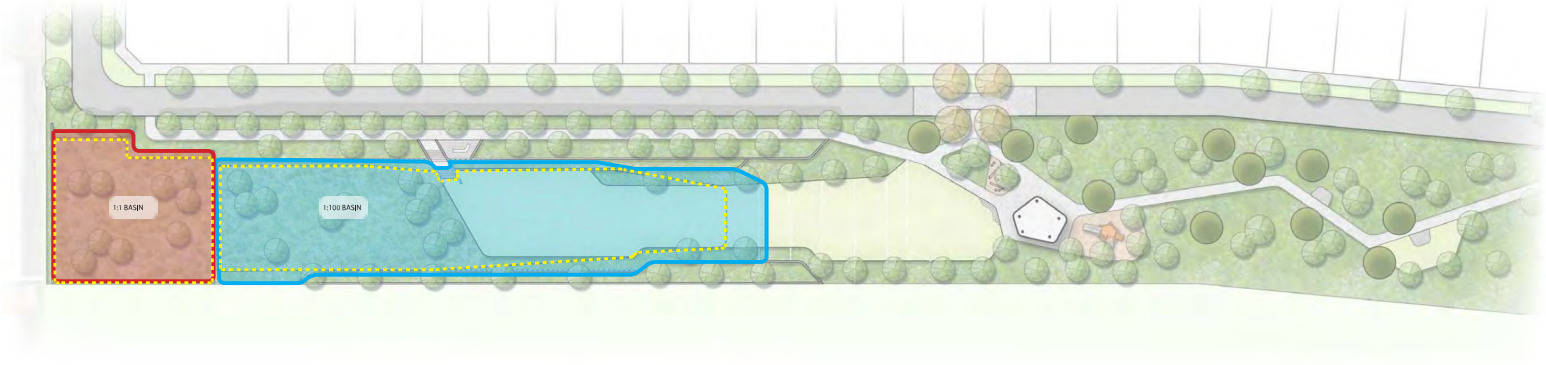
POS CALCULATIONS

POS	TOTAL AREA (ha)	1:1 BASE AREA (ha)	1:100 BASE AREA (ha)	RESTRICTED 1:1 YEAR EVENT (ha)	RESTRICTED 1:100 YEAR EVENT(ha)	BATTERED AREA WITH SLOPE GREATER THAN 1:6 (ha)	USEABLE TURF AREA (HA) INCLUSIVE OF 1:6
Central POS	0.4935 (ex. Verge)	0.0315	0.0734	0.0422	0.1165	0.0714	0.1738
Linear POS	1.9347 (ex. Verge)	0.0740	0.1640	0.0791	0.2050	0.4630	0.2580

LEGEND

- BASIN BOUNDARY AREA
- RESTRICTED 1:1 YEAR EVENT
- RESTRICTED 1:100 YEAR EVENT

LINEAR POS



HAMMOND SOUTH

PREPARED FOR QUBE MANDOGALUP PTY LTD AND PRIMEWEST

POS RESTRICTED AREAS

AUGUST 2022

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Appendix D PC Sump Results

PCSump Version 6.1: Licenced to Environnivate

Environmental and Water Resource Software

Project Number / Name:

Wattleup Rd

Project Description:

Catchment A Small Storm

Model Selection: **Deep Water Table Model**

Results:

	Design Storms				Maximum (Mean of Temporal Patterns)					
	Storm	Duration [hrs]	Rainfall Depth [mm]	EY/AEP [%]	Depth [m]	Level [mAHD]	Clearance to Allowable TWL [m]	Volume [m^3]	Area [m^2]	Temporal Pattern No.
	1	30 min	15.5	50%	0.5	20.00	0.00	383	980	8
Critical	***1***	***30 min***	***15.5***	***50%***	***0.5***	***20.00***	***0.00***	***383***	***980***	***8***

Notes:

Temporal pattern matching closest to mean water level

If Water Level is coloured Red, Maximum Capacity of the Basin has been Exceeded

PCSump Version 6.1: Licenced to Environnivate

PCSUMP
Environmental and Water Resource Software

Project Number / Name:

Wattleup Rd

Project Description:

Catchment A 20% AEP

Model Selection: **Deep Water Table Model**

Results:

	Design Storms				Maximum (Mean of Temporal Patterns)					
	Storm	Duration [hrs]	Rainfall Depth [mm]	EY/AEP [%]	Depth [m]	Level [mAHD]	Clearance to Allowable TWL [m]	Volume [m^3]	Area [m^2]	Temporal Pattern No.
	1	30 min	20.1	20%	0.42	19.22	0.78	524	1,534	7
	2	1 hour	25.8	20%	0.49	19.29	0.71	630	1,628	2
	3	2 hour	32.9	20%	0.5	19.30	0.70	645	1,642	4
	4	3 hour	38.1	20%	0.46	19.26	0.74	582	1,585	1
	5	6 hour	48.8	20%	0.4	19.20	0.80	491	1,504	3
	6	9 hour	56.1	20%	0.27	19.07	0.93	312	1,328	3
	7	12 hour	61.7	20%	0.19	18.99	1.01	209	1,220	10
	8	24 hour	75.9	20%	0.19	18.99	1.01	212	1,224	6
	9	48 hour	90.5	20%	0	18.80	1.20	-	970	10
	10	72 hour	100.0	20%	0	18.80	1.20	-	970	1
	11	96 hour	109.0	20%	0	18.80	1.20	-	970	1
	12	120 hour	118.0	20%	0	18.80	1.20	-	970	1
	13	144 hour	127.0	20%	0	18.80	1.20	-	970	1
	14	168 hour	137.0	20%	0	18.80	1.20	-	970	1
Critical	***3***	***2 hour***	***32.9***	***20%***	***0.5***	***19.30***	***0.70***	***645***	***1,642***	***4***

Notes:

Temporal pattern matching closest to mean water level

If Water Level is coloured Red, Maximum Capacity of the Basin has been Exceeded

PCSump Version 6.1: Licenced to Environnivate

PCSUMP
Environmental and Water Resource Software

Project Number / Name:

Wattleup Rd

Project Description:

Catchment A 1% AEP

Model Selection: **Deep Water Table Model**

Results:

	Design Storms				Maximum (Mean of Temporal Patterns)					
	Storm	Duration [hrs]	Rainfall Depth [mm]	EY/AEP [%]	Depth [m]	Level [mAHD]	Clearance to Allowable TWL [m]	Volume [m^3]	Area [m^2]	Temporal Pattern No.
	1	30 min	34.5	1%	1.02	19.82	0.18	1,707	2,428	8
	2	1 hour	44.4	1%	1.12	19.92	0.08	1,968	2,593	7
	3	2 hour	57.9	1%	1.2	20.00	0.00	2,157	2,709	2
	4	3 hour	68.3	1%	1.09	19.89	0.11	1,876	2,536	1
	5	6 hour	90.8	1%	0.94	19.74	0.26	1,514	2,299	3
	6	9 hour	106.0	1%	0.88	19.68	0.32	1,388	2,214	2
	7	12 hour	117.0	1%	0.64	19.44	0.56	896	1,849	5
	8	24 hour	142.0	1%	0.48	19.28	0.72	616	1,616	1
	9	48 hour	158.0	1%	0.17	18.97	1.03	189	1,198	5
	10	72 hour	167.0	1%	0.07	18.87	1.13	67	1,056	3
	11	96 hour	175.0	1%	0	18.80	1.20	-	970	10
	12	120 hour	185.0	1%	0	18.80	1.20	-	970	10
	13	144 hour	198.0	1%	0.45	19.25	0.75	572	1,576	9
	14	168 hour	213.0	1%	0.02	18.82	1.18	18	993	7
Critical	***3***	***2 hour***	***57.9***	***1%***	***1.2***	***20.00***	***0.00***	***2,157***	***2,709***	***2***

Notes:

Temporal pattern matching closest to mean water level

If Water Level is coloured Red, Maximum Capacity of the Basin has been Exceeded

PCSump Version 6.1: Licenced to Environnivate

Environmental and Water Resource Software

Project Number / Name:

Wattleup Rd

Project Description:

Catchment B Small Storm

Model Selection: **Deep Water Table Model**

Results:

	Design Storms				Maximum (Mean of Temporal Patterns)					
	Storm	Duration [hrs]	Rainfall Depth [mm]	EY/AEP [%]	Depth [m]	Level [mAHD]	Clearance to Allowable TWL [m]	Volume [m^3]	Area [m^2]	Temporal Pattern No.
	1	30 min	15.5	50%	0.5	31.00	0.00	163	447	1
Critical	***1***	***30 min***	***15.5***	***50%***	***0.5***	***31.00***	***0.00***	***163***	***447***	***1***

Notes:

Temporal pattern matching closest to mean water level

If Water Level is coloured Red, Maximum Capacity of the Basin has been Exceeded

PCSump Version 6.1: Licenced to Environnivate

Environmental and Water Resource Software

Project Number / Name:

Wattleup Rd

Project Description:

Catchment B 20% AEP

Model Selection: **Deep Water Table Model**

Results:

	Design Storms				Maximum (Mean of Temporal Patterns)					
	Storm	Duration [hrs]	Rainfall Depth [mm]	EY/AEP [%]	Depth [m]	Level [mAHD]	Clearance to Allowable TWL [m]	Volume [m^3]	Area [m^2]	Temporal Pattern No.
	1	30 min	20.1	20%	0.38	30.18	0.82	263	852	7
	2	1 hour	25.8	20%	0.46	30.26	0.74	333	921	2
	3	2 hour	32.9	20%	0.51	30.31	0.69	379	966	4
	4	3 hour	38.1	20%	0.45	30.25	0.75	329	918	1
	5	6 hour	48.8	20%	0.4	30.20	0.80	282	872	3
	6	9 hour	56.1	20%	0.26	30.06	0.94	170	752	6
	7	12 hour	61.7	20%	0.17	29.97	1.03	105	677	9
	8	24 hour	75.9	20%	0.18	29.98	1.02	107	679	6
	9	48 hour	90.5	20%	0	29.80	1.20	-	540	10
	10	72 hour	100.0	20%	0	29.80	1.20	-	540	1
	11	96 hour	109.0	20%	0	29.80	1.20	-	540	1
	12	120 hour	118.0	20%	0	29.80	1.20	-	540	1
	13	144 hour	127.0	20%	0	29.80	1.20	-	540	1
	14	168 hour	137.0	20%	0	29.80	1.20	-	540	1
Critical	***3***	***2 hour***	***32.9***	***20%***	***0.51***	***30.31***	***0.69***	***379***	***966***	***4***

Notes:

Temporal pattern matching closest to mean water level

If Water Level is coloured Red, Maximum Capacity of the Basin has been Exceeded

PCSump Version 6.1: Licenced to Environnivate

Environmental and Water Resource Software

Project Number / Name:

Wattleup Rd

Project Description:

Catchment B 1% AEP

Model Selection: **Deep Water Table Model**

Results:

	Design Storms				Maximum (Mean of Temporal Patterns)					
	Storm	Duration [hrs]	Rainfall Depth [mm]	EY/AEP [%]	Depth [m]	Level [mAHD]	Clearance to Allowable TWL [m]	Volume [m^3]	Area [m^2]	Temporal Pattern No.
	1	30 min	34.5	1%	1	30.80	0.20	971	1,452	8
	2	1 hour	44.4	1%	1.11	30.91	0.09	1,131	1,565	7
	3	2 hour	57.9	1%	1.18	30.98	0.02	1,245	1,642	2
	4	3 hour	68.3	1%	1.07	30.87	0.13	1,070	1,522	1
	5	6 hour	90.8	1%	0.93	30.73	0.27	867	1,373	3
	6	9 hour	106.0	1%	0.86	30.66	0.34	778	1,305	2
	7	12 hour	117.0	1%	0.62	30.42	0.58	498	1,075	5
	8	24 hour	142.0	1%	0.47	30.27	0.73	346	935	1
	9	48 hour	158.0	1%	0.14	29.94	1.06	82	649	5
	10	72 hour	167.0	1%	0.02	29.82	1.18	8	551	3
	11	96 hour	175.0	1%	0	29.80	1.20	-	540	10
	12	120 hour	185.0	1%	0	29.80	1.20	-	540	10
	13	144 hour	198.0	1%	0.43	30.23	0.77	306	895	9
	14	168 hour	213.0	1%	0	29.80	1.20	-	540	10
Critical	***3***	***2 hour***	***57.9***	***1%***	***1.18***	***30.98***	***0.02***	***1,245***	***1,642***	***2***

Notes:

Temporal pattern matching closest to mean water level

If Water Level is coloured Red, Maximum Capacity of the Basin has been Exceeded

Appendix B
Engineering Report

Cossill & Webley
CONSULTING ENGINEERS

Hammond Quarter West Amended Structure Plan Engineering Report

Lots 80, 815, 78 & 813 Wattleup Road, Wattleup

June 2024

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1. EXECUTIVE SUMMARY

This report has been prepared by Cossill & Webley Pty Ltd (CW) to inform the engineering requirements for the proposed development of Lots 80, 815, 78 & 813 Wattleup Road, Wattleup. This report supports the Amendment to the Hammond Quarter Structure Plan.

This report summarises the results of a review of the civil engineering issues which have influenced the form of the Plan as they relate to future servicing of the developed land and provides details of each major infrastructure type and a servicing strategy for implementation required for the development of the area. The level of detail is consistent with the requirements of a structure plan and acknowledges further, more detailed, work will be required at the time of subdivision.

The engineering review covers siteworks, roadworks, stormwater drainage, sewerage, water supply and utility services.

The investigation has found the land is suitable for development in accordance with the proposed Plan with logical progressive extension of infrastructure and base capacity.

The ground conditions and past uses are well suited to future urban development.

The available road access via Wattleup Road, and the future extension of Rowley Road, adjacent the development will provide excellent connectivity to the external arterial road system, and we anticipate will be progressively upgraded to accommodate the expected regional traffic demand.

Sewer infrastructure will be provided via connection to the existing Water Corporation pump station on Lot 74, via extension of the proposed gravity network.

Water supply, electrical supply, telecommunications and gas will all be available via the existing network in Wattleup Road. There is capacity within the existing infrastructure for servicing development of this site.

The investigation for this report is largely based on preliminary advice from the various service authorities, and is current as at June 2024.

2. INTRODUCTION

This report has been prepared by Cossill & Webley Pty Ltd (CW) to confirm the servicing requirements for Lots 80, 815, 78 & 813 Wattleup Road, Wattleup to support the Amendment to the Hammond Quarter Structure Plan.

This report summarises the results of a review of the civil engineering issues which have influenced the Plan as they relate to future servicing of the developed land. Figure 1 below presents the Hammond Quarter West Structure Plan.

Figure 1: Hammond Quarter West Structure Plan (Hatch, 2024)

The Site is located within the City of Cockburn and is bound by the existing Wattleup Road to the north, rural lots to the west, future residential lots to the east and the future Rowley Road Planning Control Area to the south.

The location of the Site will require a coordinated approach to development with neighbouring properties, for the connection of roads and services.

3. SITE DESCRIPTION

3.1 Site Vegetation

Historically, development has consisted of a mixture of semi-rural and agricultural uses resulting in the clearing of majority of the site as presented below in Figure 2. Lot 813 is currently being used for storage and is covered in hard stand and commercial sheds. There are also a number of existing dwellings on Lots 80, 815 and 78 which will require demolition and removal prior to the commencement of development.

Figure 2: Aerial Photography (MNG Maps 2024)

3.2 Geology

The Geological Survey of Western Australia Perth Metropolitan Region soils maps for Fremantle (part 2033I & 2033IV) indicates that the majority of the site is generally characterised by Sand derived from Tamala Limestone (Refer Figure 3 below). These soil types are well suited to urban development, with very good permeability anticipated. The soil maps indicate a small area of Peaty Clay may be present in the northern portion of Lot 78, which may require some remediation as part of the earthworks preparation for the Site. Development north of Wattleup Road has been completed, and Peaty Clay has not been present within 6 metres of the existing natural surface.

A site-specific geotechnical investigation will be undertaken at the detailed design stage to outline requirements for residential development and provide feedback on works required to obtain the desired site classification.

Based on experience east and west of the Site, we anticipate a Site Classification A will be provided in accordance with Australian Standard AS2870: “Residential Slabs and Footings”.

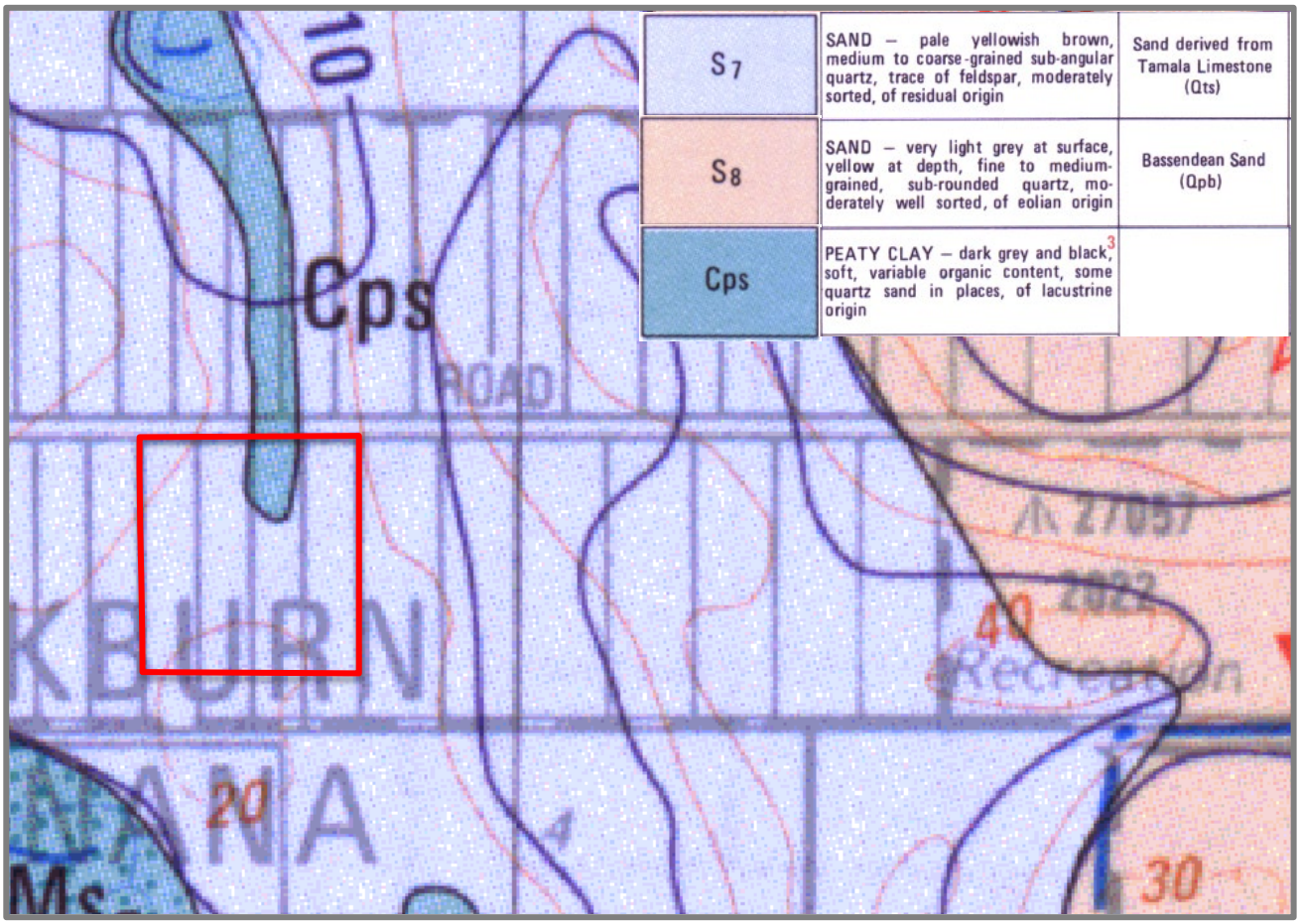


Figure 3: Geotechnical Information (Geological Survey of WA)

3.3 Topography

The Site gently grades from south to north, with levels generally ranging from a high point of RL 24m AHD at along the southern boundary of the Site to RL17.0mAHD adjacent Wattleup Road as presented below in Figure 4.

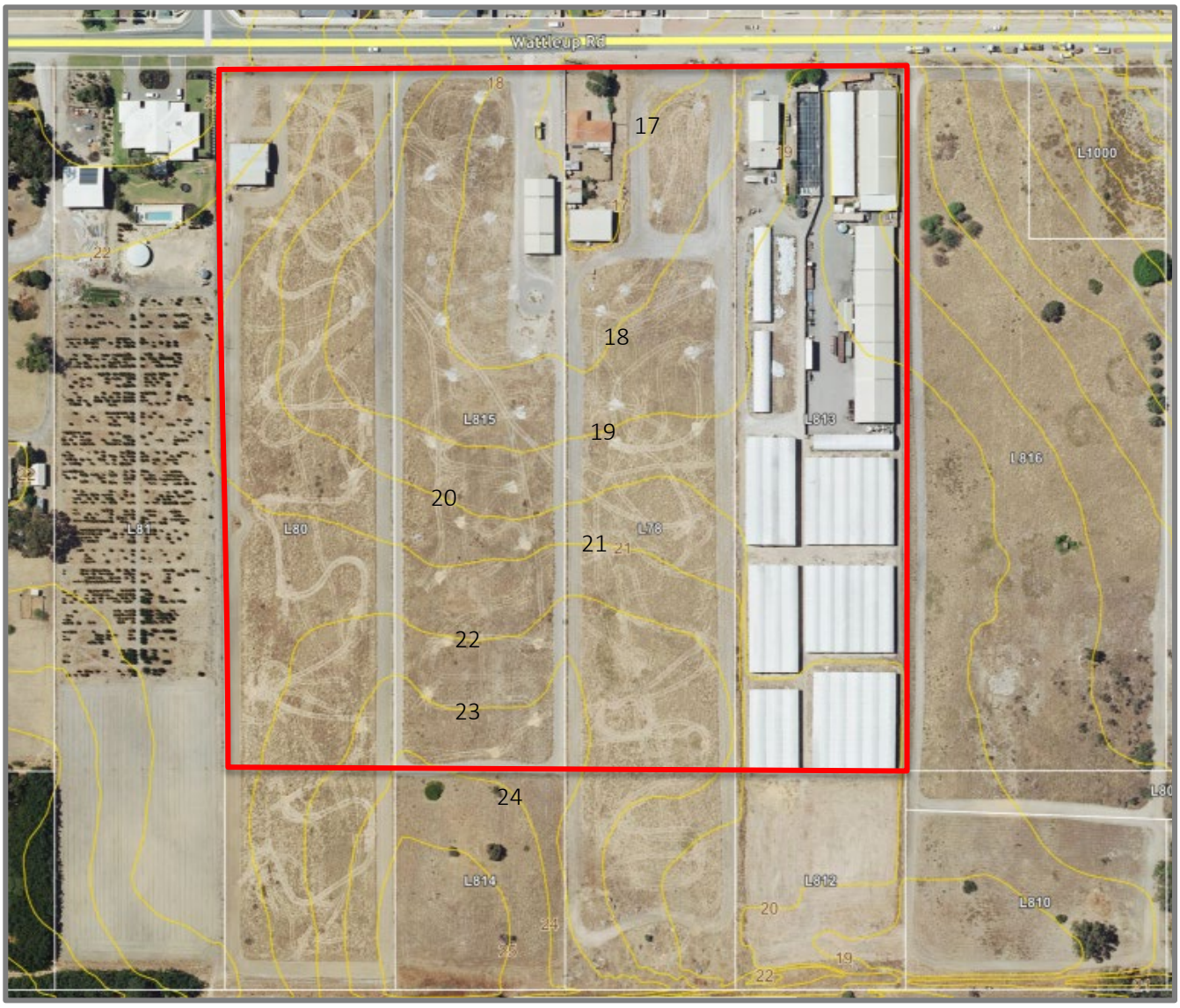


Figure 4: Existing Topography (MNG Maps 2024)

3.4 Groundwater

The Annual Average Maximum Groundwater Levels (AAMGL) vary from approximately RL10mAHD at the south-west boundary to RL13m AHD at the north-east boundary as presented below in Figure 5. We anticipate that preliminary earthworks levels will provide at least 4 metres clearance to groundwater, hence we do not anticipate groundwater will restrict or influence the development of the Site.

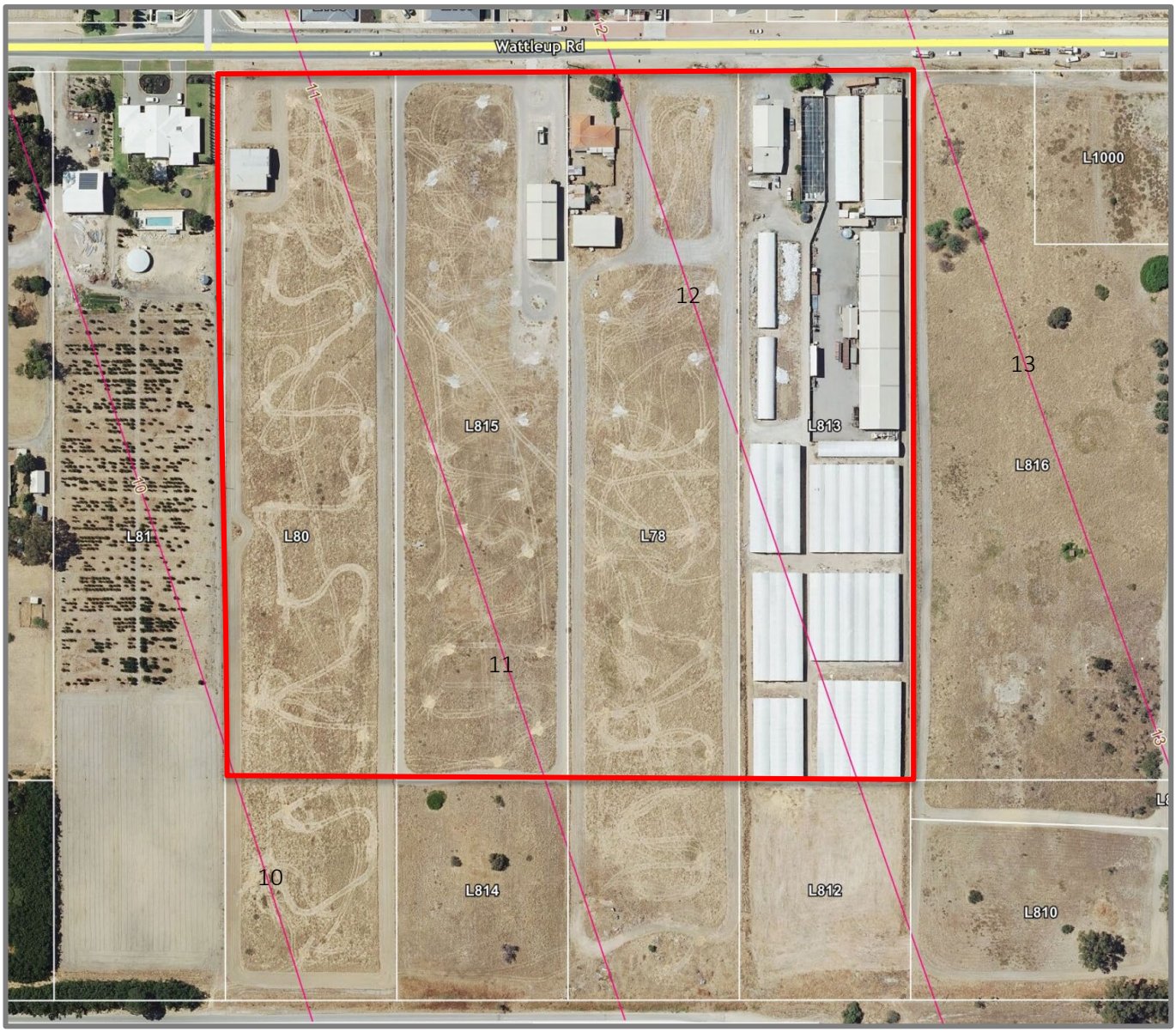


Figure 5: Department of Water Maximum Groundwater Levels (MNG Maps 2024)

3.5 Acid Sulphate Soils

A desk top review of the Department of Environment and Conservation's ASS Risk Map for the South Metropolitan Region for potential acid sulphate soils (ASS) indicates the majority of the Site is classed as having a no risk of ASS potential within 3m, or deeper from the natural surface as presented below in *Figure 6*.

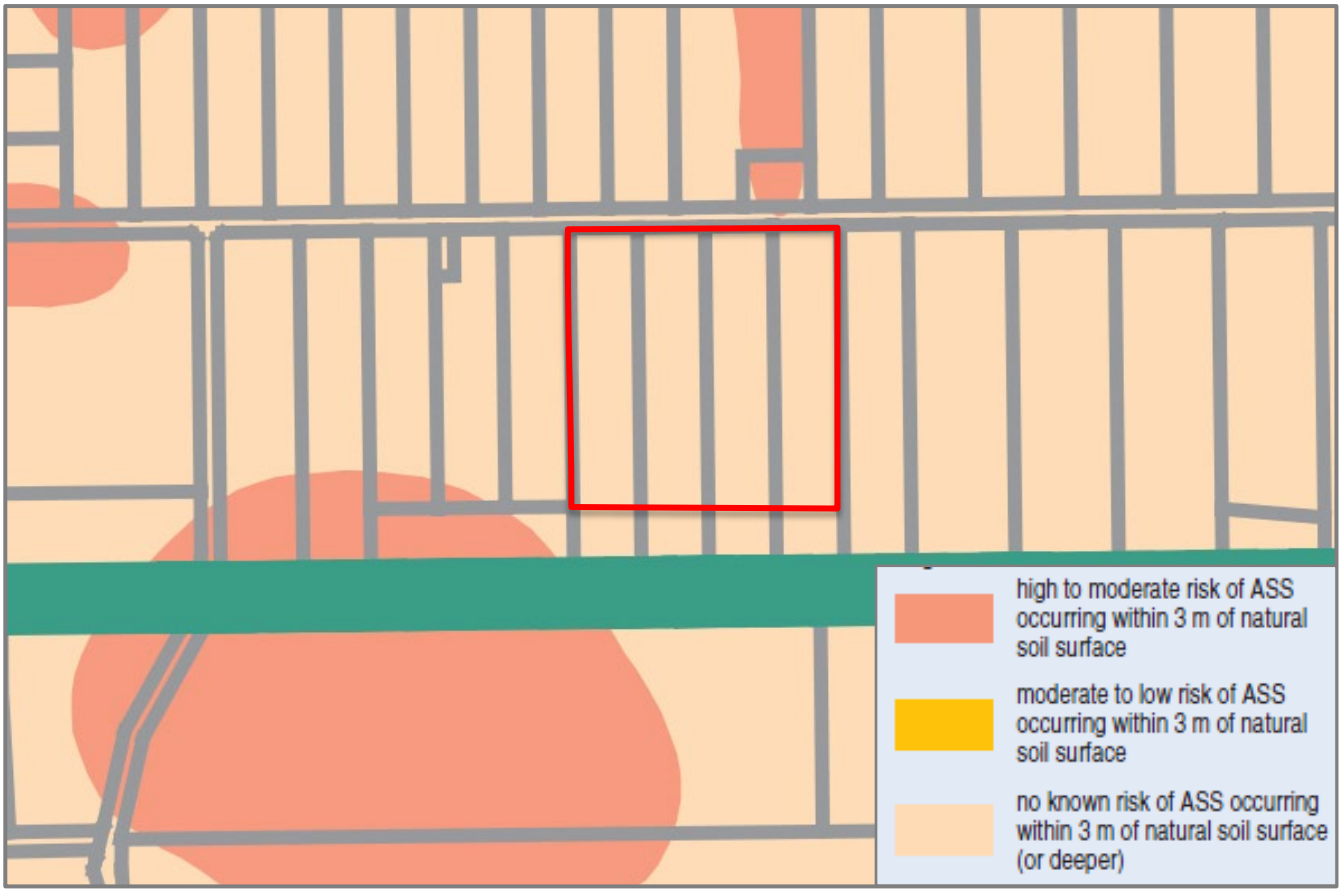


Figure 6: Acid Sulphate Soils Risk Mapping (April, 2024)

4. SITEWORKS & EARTHWORKS

Siteworks for urban development will generally comprise clearing of existing vegetation and, where necessary, earthworking the existing ground, to facilitate the required form of the development.

The extent of siteworks will be dictated by the density and nature of development. Increased densities and decreasing lot sizes has led to a current trend for the development areas to be fully earthworked to create level lots which are terraced between retaining walls.

This approach provides a number of positive outcomes:

- It reduces house building costs,
- It rationalises retaining wall layouts and designs consistent with Local Authority specifications,
- It enables lots to be terraced up natural slopes to maintain elevation and views.

We intend to earthwork the Site to provide a cut-to-fill balance across the development. This will generally involve cutting the southern higher areas of the Site and filling the lower areas at the north of the future development.

We will ensure earthworks levels tie in to existing levels at Wattleup Road, the existing rural lot to the west, proposed development levels to the east and the Rowley Road proposed levels to the south.

The site grades will also ensure grades across the site are within typical tolerances for roads, drainage and sewerage reticulation.

5. DRAINAGE AND GROUNDWATER MANAGEMENT

The landform through the area is generally steep with good separation from the groundwater table.

An Urban Water Management Plan (UWMP) has been prepared by Hyd20. The UWMP confirms the proposed storage and disposal strategy for stormwater runoff generated from the proposed development of the Site.

5.1 Stormwater Management

Groundwater recharge will be maximised through the adoption of 'Best Management Practices' that promote the dispersion and infiltration of run off as close to source as possible. This will include incorporation of inter-allotment drainage soakwells to infiltrate runoff from building roofs and private open space areas and the disposal of road runoff into infiltration basins within the POS area adjacent to Wattleup Road. Roadside swales along the southern and western boundaries may be considered to reduce drainage storage in the central POS.

5.2 Water Quality Management

Recharge water quality will be improved through the adoption of 'Best Management Practices' which promote the disposal of runoff via water pollution control facilities (including vegetated swales and basins, detention storages and gross pollutant traps) and the implementation of non-structural source controls (including urban design, street sweeping, community education, low fertiliser landscaping regimes, etc).

5.3 Stormwater Collection & Disposal

Drainage from public roads and lanes would be collected via conventional gullies or open swales depending on the nature of the adjacent land uses and the extent of traffic and pedestrian activity.

The drainage collection and conveyance system will be designed to cater for the runoff from storms with up to a 20% Average Exceedance Probability (AEP). A series of detention basins will be designed to store runoff to the pre-development peak flow rates for the 20%, 10% and 1EY AEP events in accordance with the UWMP. In all cases roads and POS would be designed to cater for the surface overflow for more severe storms with building pad levels set at least 300 millimetres above the 1% AEP level in roadways and 500 millimetres above the 1% flood level for storage detention basins.

The dispersion of stormwater disposal throughout the site will maximise the area of recharge down through the soil profile to the shallow aquifer, thereby maximising the potential for nutrient stripping and water quality improvements.

6. WATER RETICULATION

The subject land is located within the current boundary of the Water Corporation's Water Supply Scheme and overall planning for the scheme has made provision for residential development over the subject land.

The current planning indicates the Site will ultimately be serviced via the extension of an existing 610mm distribution main in Hammond Road that currently terminates at the intersection of Hammond Road and Gaebler Road. The extension of this main further south to Wattleup Road will be a Water Corporation capital project, as demand requires, however the Water Corporation has advised that the implementation of the project is in part dependent upon the extension and upgrade south of Hammond Road along Frankland Avenue, as the alignment and profile of the main will be dictated by final road levels and embankments.

The Water Corporation has confirmed the Site can be serviced off the existing DN150 main in Wattleup Road.

7. SEWERAGE RETICULATION

The Site forms part of the Water Corporation's Thompson's Lake Waste Water Reticulation System and preliminary planning occurred to develop strategies for providing reticulated sewerage to all proposed urban land within the subject area. An excerpt of the Water Corporation's catchment plan for the area is presented below in *Figure 7*.

The Site is proposed to be serviced by connection to the reticulation sewer that runs along the Wattleup Road north of the Site. This new line grades to a Type 40 Waste Water Pumping Station (WWPS) "Thomsons Lake Pump Station G", located at the natural low point within Lot 74. The pump station was commissioned in 2023 and is now in use. There are no impediments to the provision of sewerage infrastructure to service the Site.

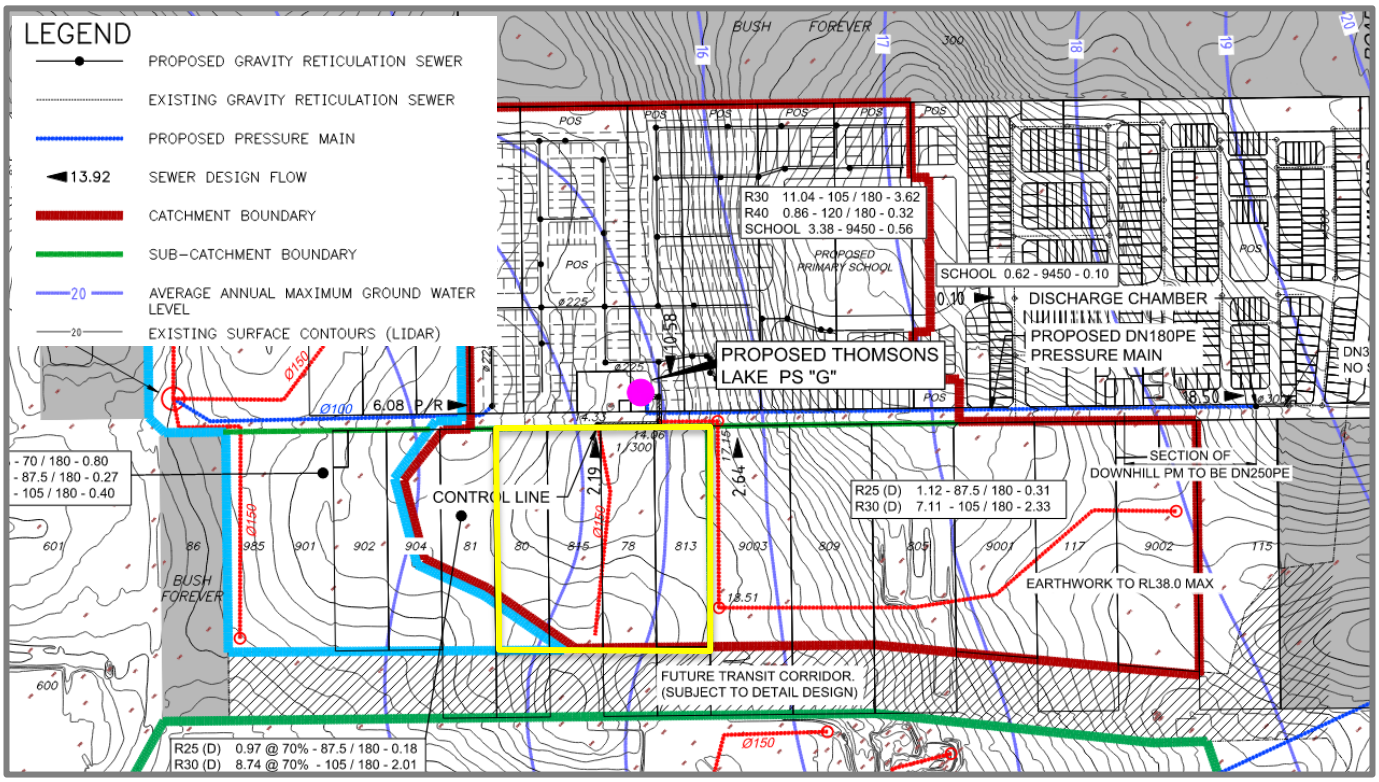


Figure 7: Sewer Reticulation Planning (Water Corporation 9 March 2023)

8. POWER

The Site can readily be serviced via the existing overhead high voltage cable located on the southern side of Wattleup Road.

Based on Western Power's predicted Network Capacity in October 23, there is sufficient capacity in this existing network to support the proposed development. All power to the proposed development will be underground and fed from transformers located strategically within the development.

9. GAS SUPPLY

ATCO Gas has advised the existing network has the capacity to supply the development from the existing frontal main in Wattleup Road.

10. TELECOMMUNICATIONS

10.1 NBN

The Site is within the fixed line footprint of the NBN, and hence can be serviced with optic fibre under their roll-out scheme for greenfield developments via connection to the existing network in Wattleup Road.

Under the Federal Government's Telecommunications in New Developments Policy, developers are responsible for contributing to the cost of delivering the NBN network in new developments. This includes contributing to part of the costs of the build (civils and any backhaul required) as well as a $600 per lot deployment change.

The current design practice for road reserves, pavement and verge provisions will make adequate allowance for services including broadband in accordance with the agreed Utilities Service Providers handbook. There will be some local land requirements for equipment sites, similar to current provisions which will be accommodated at detailed subdivision stage.

10.2 Existing Telecommunications Infrastructure

Telecommunications providers Optus, Telstra and TPG have been consulted on the coverage, capacity and quality of the existing infrastructure surrounding the Site and its ability to service the proposed development, inclusive of the area proposed in Amendment 1.

Telstra has advised the development is not likely to significantly impact on the coverage, capacity and quality of the existing Telstra Wireless services in the area, all of which are currently well within normal KPIs. Further to this, Telstra has advised no Telstra Wireless infrastructure upgrades are likely to be required as a result of the development.

Optus has advised the existing infrastructure has adequate coverage and capacity to service the Site from existing network sites and have confirmed they do not require any additional network infrastructure sites to provide coverage/capacity to the proposed subdivision. It is also noted that Optus are planning on coverage and capacity improvements as part of their new P0955 Wandi North infrastructure, which is forecast for completion in March 2024.

TPG were contacted for comment however have not provided a response.

11. ROADWORKS & FOOTPATHS

11.1 Abutting Roads and Access Points

The Site will be well serviced with good transit options to the broader regional network. Wattleup Road abuts the Site to the north, and a transit corridor for the future extension of Rowley Road abuts the southern boundary.

Wattleup Road has been identified by Main Roads WA as a "Regional Distributor Road" and forms part of the MRWA RAV network for heavy vehicles and is currently being upgraded to an urban standard including kerbing drainage, paths and lighting. We note that the existing vertical geometry of Wattleup Road cannot be amended due to tying in with existing dwellings that will be retained, and the existing k values do not comply with Austroad Standards for Safe Stopping Distance for the current speed zoning.

Upon completion of the upgrades, Wattleup Road will consist of twin 3.5m carriageways with a 3m median. A Traffic Impact Assessment has been completed to inform the ultimate design of Wattleup Road by Stantec.

A Traffic Impact Assessment has also been completed by PTG to accompany this Amendment to the Hammond Quarter Structure Plan and confirms that the Wattleup Road intersection proposed at the eastern boundary of the Site will have sufficient capacity to accommodate proposed traffic from this project.

Rowley Road will be extended across the south boundary of the Site in the future, and will provide improved transport route options between Kwinana Freeway and the coast, as well as relieving the traffic burden from Wattleup Road.

11.2 Internal Road Network

Internal road designs will comply with Liveable Neighbourhoods and the City of Cockburn Standards.

In all cases the road cross-sections will be designed to cater for utility services, on standard verge alignments, street trees, parking embayments where appropriate and footpaths. Where roads abut public open space, verges can be reduced to a minimum of 0.5m if no parking is required.

11.3 Footpaths

Footpaths will be provided in accordance with *Liveable Neighbourhoods* and the City of Cockburn standards and will consist of one path in every road.

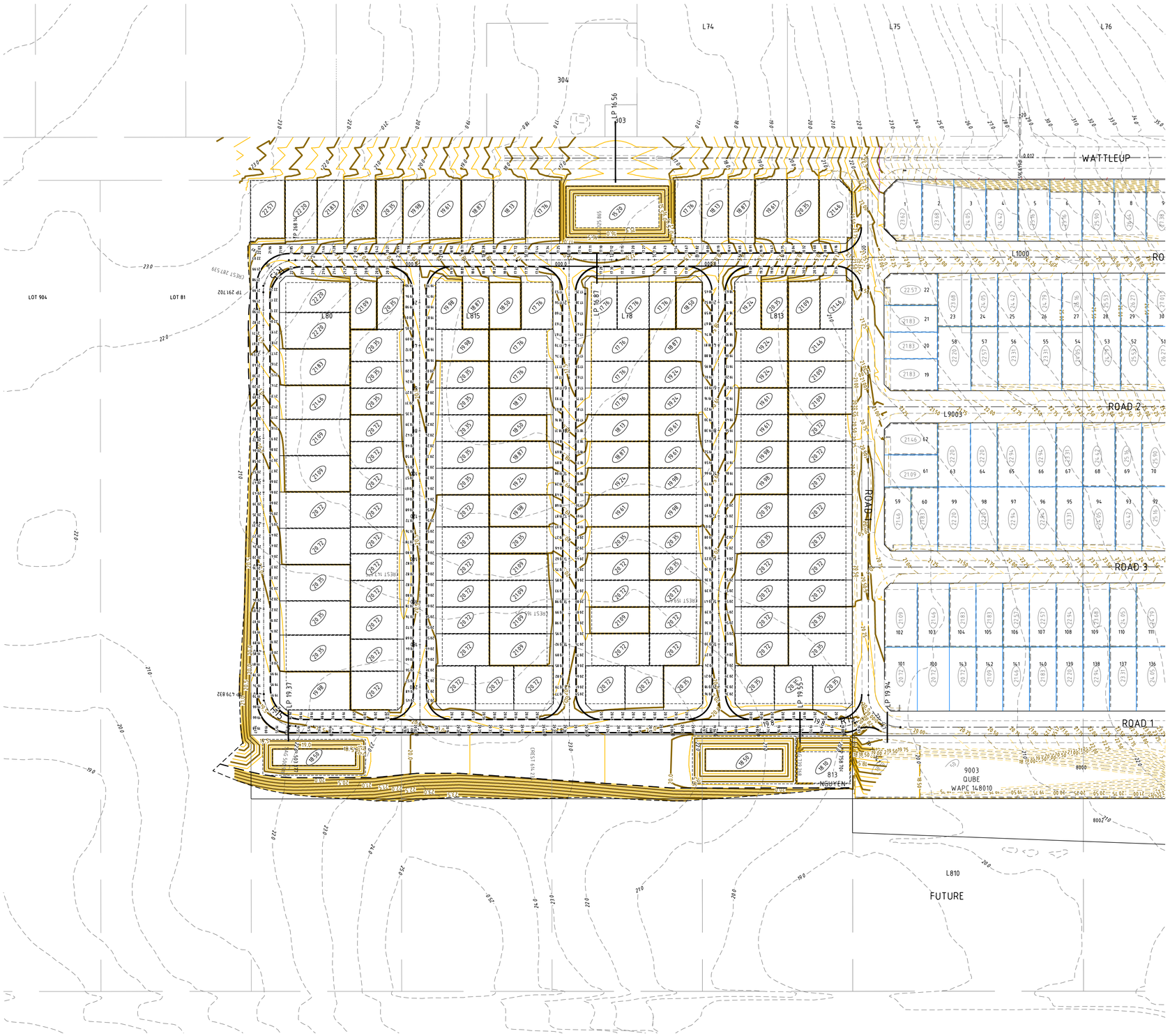
12. STAGING

It is anticipated that development will begin at the eastern boundary for connection to the existing road and service infrastructure. Stages will progress westwards as per market demands.

13. CONCLUSION

Based on the advice received from various servicing authorities, consultants and the City of Cockburn, we consider there are no impediments to the development of the Site. The ground conditions and past uses will not limit the proposed urban development, and the Site can be easily incorporated into the existing and planned future road network. Water supply, sewerage and other public utility services are available and are currently being upgraded along Wattleup Road.

The investigation for this report is largely based on preliminary advice from the various service authorities, and is current at April 24.



LEGEND

DESCRIPTION	SYMBOL
LIMIT OF WORKS BOUNDARY	
FINISHED SURFACE CONTOUR MAJOR	25.0
FINISHED SURFACE CONTOUR MINOR	24.5
EXISTING SURFACE CONTOUR	25.0
FINISHED LOT PAD LEVEL	25.00
FINISHED LOT SPOT LEVEL	+25.00
PROPOSED RETAINING WALL	
EXISTING RETAINING WALL	
FUTURE RETAINING WALL	
BUILDING SETBACK LINE	
EXISTING TREE (AND NUMBER) TO BE RETAINED	100

REV	DATE	DRN	CKD	APP	AMENDMENT
A	01.05.24	MTW	-		ISSUED FOR INFORMATION

N

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CLIENT: QUBE

APPROVED

DESIGNED: MTW

SCALE: 1:1000

PROJECT: WATTLEUP SOUTH - STRATEGIES

TITLE: EARTHWORKS STRATEGY - PLAN WESTERN LOTS

WAPC No. 148010, 147989 & 163914

DRAWING No. 5910-ST-205

REVISION A

ORIGINAL SIZE A1

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Cossill & Webley
CONSULTING ENGINEERS

Hammond Quarter West Amended Structure Plan Engineering Report

Lots 80, 815, 78 & 813 Wattleup Road, Wattleup

November 2025

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This report has been prepared by Cossill & Webley Pty Ltd (CW) to inform the engineering requirements for the proposed development of Lots 80, 815, 78 & 813 Wattleup Road, Wattleup. This report supports the Amendment to the Hammond Quarter Structure Plan.

This report summarises the results of a review of the civil engineering issues which have influenced the form of the Plan as they relate to future servicing of the developed land and provides details of each major infrastructure type and a servicing strategy for implementation required for the development of the area. The level of detail is consistent with the requirements of a structure plan and acknowledges further, more detailed, work will be required at the time of subdivision.

The engineering review covers siteworks, roadworks, stormwater drainage, sewerage, water supply and utility services.

The investigation has found the land is suitable for development in accordance with the proposed Plan with logical progressive extension of infrastructure and base capacity.

The ground conditions and past uses are well suited to future urban development.

The available road access via Wattleup Road, and the future extension of Rowley Road, adjacent the development will provide excellent connectivity to the external arterial road system, and we anticipate will be progressively upgraded to accommodate the expected regional traffic demand.

Sewer infrastructure will be provided via connection to the existing Water Corporation pump station on Lot 74, via extension of the proposed gravity network.

Water supply, electrical supply, telecommunications and gas will all be available via the existing network in Wattleup Road. There is capacity within the existing infrastructure for servicing development of this site.

The investigation for this report is largely based on preliminary advice from the various service authorities, and is current as at June 2025.

2. INTRODUCTION

This report has been prepared by Cossill & Webley Pty Ltd (CW) to confirm the servicing requirements for Lots 80, 815, 78 & 813 Wattleup Road, Wattleup to support the Amendment to the Hammond Quarter Structure Plan.

This report summarises the results of a review of the civil engineering issues which have influenced the Plan as they relate to future servicing of the developed land. Figure 1 below presents the Hammond Quarter West Structure Plan.

Figure 1: Hammond Quarter West Structure Plan (Hatch, 2024)

The Site is located within the City of Cockburn and is bound by the existing Wattleup Road to the north, rural lots to the west, future residential lots to the east and the future Rowley Road Planning Control Area to the south.

The location of the Site will require a coordinated approach to development with neighbouring properties, for the connection of roads and services.

3. SITE DESCRIPTION

3.1 Site Vegetation

Historically, development has consisted of a mixture of semi-rural and agricultural uses resulting in the clearing of majority of the site as presented below in Figure 2. Lot 813 is currently being used for storage and is covered in hard stand and commercial sheds, which will require demolition and removal prior to the commencement of development.

Figure 2: Aerial Photography (MNG Maps 2025)

3.2 Geology

The Geological Survey of Western Australia Perth Metropolitan Region soils maps for Fremantle (part 2033I & 2033IV) indicates that the majority of the site is generally characterised by Sand derived from Tamala Limestone (Refer Figure 3 below). These soil types are well suited to urban development, with very good permeability anticipated. The soil maps indicate a small area of Peaty Clay may be present in the northern portion of Lot 78, which may require some remediation as part of the earthworks preparation for the Site. Development north of Wattleup Road has been completed, and Peaty Clay has not been present within 6 metres of the existing natural surface.

A site-specific geotechnical investigation will be undertaken at the detailed design stage to outline requirements for residential development and provide feedback on works required to obtain the desired site classification.

Based on experience east and west of the Site, we anticipate a Site Classification A will be provided in accordance with Australian Standard AS2870: “Residential Slabs and Footings”.

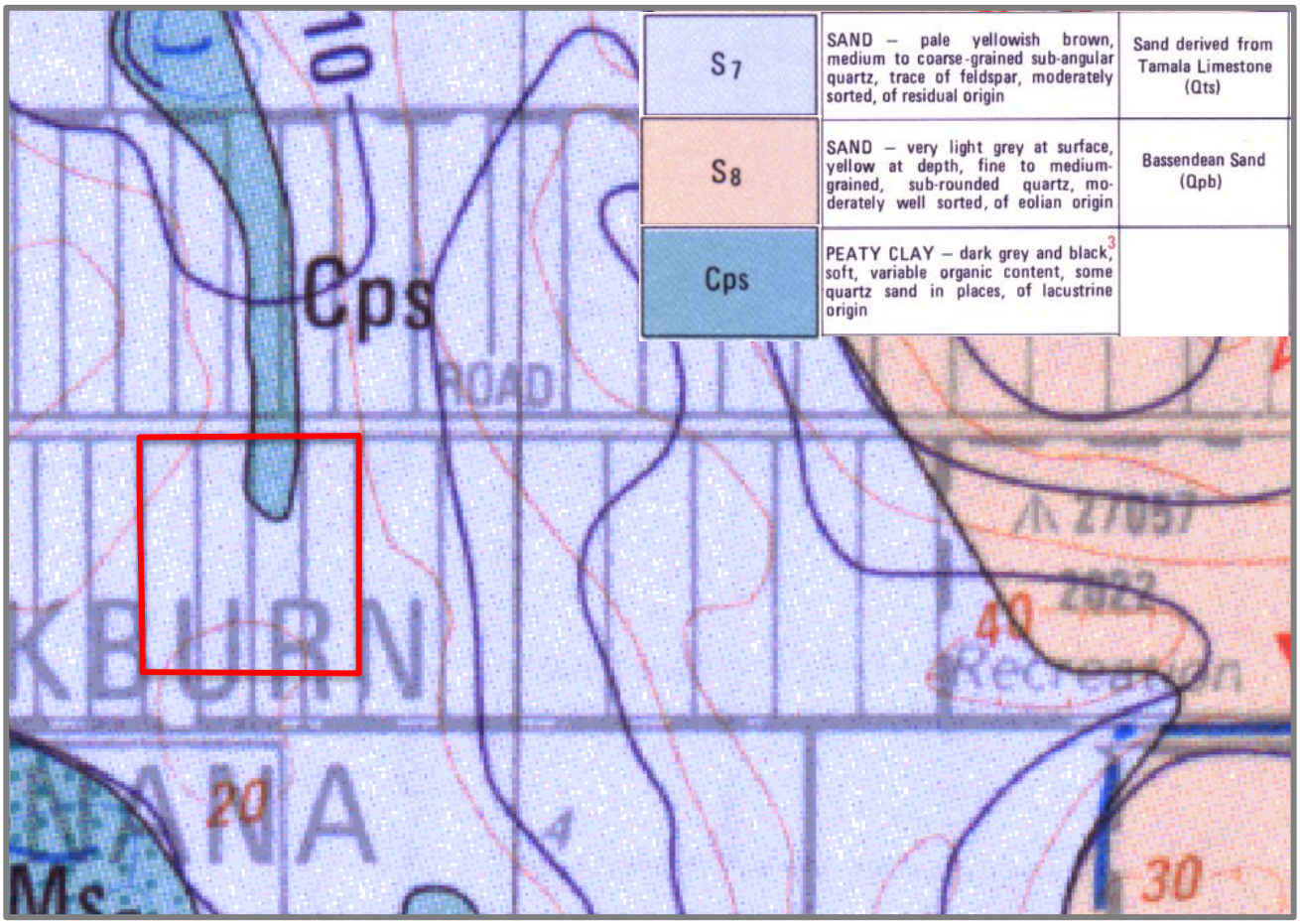


Figure 3: Geotechnical Information (Geological Survey of WA)

3.3 Topography

The Site gently grades from south to north, with levels generally ranging from a high point of RL 24m AHD at along the southern boundary of the Site to RL17.0mAHD adjacent Wattleup Road as presented below in Figure 4.

Figure 4: Existing Topography (MNG Maps 2025)

3.4 Groundwater

The Maximum Groundwater Levels (MGL) vary from approximately RL11mAHD at the south-west boundary to RL12m AHD at the north-east boundary as presented below in Figure 5. We anticipate that preliminary earthworks levels will provide at least 4 metres clearance to groundwater, hence we do not anticipate groundwater will restrict or influence the development of the Site.

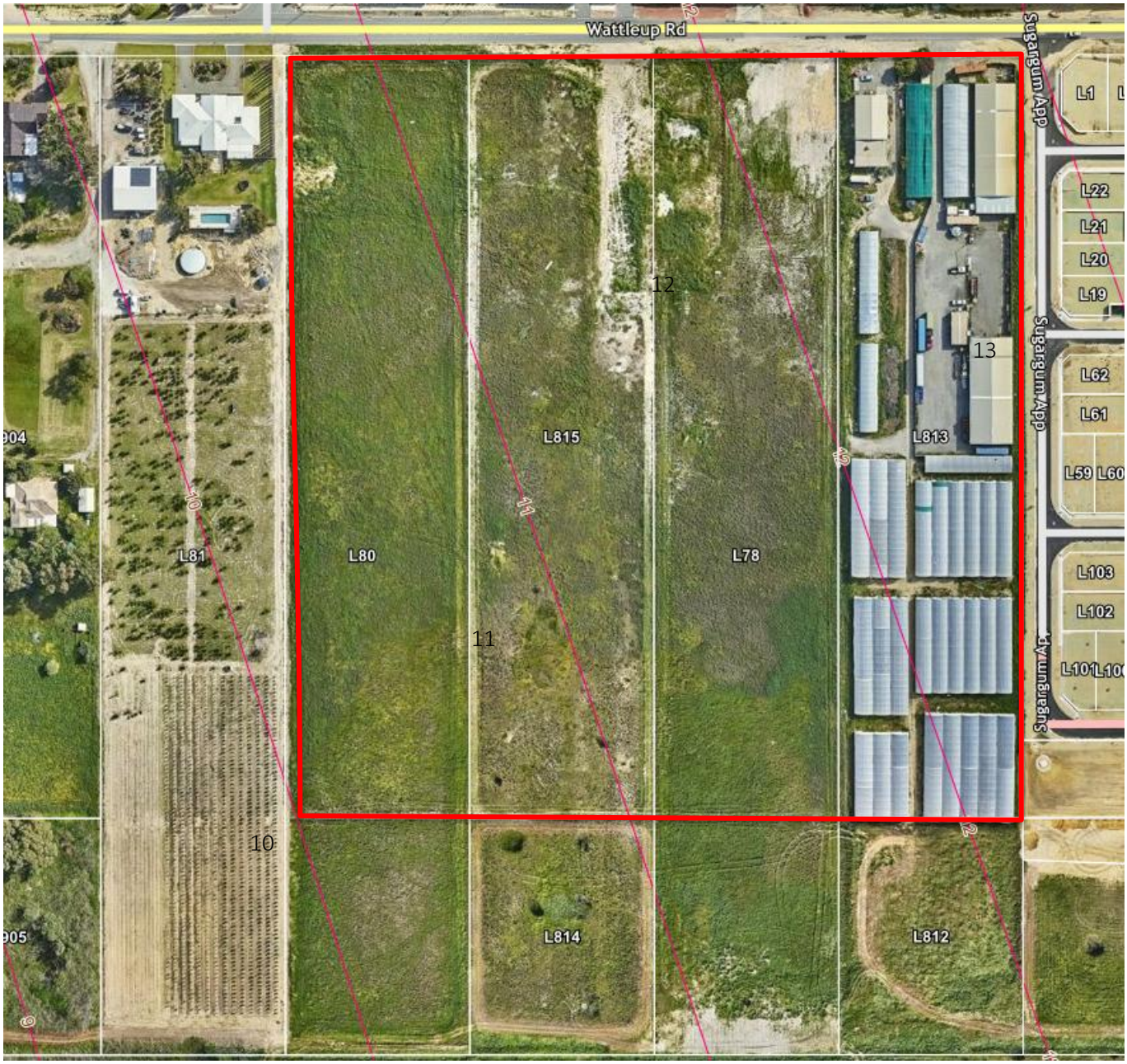


Figure 5: Department of Water 2019 Maximum Groundwater Levels (MNG Maps 2025)

3.5 Acid Sulphate Soils

A desk top review of the Department of Environment and Conservation's ASS Risk Map for the South Metropolitan Region for potential acid sulphate soils (ASS) indicates the majority of the Site is classed as having a no risk of ASS potential within 3m, or deeper from the natural surface as presented below in *Figure 6*.

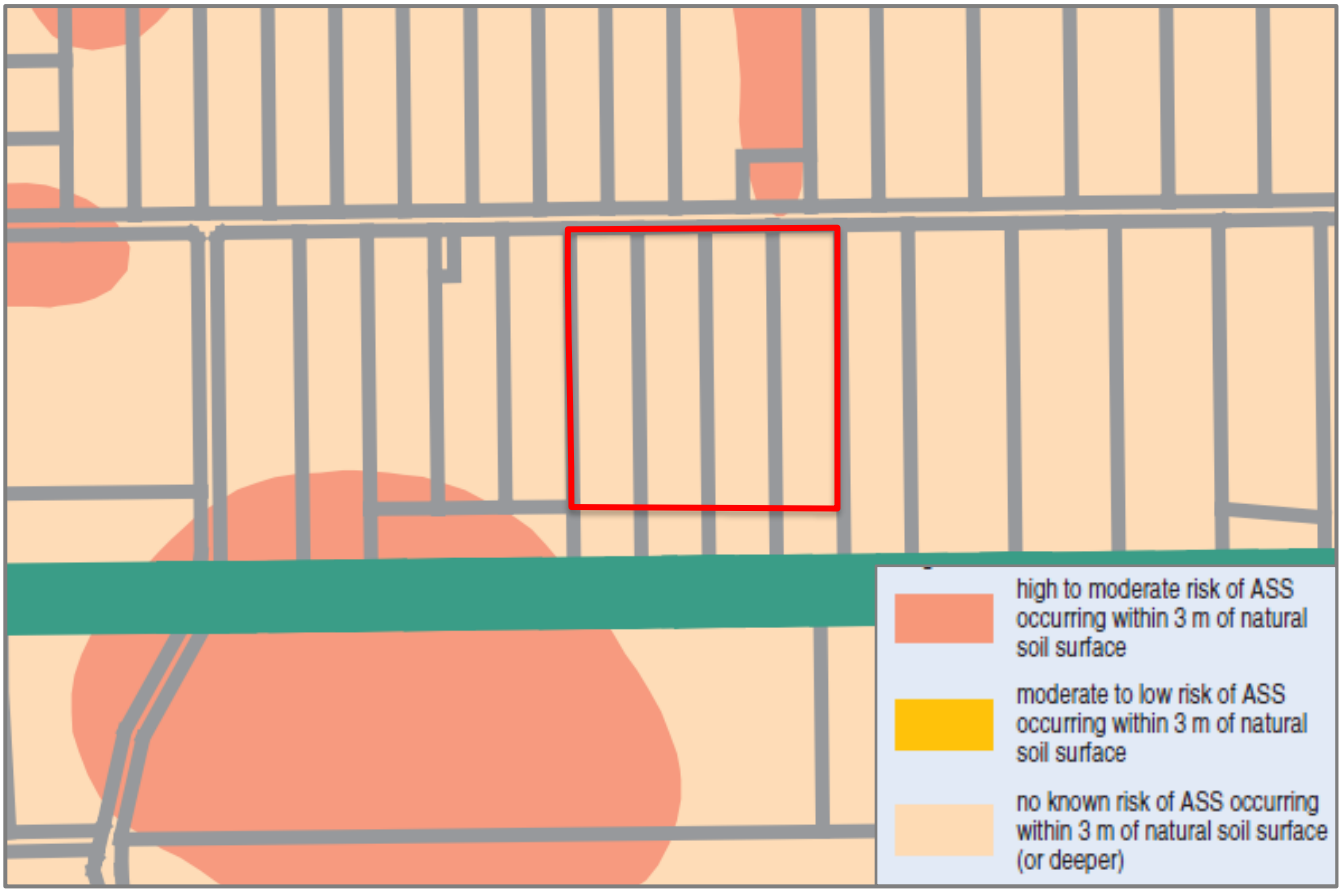


Figure 6: Acid Sulphate Soils Risk Mapping (April, 2024)

4. SITEWORKS & EARTHWORKS

Siteworks for urban development will generally comprise clearing of existing vegetation and, where necessary, earthworking the existing ground, to facilitate the required form of the development.

The extent of siteworks will be dictated by the density and nature of development. Increased densities and decreasing lot sizes has led to a current trend for the development areas to be fully earthworked to create level lots which are terraced between retaining walls.

This approach provides a number of positive outcomes:

- It reduces house building costs,
- It rationalises retaining wall layouts and designs consistent with Local Authority specifications,
- It enables lots to be terraced up natural slopes to maintain elevation and views.

We intend to earthwork the Site to provide a cut-to-fill balance across the development. This will generally involve cutting the southern higher areas of the Site and filling the lower areas at the north of the future development.

We will ensure earthworks levels tie in to existing levels at Wattleup Road, the existing rural lot to the west, proposed development levels to the east and the Rowley Road proposed levels to the south.

The site grades will also ensure grades across the site are within typical tolerances for roads, drainage and sewerage reticulation.

An earthworks plan has been included in the appendix of this report. The plan demonstrates that no batters encroach onto third-party landholdings, with the exception of an encroachment onto MRWA PCA land. MRWA has confirmed that the proposed earthworks will not preclude the future delivery of Rowley Road.

5. DRAINAGE AND GROUNDWATER MANAGEMENT

The landform through the area is generally steep with good separation from the groundwater table.

An Urban Water Management Plan (UWMP) has been prepared by Hyd20. The UWMP confirms the proposed storage and disposal strategy for stormwater runoff generated from the proposed development of the Site.

5.1 Stormwater Management

Groundwater recharge will be maximised through the adoption of 'Best Management Practices' that promote the dispersion and infiltration of run off as close to source as possible. This will include incorporation of inter-allotment drainage soakwells to infiltrate runoff from building roofs and private open space areas and the disposal of road runoff into infiltration basins within the POS area adjacent to Wattleup Road. Roadside swales along the southern and western boundaries may be considered to reduce drainage storage in the central POS.

5.2 Water Quality Management

Recharge water quality will be improved through the adoption of 'Best Management Practices' which promote the disposal of runoff via water pollution control facilities (including vegetated swales and basins, detention storages and gross pollutant traps) and the implementation of non-structural source controls (including urban design, street sweeping, community education, low fertiliser landscaping regimes, etc).

5.3 Stormwater Collection & Disposal

Drainage from public roads and lanes would be collected via conventional gullies or open swales depending on the nature of the adjacent land uses and the extent of traffic and pedestrian activity.

The drainage collection and conveyance system will be designed to cater for the runoff from storms with up to a 20% Average Exceedance Probability (AEP). A series of detention basins will be designed to store runoff to the pre-development peak flow rates for the 20%, 10% and 1EY AEP events in accordance with the UWMP. In all cases roads and POS would be designed to cater for the surface overflow for more severe storms with building pad levels set at least 300 millimetres above the 1% AEP level in roadways and 500 millimetres above the 1% flood level for storage detention basins.

The dispersion of stormwater disposal throughout the site will maximise the area of recharge down through the soil profile to the shallow aquifer, thereby maximising the potential for nutrient stripping and water quality improvements.

6. WATER RETICULATION

The subject land is located within the current boundary of the Water Corporation's Water Supply Scheme and overall planning for the scheme has made provision for residential development over the subject land.

The current planning indicates the Site will ultimately be serviced via the extension of an existing 610mm distribution main in Hammond Road that currently terminates at the intersection of Hammond Road and Gaebler Road. The extension of this main further south to Wattleup Road will be a Water Corporation capital project, as demand requires, however the Water Corporation has advised that the implementation of the project is in part dependent upon the extension and upgrade south of Hammond Road along Frankland Avenue, as the alignment and profile of the main will be dictated by final road levels and embankments.

The Water Corporation has confirmed the Site can be serviced off the existing DN150 main in Wattleup Road.

7. SEWERAGE RETICULATION

The Site forms part of the Water Corporation's Thompson's Lake Waste Water Reticulation System and preliminary planning occurred to develop strategies for providing reticulated sewerage to all proposed urban land within the subject area. An excerpt of the Water Corporation's catchment plan for the area is presented below in *Figure 7*.

The Site is proposed to be serviced by connection to the reticulation sewer that runs along the Wattleup Road north of the Site. This new line grades to a Type 40 Waste Water Pumping Station (WWPS) "Thomsons Lake Pump Station G", located at the natural low point within Lot 74. The pump station was commissioned in 2023 and is now in use. There are no impediments to the provision of sewerage infrastructure to service the Site.

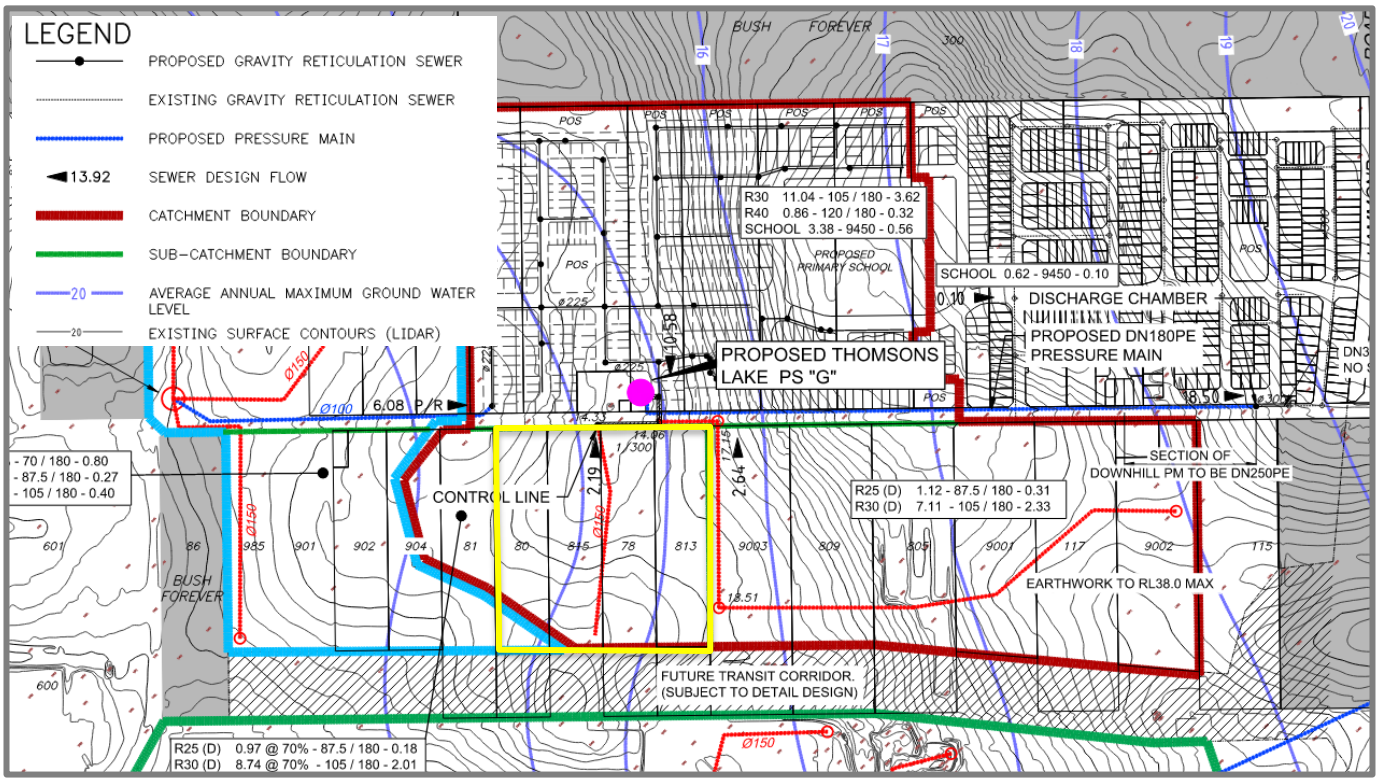


Figure 7: Sewer Reticulation Planning (Water Corporation 9 March 2023)

8. POWER

The Site can readily be serviced via the existing overhead high voltage cable located on the southern side of Wattleup Road.

Based on Western Power's predicted Network Capacity in October 23, there is sufficient capacity in this existing network to support the proposed development. All power to the proposed development will be underground and fed from transformers located strategically within the development.

9. GAS SUPPLY

ATCO Gas has advised the existing network has the capacity to supply the development from the existing frontal main in Wattleup Road.

10. TELECOMMUNICATIONS

10.1 NBN

The Site is within the fixed line footprint of the NBN, and hence can be serviced with optic fibre under their roll-out scheme for greenfield developments via connection to the existing network in Wattleup Road.

Under the Federal Government's Telecommunications in New Developments Policy, developers are responsible for contributing to the cost of delivering the NBN network in new developments. This includes contributing to part of the costs of the build (civils and any backhaul required) as well as a $600 per lot deployment change.

The current design practice for road reserves, pavement and verge provisions will make adequate allowance for services including broadband in accordance with the agreed Utilities Service Providers handbook. There will be some local land requirements for equipment sites, similar to current provisions which will be accommodated at detailed subdivision stage.

10.2 Existing Telecommunications Infrastructure

Telecommunications providers Optus, Telstra and TPG have been consulted on the coverage, capacity and quality of the existing infrastructure surrounding the Site and its ability to service the proposed development.

Telstra has advised the development is not likely to significantly impact on the coverage, capacity and quality of the existing Telstra Wireless services in the area, all of which are currently well within normal KPIs. Further to this, Telstra has advised no Telstra Wireless infrastructure upgrades are likely to be required as a result of the development.

Optus has advised the existing infrastructure has adequate coverage and capacity to service the Site from existing network sites and have confirmed they do not require any additional network infrastructure sites to provide coverage/capacity to the proposed subdivision. It is also noted that Optus are planning on coverage and capacity improvements as part of their new P0955 Wandi North infrastructure, which is forecast for completion in March 2024.

TPG were contacted for comment however have not provided a response.

11. ROADWORKS & FOOTPATHS

11.1 Abutting Roads and Access Points

The Site will be well serviced with good transit options to the broader regional network. Wattleup Road abuts the Site to the north, and a transit corridor for the future extension of Rowley Road abuts the southern boundary.

Wattleup Road has been identified by Main Roads WA as a "Regional Distributor Road" and forms part of the MRWA RAV network for heavy vehicles and is currently being upgraded to an urban standard including kerbing drainage, paths and lighting. We note that the existing vertical geometry of Wattleup Road cannot be amended due to tying in with existing dwellings that will be retained, and the existing k values do not comply with Austroad Standards for Safe Stopping Distance for the current speed zoning.

Upon completion of the upgrades, Wattleup Road will consist of twin 3.5m carriageways with a 3m median. A Traffic Impact Assessment has been completed to inform the ultimate design of Wattleup Road by Stantec.

A Traffic Impact Assessment has also been completed by PTG to accompany this Amendment to the Hammond Quarter Structure Plan and confirms that the Wattleup Road intersection proposed at the eastern boundary of the Site will have sufficient capacity to accommodate proposed traffic from this project.

Rowley Road will be extended across the south boundary of the Site in the future, and will provide improved transport route options between Kwinana Freeway and the coast, as well as relieving the traffic burden from Wattleup Road.

11.2 Internal Road Network

Internal road designs will comply with Liveable Neighbourhoods and the City of Cockburn Standards.

In all cases the road cross-sections will be designed to cater for utility services, on standard verge alignments, street trees, parking embayments where appropriate and footpaths. Where roads abut public open space, verges can be reduced to a minimum of 0.5m if no parking is required.

11.3 Footpaths

Footpaths will be provided in accordance with *Liveable Neighbourhoods* and the City of Cockburn standards and will consist of one path in every road.

12. STAGING

It is anticipated that development will begin at the eastern boundary for connection to the existing road and service infrastructure. Stages will progress westwards as per market demands.

13. CONCLUSION

Based on the advice received from various servicing authorities, consultants and the City of Cockburn, we consider there are no impediments to the development of the Site. The ground conditions and past uses will not limit the proposed urban development, and the Site can be easily incorporated into the existing and planned future road network. Water supply, sewerage and other public utility services are available and are currently being upgraded along Wattleup Road.

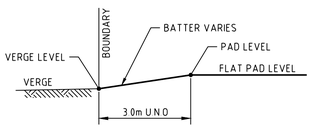
The investigation for this report is largely based on preliminary advice from the various service authorities, and is current at June 2026.

LEGEND

DESCRIPTION	SYMBOL
LIMIT OF WORKS BOUNDARY	
FINISHED SURFACE CONTOUR MAJOR	25.0
FINISHED SURFACE CONTOUR MINOR	24.5
EXISTING SURFACE CONTOUR	25.0
FINISHED LOT PAD LEVEL	25.00
FINISHED LOT SPOT LEVEL	×25.00
PROPOSED RETAINING WALL	
EXISTING RETAINING WALL	
FUTURE RETAINING WALL	
BUILDING SETBACK LINE	
EXISTING TREE (AND NUMBER) TO BE RETAINED	100
DWER HISTORICAL MAXIMUM GROUND WATER LEVEL	14.0

NOTES

1. ALL LEVELS IN METRES TO AHD. SURVEY BY MNG.
2. BATTERS TO EXISTING SURFACE AT 1:3 (CUT) 1:4 (FILL) UNLESS NOTED OTHERWISE.
3. BATTER POSITION FOR FUTURE WALLS TO ENSURE CUT TO FILL EARTHWORKS BALANCE.
4. ALL UNSUITABLE MATERIAL TO BE REMOVED BY THE CONTRACTOR TO APPROVED TIPPING SITE PRIOR TO COMMENCEMENT OF CONSTRUCTION. ALL FEES TO BE PAID BY CONTRACTOR.
5. EXTENT OF CLEARING AND EARTHWORKS TO BE LIMITED TO THE STAGE CLEARING BOUNDARY UNLESS AGREED WITH THE SUPERINTENDENT.
6. ALL CLEARED MATERIAL TO BE MULCHED AND STOCKPILED ON SITE AS DIRECTED BY THE SUPERINTENDENT.
7. CONTRACTOR TO LOCATE ALL EXISTING SERVICES PRIOR TO COMMENCEMENT OF WORKS ON SITE.
8. CONTRACTOR TO GRADE EVENLY BETWEEN DESIGN CONTOURS AND MATCH INTO EXISTING SURFACE AT LIMIT OF EARTHWORKS BOUNDARY WHERE APPROPRIATE.
9. EXCESS CUT FROM EARTHWORKS SHALL BE PLACED ON SITE AS DIRECTED BY THE SUPERINTENDENT.
10. WHERE LIMESTONE IS WITHIN 600mm OF THE FINAL SURFACE LEVEL THE CONTRACTOR SHALL TREAT THE SITE IN ACCORDANCE WITH THE SPECIFICATION.
11. DESIGN LEVELS SHOWN SHALL BE ON THE FINISHED SURFACE INCLUDING TOPSOIL WHERE SPECIFIED.
12. THE CONTRACTOR SHALL LIMIT THE MOVEMENT OF EQUIPMENT AND MANPOWER TO THE MINIMUM AREA NECESSARY AND PROTECT ALL VEGETATION AND EXISTING SERVICES ON SITE.
13. ADJACENT RESIDENTS TO BE NOTIFIED OF THE WORKS AT LEAST TWO WEEKS IN ADVANCE. CONTRACTOR TO PROVIDE MOBILE NUMBER FOR SUPERVISOR AS PART OF NOTIFICATION.



TYPICAL BATTER TO FRONT OF TRADITIONAL LOTS

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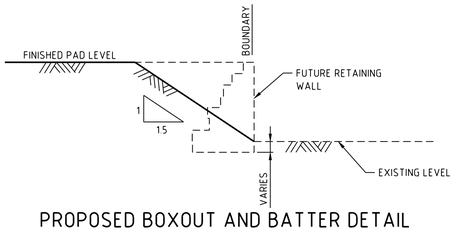
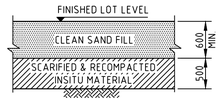


PROPOSED BOXOUT AND BATTER DETAIL FOR FUTURE RETAINING WALLS

SCALE: N.T.S



TYPICAL CUT SECTION FOR LOTS IN LIMESTONE AREAS

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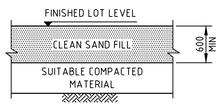

TYPICAL FILL SECTION FOR LOTS IN SAND AREAS

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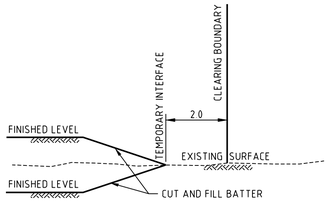

TEMPORARY EARTHWORKS INTERFACE

SCALE: N.T.S

NOTICE TO CONTRACTOR

IT IS THE CONTRACTOR'S RESPONSIBILITY TO INVESTIGATE THE NATURE AND LOCATION OF ALL SERVICES WHICH MAY BE ENCOUNTERED AND TO CONSULT WITH THE RELEVANT SERVICE AUTHORITIES PRIOR TO COMMENCEMENT OF EXCAVATIONS. FAILURE TO DO SO OR TO TAKE DUE CARE SHALL NOT LIMIT THE CONTRACTOR'S LIABILITY FOR REPAIR OF ALL SERVICES DAMAGED BY HIM DURING CONSTRUCTION WORKS. THE CONTRACTOR SHALL TAKE ALL PRECAUTIONS NECESSARY FOR THE PROTECTION OF ALL EXISTING SERVICES.

REV	DATE	DRN	CKD	APP	AMENDMENT
2	25.05.26	MT	RC	A. THOMSON	PRECAL UPDATED
1	13.05.26	WBR	RC	A. THOMSON	ROAD AND PAD LEVELS REVISED, HOLD CLOUDS REMOVED FROM BASINS
0	01.05.26	WBR	RC	A. THOMSON	ISSUED FOR CONSTRUCTION
D	23.04.26	WBR	RC	A. THOMSON	ISSUED FOR APPROVAL
C	12.03.26	MT	RC	A. THOMSON	UNDERGROUND POWER AND EXISTING COMMS ADDED

N

BEFORE YOU DIG www.byda.com.au

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CLIENT: QUBE

APPROVED: AVRIL THOMSON

DESIGNED: MT

SCALE: 1:1000

PROJECT: HAMMOND CORNER - STAGE 14

TITLE: EARTHWORKS PLAN SHEET 1 OF 2

WAPC No. 202211

DRAWING No. 5910-14-200

REVISION 2

ORIGINAL SIZE A1

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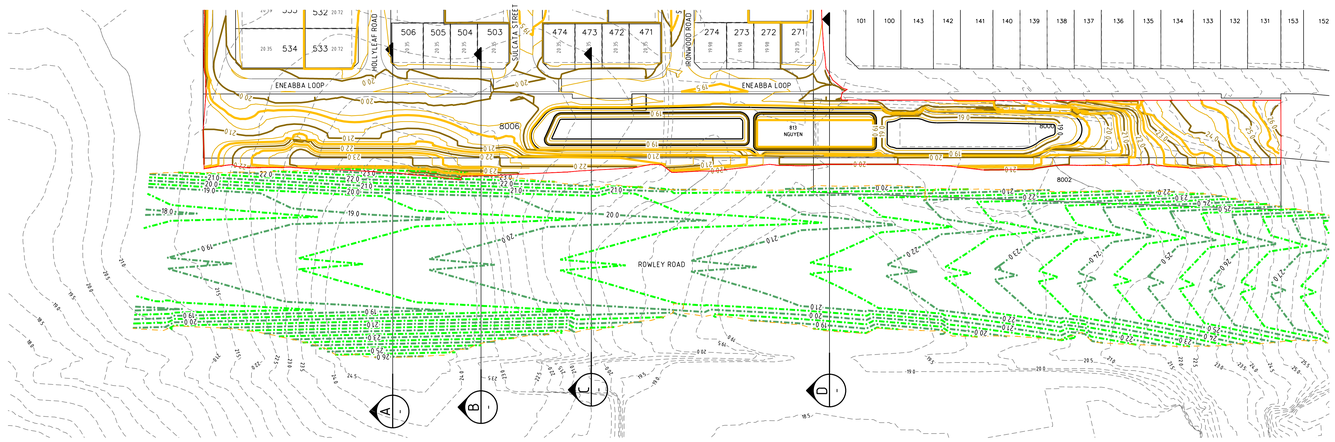
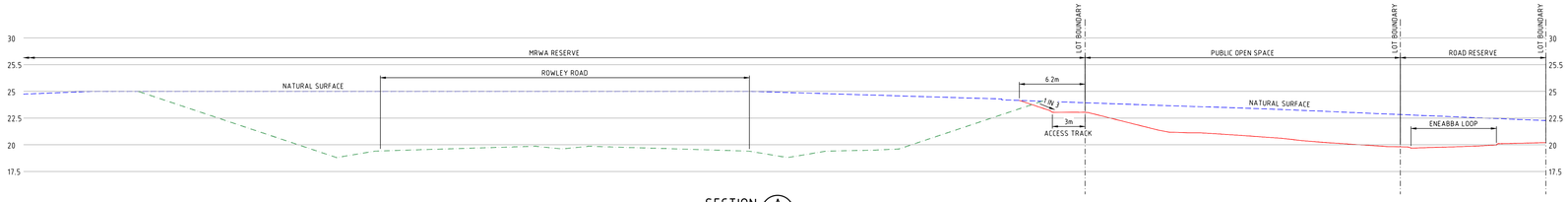


PLAN
1:1000

LEGEND

- NATURAL SURFACE LEVEL (0.5m INTERVAL)
- ROWLEY ROAD DESIGN CONTOURS (1.0m INTERVAL)
- ROWLEY ROAD DESIGN CONTOURS (0.5m INTERVAL)
- HAMMOND CORNER DESIGN CONTOURS (1.0m INTERVAL)
- HAMMOND CORNER DESIGN CONTOURS (0.5m INTERVAL)



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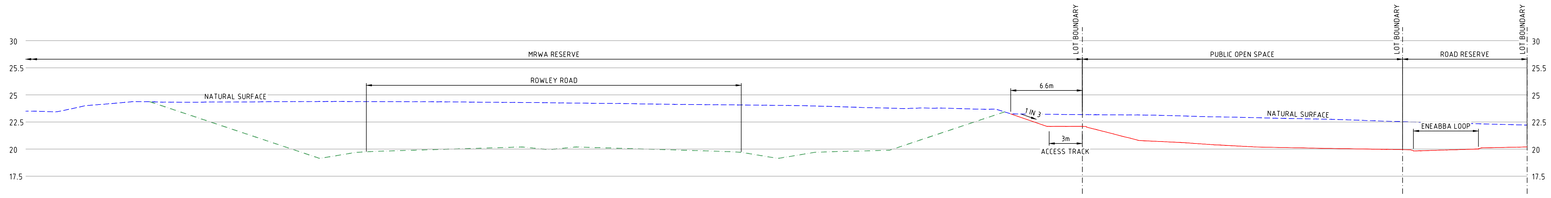

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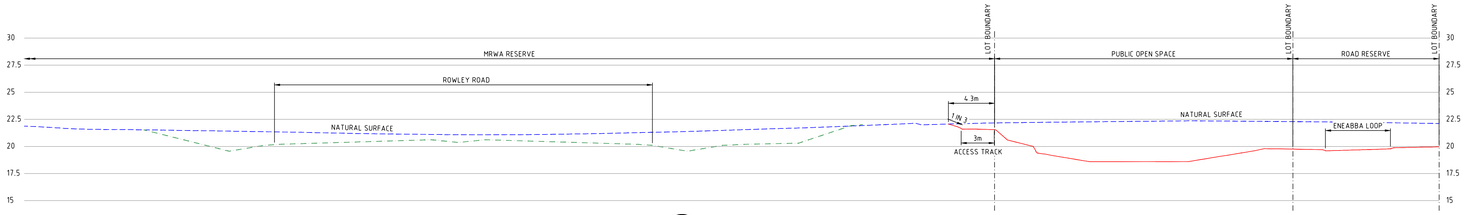

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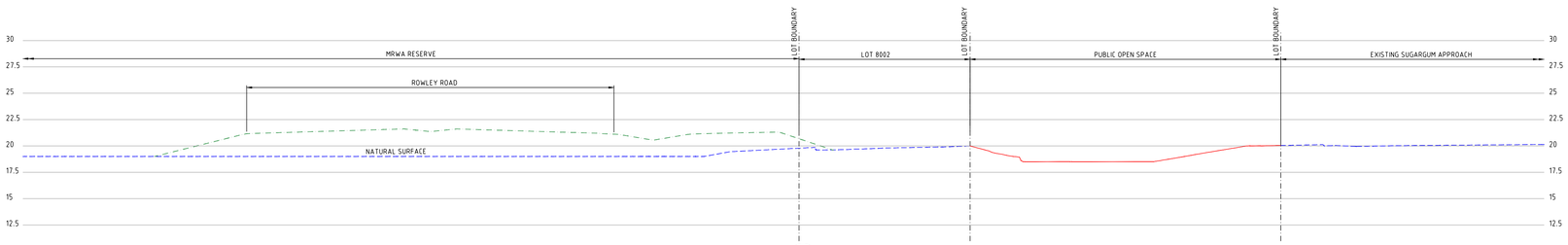

SECTION D
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REV	DATE	DRN	CKD	APP	AMENDMENT
A	15.04.26	A	-		ISSUED FOR REVIEW

N

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1:1000 0m 20 40 60

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CLIENT: QUBE

APPROVED:

DESIGNED: WBR

SCALE: 1:200 1:1000

PROJECT: HAMMOND CORNER - STAGE 14

TITLE: ROWLEY ROAD AND HAMMOND CORNER CROSS SECTIONS

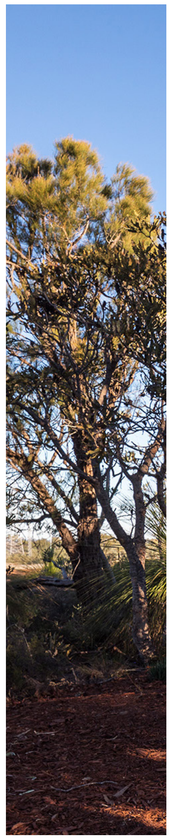
WAPC No.

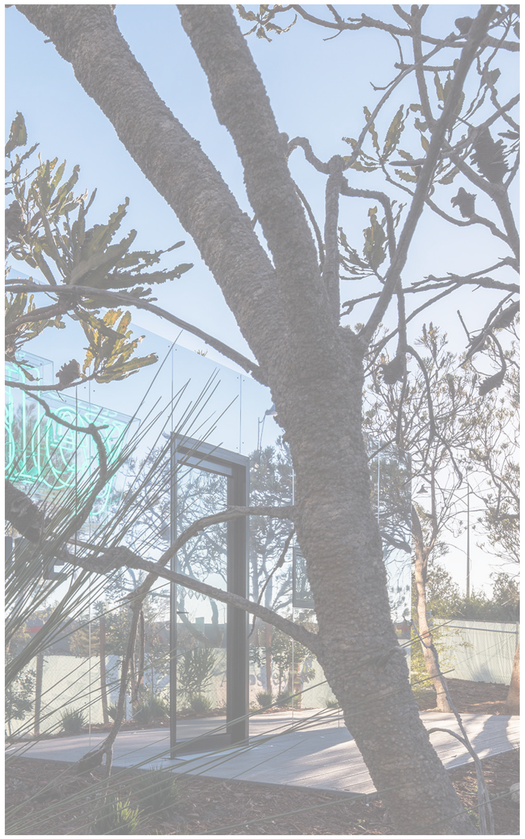
DRAWING No. 5910-14-SK103

REVISION A

ORIGINAL SIZE A0

Appendix C
Landscape Masterplan





HAMMOND QUARTER LSP AMENDMENT

landscape masterplan | July 2026 [E]

PLAN E

LANDSCAPE ARCHITECTS

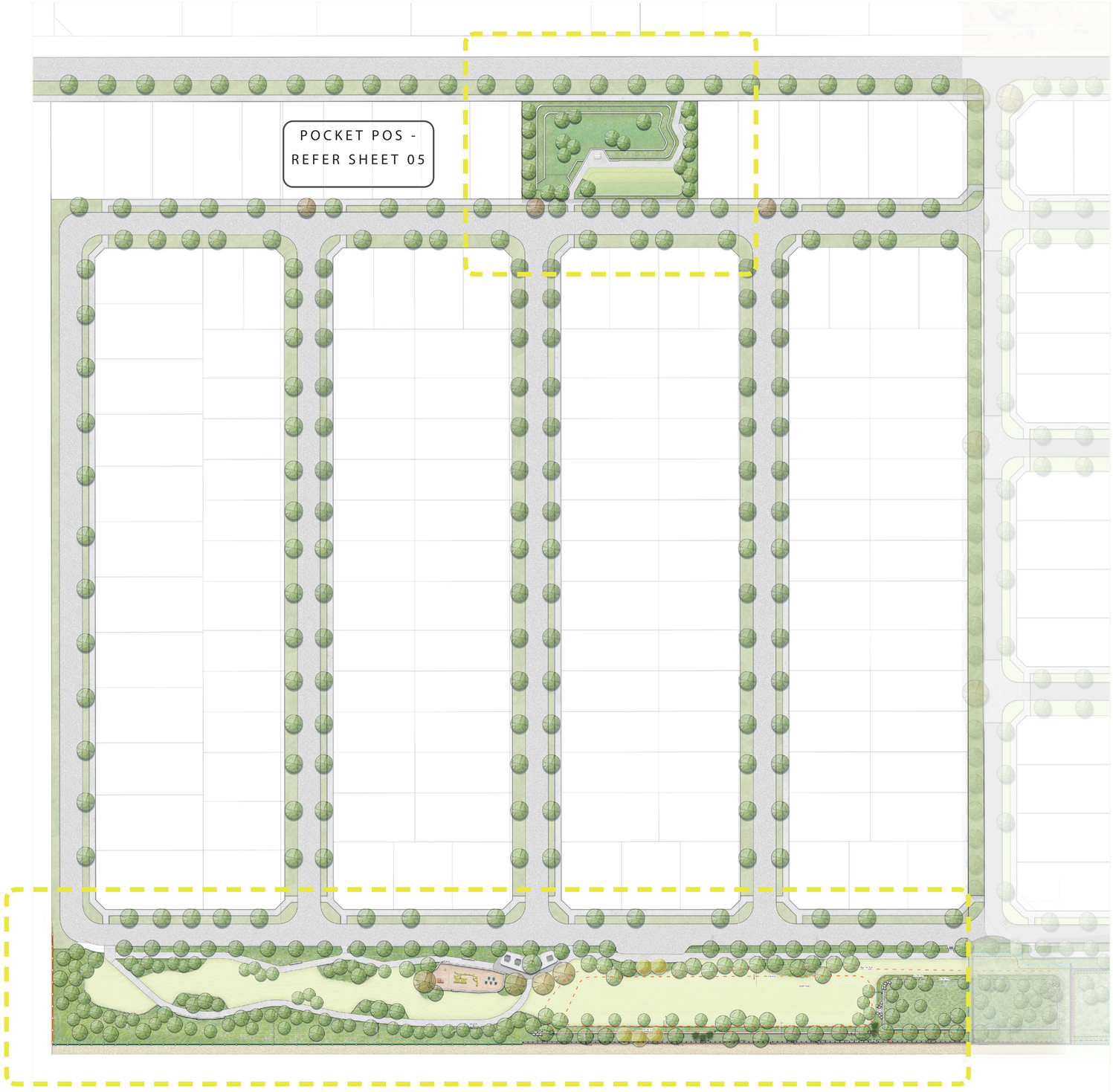
LEVEL 1 278 RAILWAY PDE WEST LEEDERVILLE WA 6007
T: (08) 9388 9566 E: mail@plane.com.au

QUBE

01 | MASTERPLAN

TERRACING

MANUFACTURED SHADE



PLAN E

LANDSCAPE ARCHITECTS

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HAMMOND CORNER - HAMMOND QUARTER
LSP AMENDMENT
PREPARED FOR QUBE MANDOGALUP PTY LTD
JULY 2026

M1.102

REV E
1:700 @ A1

0 7 14 28 42 70m

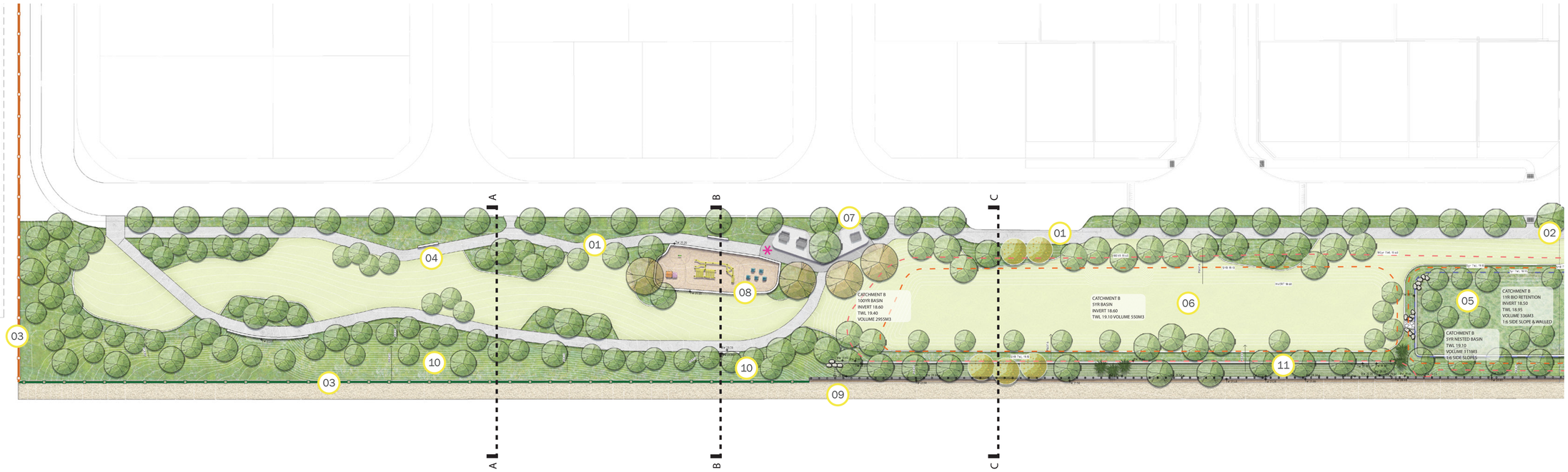
2102805 HAMMOND CORNER- landscape concept

© PLAN E

02 LINEAR POS
PLAN

LEGEND

- PROPOSED TREE PLANTING
- 01 CONCRETE FOOTPATH EXTENDS LINEAR POS WALKABLE NETWORK
- 02 FUTURE PATH CONNECTION WITH HAMMON SOUTH LINEAR POS
- 03 CONSERVATION FENCE
- 04 SEATING WALLS OVERLOOKING TURF & PLANTING
- 05 PLANTED BIORETENTION BASIN WITH WINTER-WET NATIVE TREES AND PLANT SPECIES.
- 06 TURFED 1:100 BASIN AREA
- 07 SHADE STRUCTURE WITH SEATING AND BBQ
- 08 PLAYGROUND AREA WITH SHADE TREES
- 09 CRUSHED GRAVEL ACCESS TRACK THROUGH POS
- 10 1:4 MAX EARTHWORKS BATTER
- 11 1:6 MAX EARTHWORKS BATTER
- ALL-AGES FITNESS EQUIPMENT NODE



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LSP AMENDMENT
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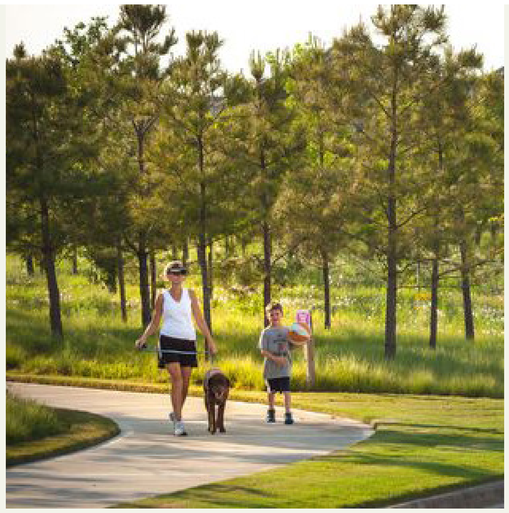

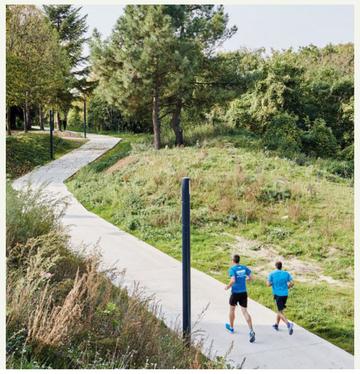

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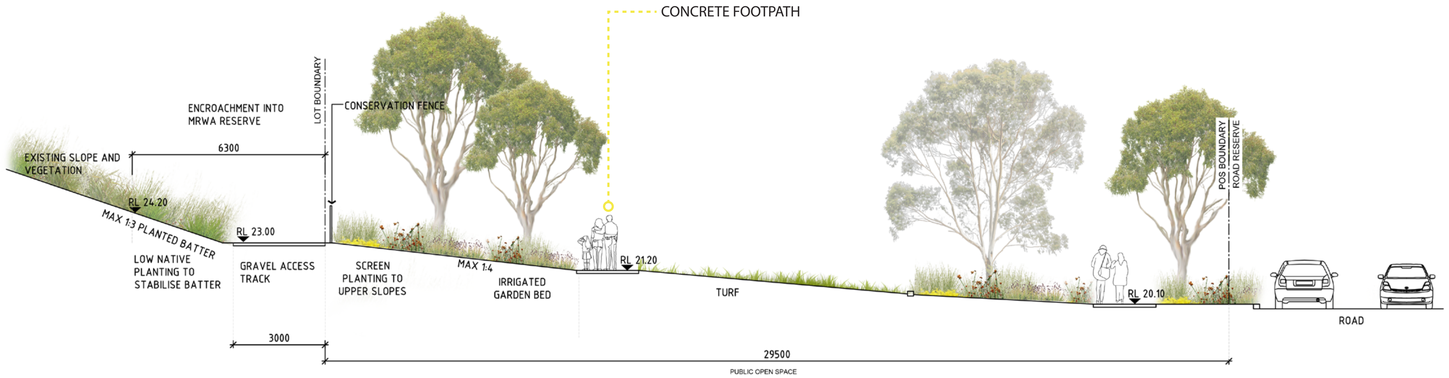
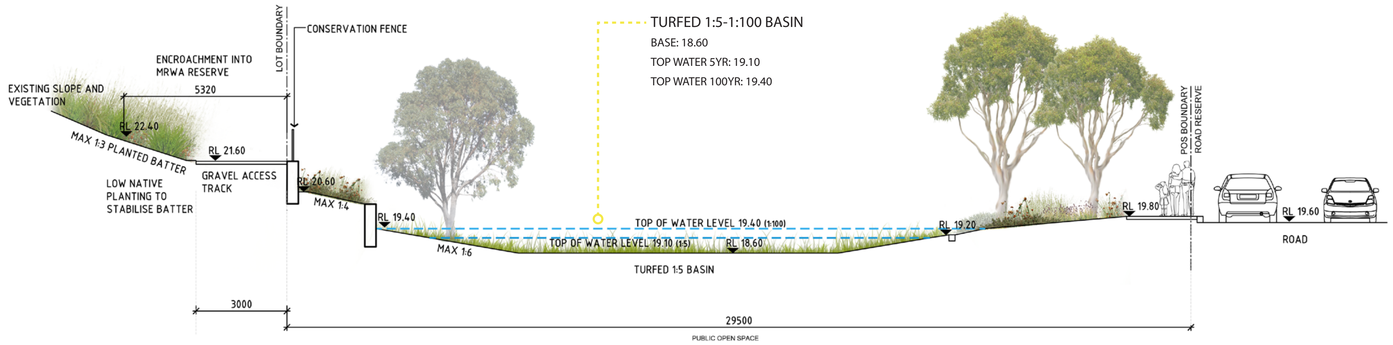
04 LINEAR POS
CROSS SECTIONS

SECTION A - A



SECTION B - B

SECTION C - C



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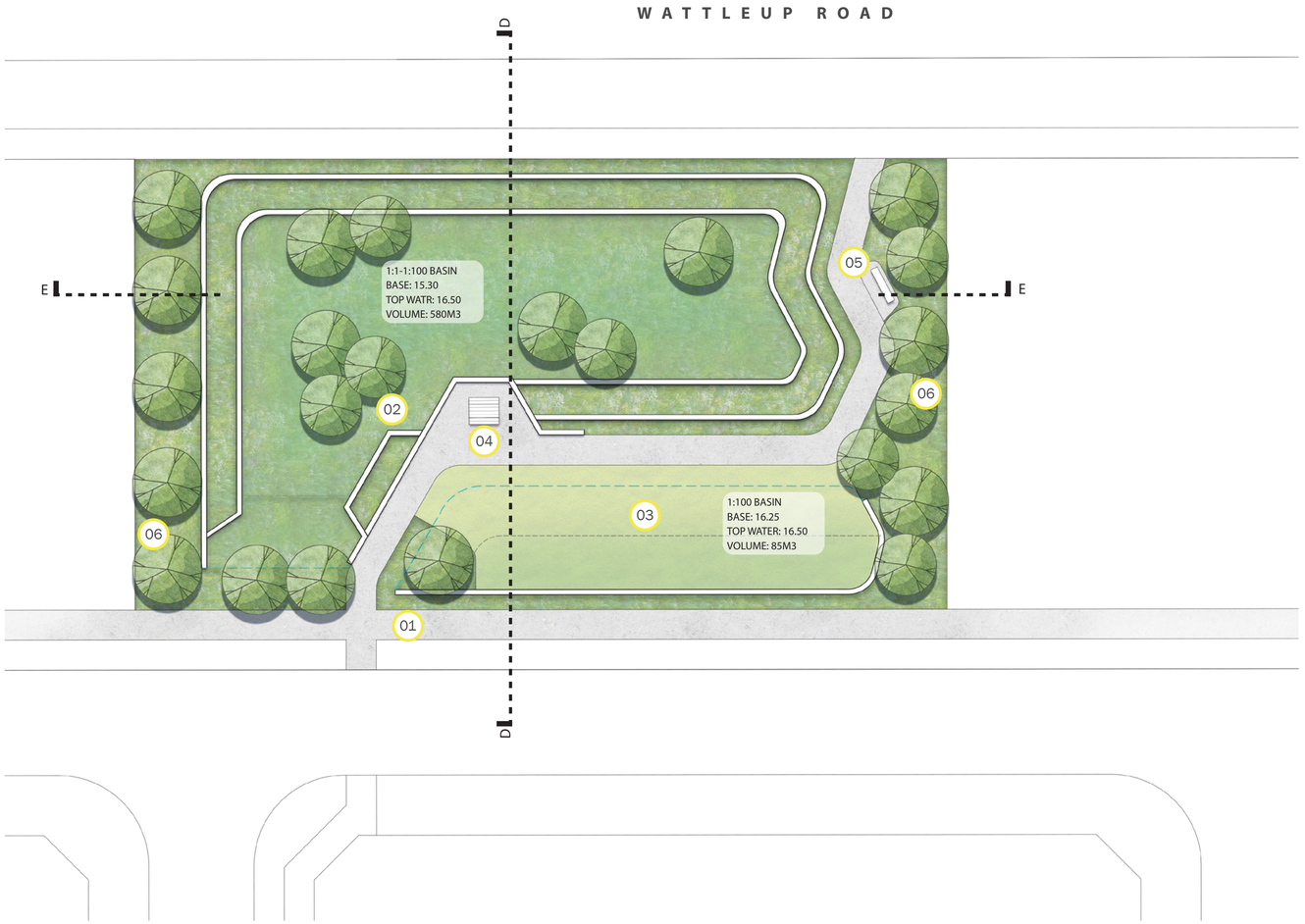
05 POCKET PARK
PLAN

LEGEND

- PROPOSED TREE PLANTING.
- 01 CONCRETE FOOTPATH CONNECTS TO WATTLEUP ROAD
- 02 PLANTED 1:1-1:100 BASIN
- 03 TURF 1:100 OVERFLOW BASIN
- 04 RAISED SEATING PLATFORM OVERLOOKING BASIN
- 05 SEATING NODE
- 06 SCREENING TREES AND PLANTING ALONG LOT BOUNDARY



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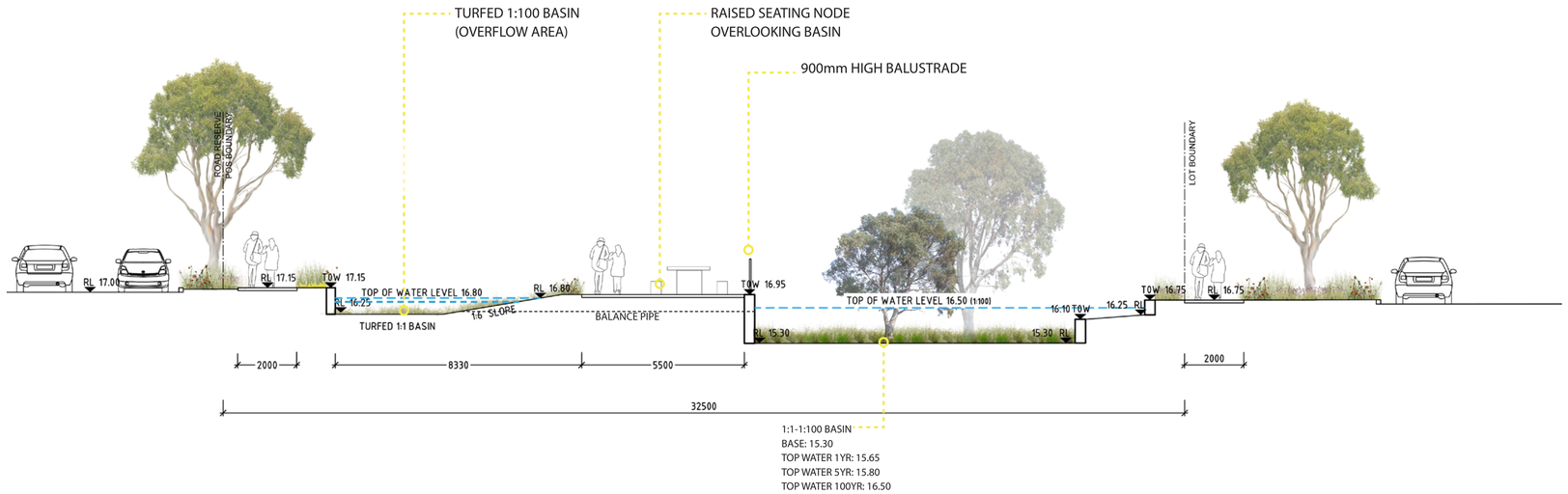
06 POCKET PARK
PLAN

SECTION D - D



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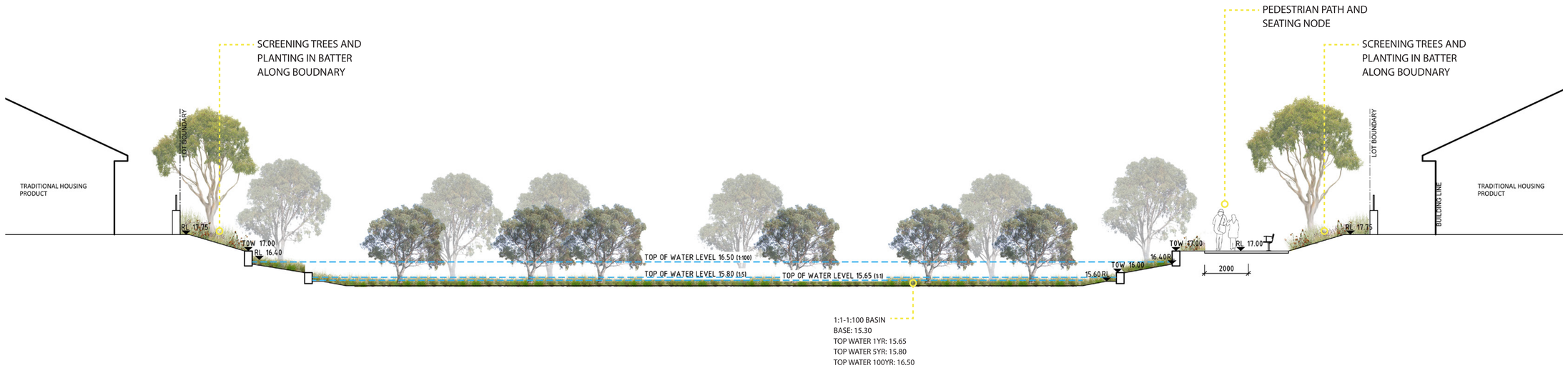

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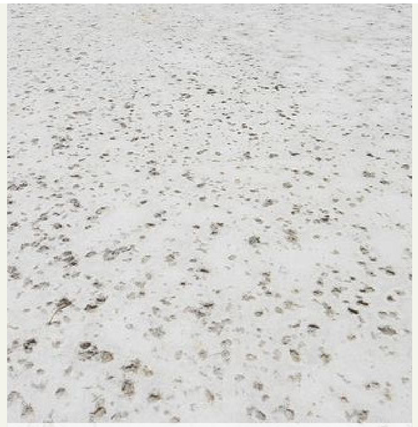
07 MATERIALS PALETTE
HARDWORKS

EXPOSED CONCRETE



ROCK SALT CONCRETE

COMPOSITE DECKING

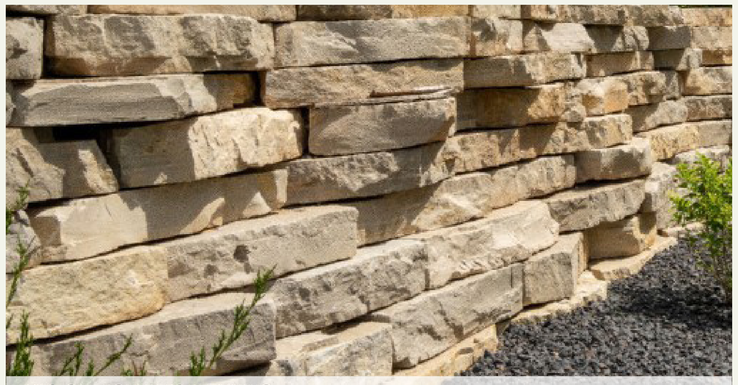
LIMESTONE RETAINING WALLS

POWDER COATING

FEATURE BRICK

EXPOSED CONCRETE

RAMMED EARTH WALL



LIMESTONE BOULDERS RETAINING

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08 PLANTING PALETTE
TREES

BANKSIA WOODLAND

BANKSIA ATTENUATTA

BANKSIA GRANDIS

BANKSIA ILLICIFOLIA

BANKSIA MENZIESSII

MACROZAMIA RIEDLEI

XANTHORRHOEA PRIESSII

SMALL TREES

ACACIA SALIGNA

CALLISTEMON KING S PARK SPECIAL

EUCALYPTUS VICTRIX

HAKEA LAURINA

KUNZEA GLABRASCENS

MELALEUCA LANCEOLATA

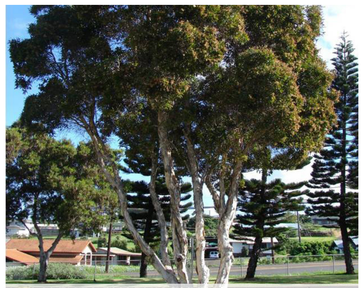
LARGE TREES

ALLOCASUARINA FRASERIANA

EUCALYPTUS GOMPHOCEPHALA

EUCALYPTUS MARGINATA

MELALEUCA LEUCADENDRA


MELALEUCA RHAPHIOPHYLLA

TRISTANIOPSIS LAURINA

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09 PLANTING PALETTE
SHRUBS

GROUNDCOVERS

ACACIA SALIGNA GREEN CARPET

CONOSTYLIS CANDICANS

CALOTHAMNUS QUADRIFIDUS PROSTRATE

DAMPIERA LINEARIS

KENNEDIA PROSTRATA

MYOPORUM PARVIFOLIUM FINE LEAF

SHRUBS LOW

ANIGOZANTHOS HUMILIS

BANKSIA NIVEA PROSTRATE

CALOTHAMNUS CLEAN AND GREEN

CONOSTYLIS ACULEATA

DIANELLA REVOLUTA

PATTERSONIA OCCIDENTALIS

SHRUBS

ANIGOZANTHOS MANGLESSII

HAKEA PROSTRATA

HIBBERTIA HYPERICOIDES

MELALEUCA HUEGELII

SCAEVOLA CRASSIFOLIA

VERTICORDIA DENSIFLORA

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LEGEND

- PROPOSED TREES.
- PROPOSED FEATURE TREES.
- RETAINED TREES FOR PROTECTION (SUBJECT TO ABORIST REPORT AND SURVEY)
- 01 ENTRY WITH LARGE DECIDUOUS FEATURE TREES.
- 02 CONCRETE FOOTPATH.
- 03 FEATURE PAVING TO STREET INTERSECTIONS TO SLOW TRAFFIC AND ENHANCE CONNECTION TO POS.
- 04 FEATURE DECIDUOUS TREES TO SLOW POINTS.
- 05 SCREEN PLANTING WITH TREES.

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LANDSCAPE MASTERPLAN

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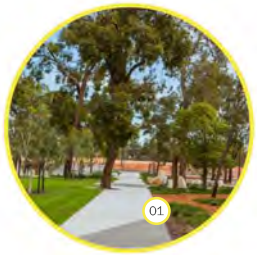

LEGEND

- PROPOSED TREE PLANTING
- PROPOSED FEATURE TREES.
- RETAINED TREES FOR PROTECTION (SUBJECT TO ABORIST REPORT AND SURVEY)
- 01 CONCRETE FOOTPATH
- 02 PLANTED BIORETENTION BASIN WITH WINTER WET NATIVE TREES AND PLANT SPECIES. 1:1 ARI, BASE AREA: 740 M2, VOLUME: 376 M3
- 03 PLANTED DETENTION BASIN - 1:100 ARI, BASE AREA: 1640 M2 , VOLUME: 2157 M3
- 04 PASSIVE TURF AREA
- 05 KICKABOUT TURF AREA
- 06 INFORMAL PLAYGROUND EQUIPMENT IN MULCH
- 07 SHELTER WITH TABLE SEATINGS & BBQ.
- 08 NATIVE PLANTING WITH GROVES OF TREES
- 09 ALL-AGES FITNESS EQUIPMENT NODE
- 10 ACTIVE ZONE WITH HIT UP WALL, BASKETBALL HOOP, SOCCER AND COLOURED LINEMARKING
- 11 SEATING NODE
- 12 REFLECTIVE NODE - TERRACED TIMBER SEATING.
- 13 TERRACED SEATING WITH CLIMBING OPPORTUNITIES
- 14 TERRACED RETAINING WALL
- 15 EARTHWORKS BATTER
- 16 3M MAINTENANCE ACCESS (OFF SITE)
- 17 OVERFLOW SPILLWAY FROM 1:1 TO 1:100 BASIN

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LINEAR POS

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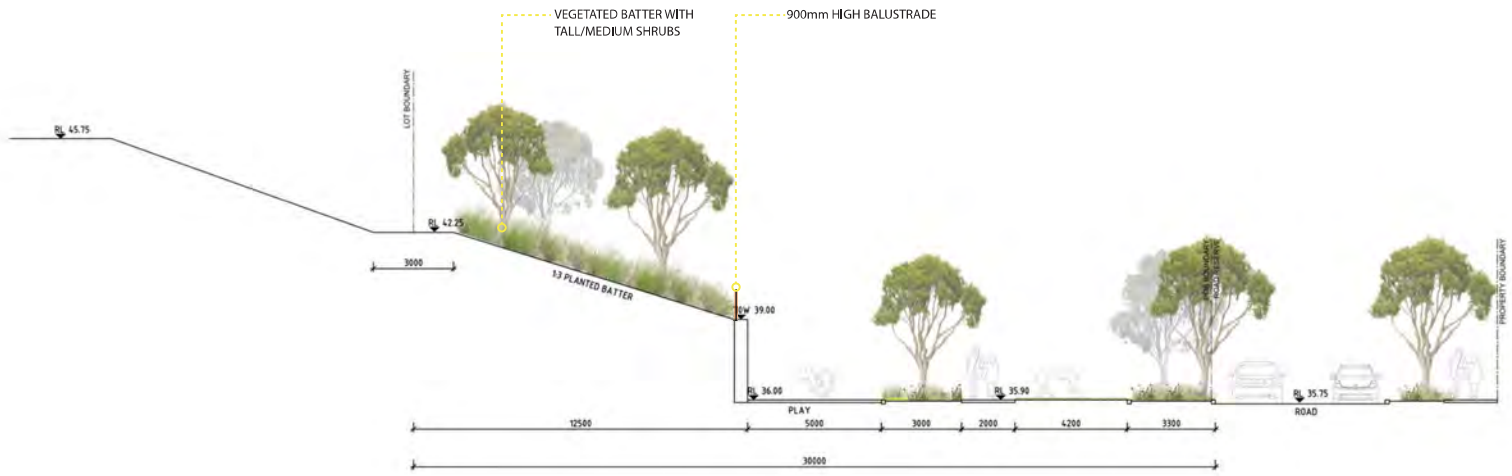
SECTION A

SECTION B



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LINEAR POS - SECTIONS

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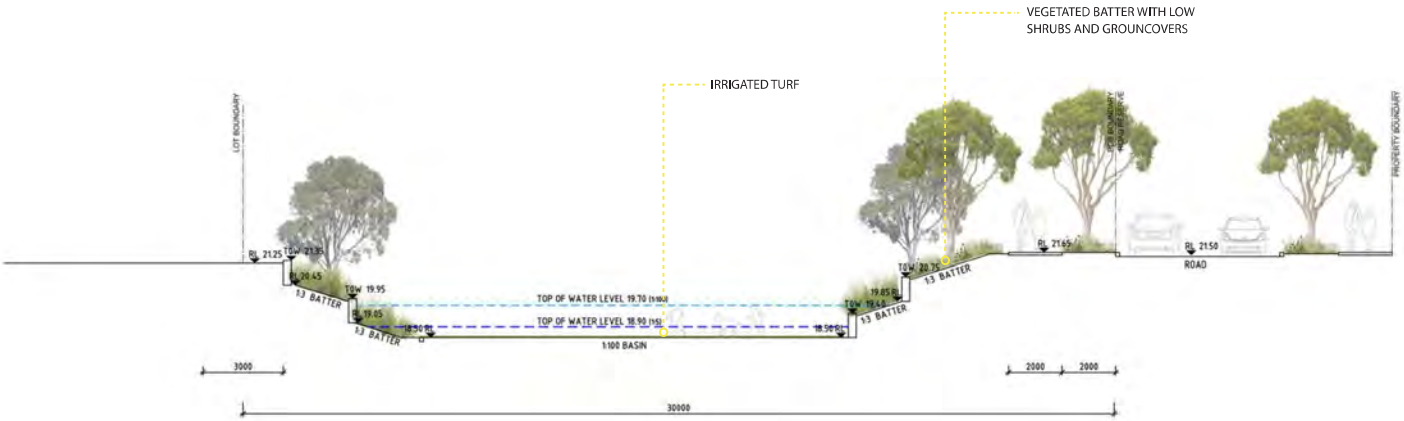

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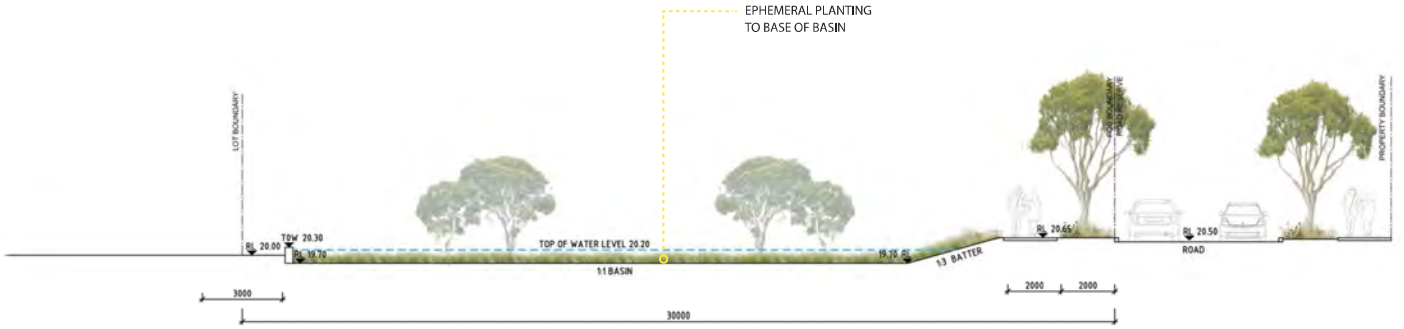

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LINEAR POS - SECTIONS

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LEGEND

- PROPOSED TREE PLANTING.
- 01 FEATURE TREE PLANTING / VISUAL GREEN CONNECTION FROM ENTRY ROAD
- 02 OPPORTUNITY FOR ENTRY / WAYFINDING ARTWORK
- 03 TURF KICKABOUT AREA
- 04 MOUNDED TURF
- 05 SHADE STRUCTURE WITH SEATING, BBQ AND AMENITY
- 06 PLAYGROUND EQUIPMENT IN SAND PIT
- 07 TIERED RETAINING WALLS WITH PLANTING
- 08 1:100 ARI DETENTION BASIN
- 09 PLANTED 1:1 ARI BIORETENTION BASIN WITH WINTER-WET NATIVE TREES AND PLANT SPECIES.
- 10 CULVERT AND HEADWALL TO CONNECT 1:1 AND 1:100 BASINS
- 11 COMMUNITY ORCHARD
- 12 CONCRETE FOOTPATH
- 13 FEATURE CONCRETE PAVING
- 14 PATH CONNECTION TO ADJACENT LOTS
- 15 TREES AND PLANTING TO INTERFACE WITH OVERWATCH PRODUCT
- 16 POS PARKING BAYS

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CENTRAL POS - CONCEPT PLAN

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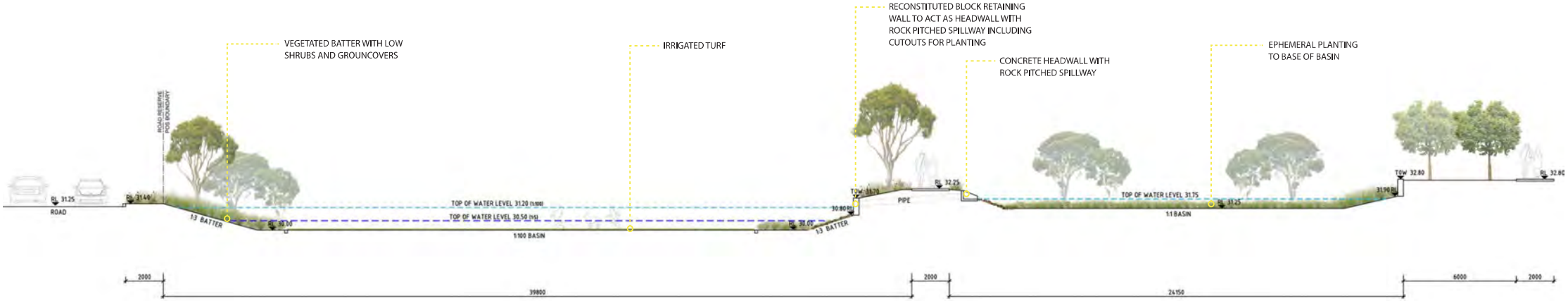

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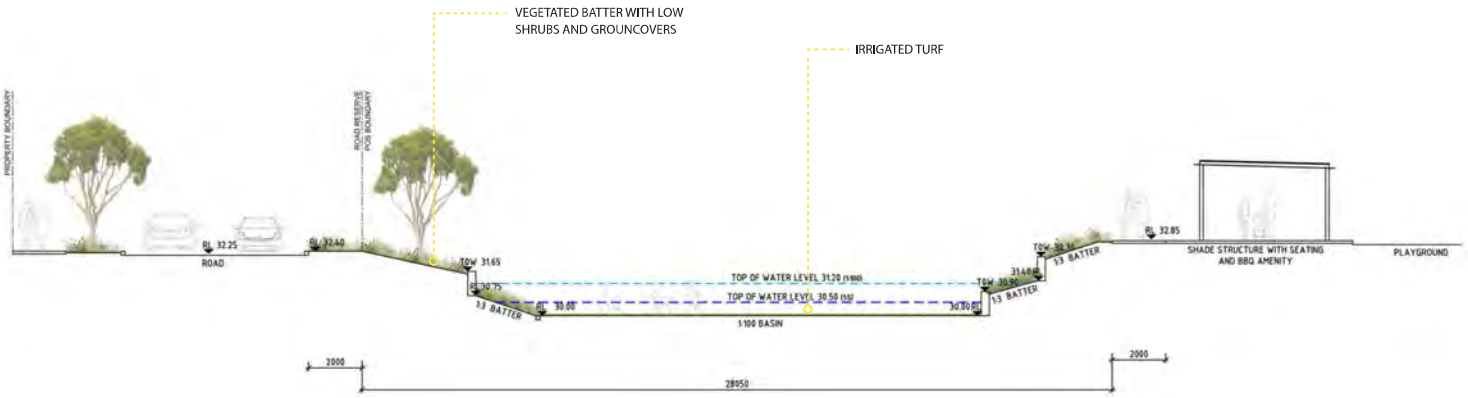

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CENTRAL POS - SECTIONS

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CENTRAL POS

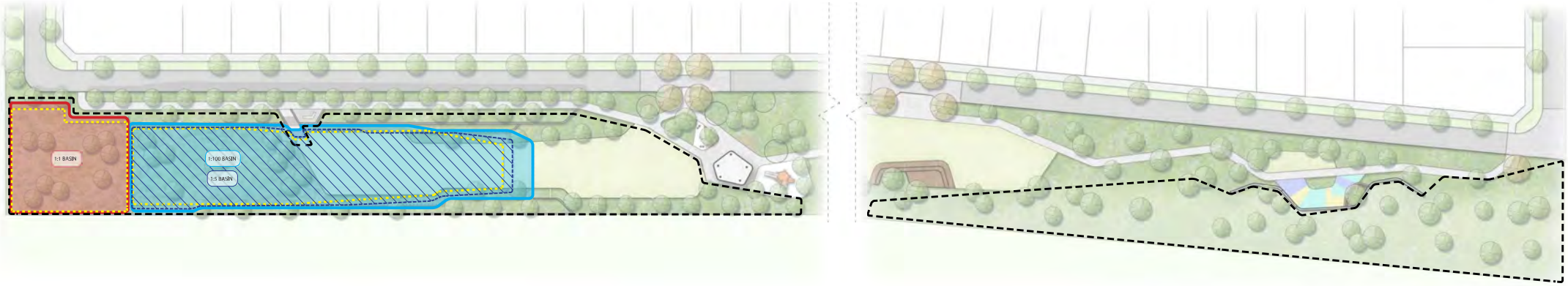
POS CALCULATIONS

POS	TOTAL AREA (ha)	1:1 BASE AREA (ha)	1:100 BASE AREA (ha)	RESTRICTED 1:1 YEAR EVENT (ha)	RESTRICTED 1:5 YEAR EVENT (ha)	RESTRICTED 1:100 YEAR EVENT(ha)	EXTENT OF BATTERED AREA WITH SLOPE GREATER THAN 1:6 (ha)	USEABLE TURF AREA (HA) INCLUSIVE OF 1:6
Central POS	0.4935 (ex. Verge)	0.0315	0.0734	0.0422	0.0870	0.1165	0.0714	0.1738
Linear POS	1.9347 (ex. Verge)	0.0740	0.1640	0.0791	0.1828	0.2050	0.3625	0.2580

LEGEND

- BASIN BASE AREA
- RESTRICTED 1:1 YEAR EVENT
- RESTRICTED 1:5 YEAR EVENT
- RESTRICTED 1:100 YEAR EVENT
- BATTERED AREA WITH SLOPE GRATER THAN 1:6

LINEAR POS



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POS RESTRICTED AREAS

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Appendix D
Bushfire Management Plan

BUSHFIRE MANAGEMENT PLAN

LOTS 78, 80, 813, AND 815
WATTLEUP ROAD, HAMMOND QUARTER WEST

PREPARED FOR:

QUBE HAMMOND CORNER PTY LTD

QUBE

25 AUGUST 2026

LOTS 78, 80, 813, AND 815 HAMMOND QUARTER WEST BUSHFIRE MANAGEMENT PLAN

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Document Control for Job Number: QPGHQWBMP

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Version 2 (Surefire Environmental)	Sue Brand	Sue Brand	25 August 2026

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  - Purchasers of Lots in designated bushfire prone areas.
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APPENDICES

Appendix 1: Landscape Masterplan

1. BACKGROUND INFORMATION

Qube Hammond Corner Pty Ltd (Qube) are planning to develop Lots 78, 80, 813, and 815 Hammond Quarter West (the Site), within the City of Cockburn (the City) as a residential subdivision (Figure 1). Surefire Environmental Pty Ltd (Surefire Environmental) were engaged to prepare this updated Bushfire Management Plan (BMP) Addendum to support the planning approvals process. The broad aim of the assessment process was to identify potential bushfire risks to future properties along with appropriate management actions during and after site development.

A portion of the Site in the southwest of the area under assessment, along with its surroundings is designated as a bushfire-prone area by the Fire and Emergency Services Commissioner, Office of Bushfire Risk Management (OBRM), within the Department of Fire and Emergency Services (2025). Accordingly, there is a requirement for landowners to undertake an assessment to determine the risks and identify appropriate management strategies such that the development does not increase the inherent bushfire risk. Portions of the site that are located within 100 m of vegetation designated bushfire prone necessitate the need for a Bushfire Attack Level assessment (BAL-assessment) and assignment of a BAL-rating that will determine appropriate construction standards as per *AS 3959:2018 Construction of Buildings in Bushfire Prone Areas* (*AS 3959:2018*). The BAL assessment component of this document considers current and projected site conditions (i.e. vegetation classification pre- and post-development), along with the provisions of *State Planning Policy 3.7 Bushfire* (SPP3.7) (Department of Planning, Lands and Heritage (DPLH)), and the Western Australian Planning Commission (WAPC) (2024b) and *Planning for Bushfire Guidelines for the Implementation of State Planning Policy 3.7 Bushfire* (the *Guidelines*) (Department of Planning, Lands and Heritage and the Western Australian Planning Commission, 2024a).

1.1 LOCATION

The Site is located in Hammond Park, within the City of Cockburn (Figure 1), and is:

- Approximately 24 km southwest of the Perth Central Business District (CBD).
- Approximately 6.7 ha in size.

The Site is bounded by Wattleup Road to the north, paddocks and bushland to the east, paddocks and Mandogalup Road to the south, and private freehold properties to the west.

1.2 AIMS AND OBJECTIVES

The aim of the BMP is to outline the bushfire management methods and requirements that will be implemented within the Site. Accordingly, broad aims include:

- Reduce the occurrence of and minimise the impact of bushfire to the life and property of future residents and the environment.
- Allow easy access of firefighters and egress for the public should a bushfire occur.
- Protect the landscape within the Site as far as is possible.
- Document bushfire prevention requirements of the area to which it relates.

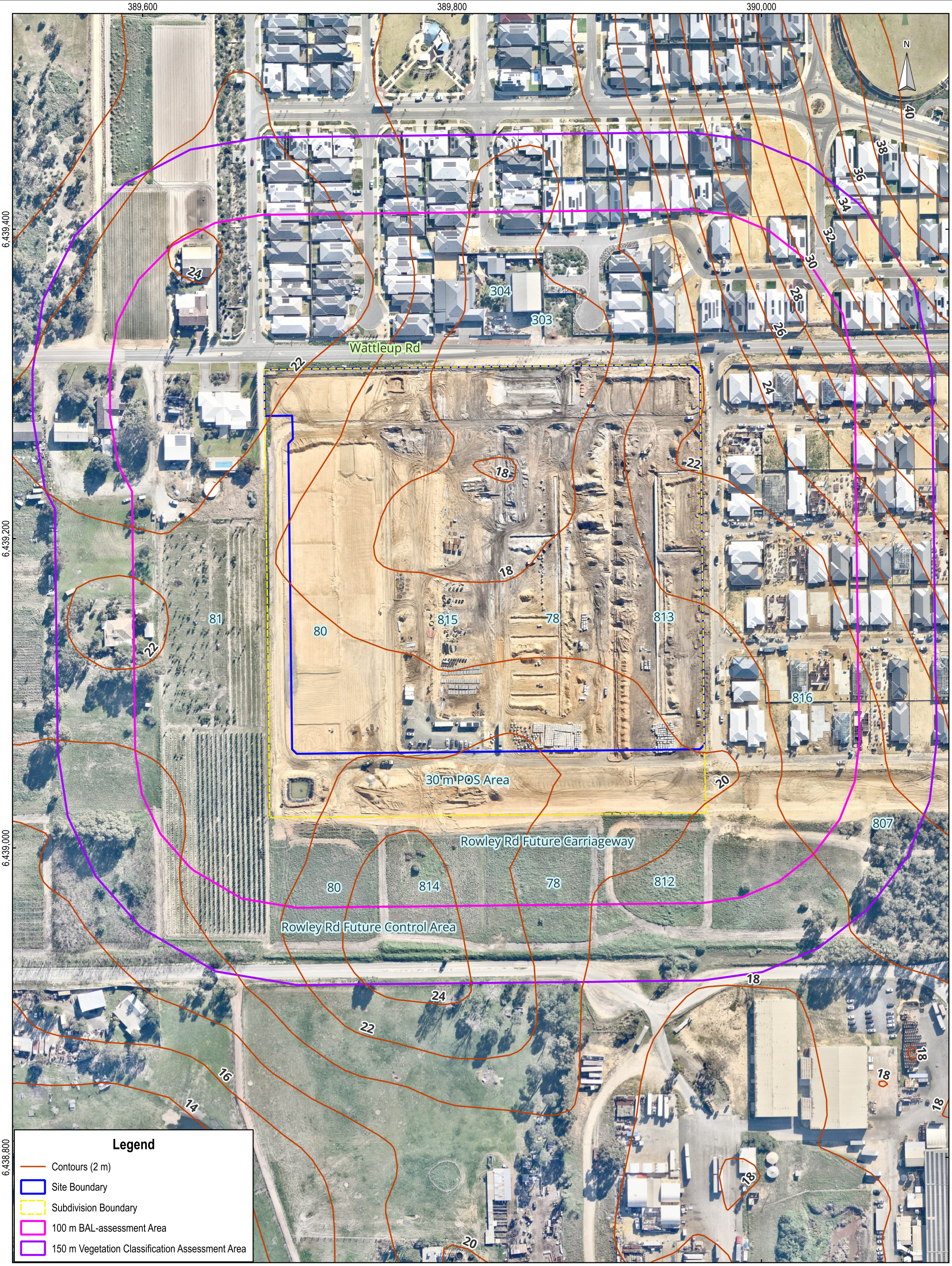
The objectives of this BMP are to:

- Define land use areas and values within the subdivision, with the entire subdivision to be developed as urban residential lots, except for the nominated areas of public open space (POS) that will be created to the south and a small patch to the north.
- Define and rank bushfire hazard areas according to the vegetation class and fire fuels present.
- Outline the roles and responsibilities of individuals and organisations in relation to bushfire management within the subdivision.
- Document bushfire management strategies for the subdivision, taking into consideration the need to:
  - Define building construction standards where vegetated areas interface with the urban development.
  - Identify access for firefighting operations and daily maintenance in and around vegetated areas and development.
  - Define an assessment procedure that will evaluate the effectiveness and impact of existing and/or proposed bushfire prevention activities and strategies.
  - Document the performance criteria and acceptable solutions adopted for the Site.

1.3 DOCUMENT PREPARATION

This document has been prepared by Sue Brand, an accredited Level 2 Bushfire Planning and Design (BPAD) practitioner with the Fire Protection Association Australia. Activities involved with the plan preparation process included:

- Assessing the vegetation type and class present within and adjacent to the proposed development site using descriptions provided in *AS 3959:2018*.
- Assigning hazard ratings based on the vegetation types present on and offsite.
- Determining Bushfire Attack Level (BAL) ratings and suggesting management strategies that could be implemented based on current and projected site considerations.
- Preparing this BMP.



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Original Size: A3
Aerial Imagery: NearMap November 2025
Grid: GDA94 / MGA zone 50 (EPSG:28350)
0 50 100 m

Bushfire Management Plan
Lots 78, 80, 813, and 815
Hammond Quarter West
Qube Hammon Quarter Pty Ltd

Figure 1

Location and Contours

Surefire ENVIRONMENTAL

C:\Users\Sue. B\Documents\My Documents\Surefire Environmental\Client Folders\Qube Property\Hammond Quarter West\GIS\HQW - updated BAL-model.qgz 21/08/2026 F1 Location

2. CONSIDERATION OF BUSHFIRE THREAT

2.1 SITE CHARACTERISTICS

2.1.1 Regional Context

Perth is located within the Swan Coastal Plain region of the Interim Biogeographical Regionalisation of Australia (IBRA). The Swan Coastal Plain comprises two major divisions, namely the Swan Coastal Plain 1 – Dandaragan Plateau and Swan Coastal Plain 2 – Perth Coastal Plain. The Site is in the Perth subregion, which is broadly characterised as including areas of Jarrah and Banksia woodlands on sandy soils in a series of sand dunes, along with wetland areas, often within the interdunal swales (Mitchell, Williams, and Desmond, 2002).

2.1.2 Vegetation

Lots 78, 80, 813, and 815 were predominantly paddocks containing weedy grasses and a few scattered trees (Figure 2) that have all since been cleared within the approved structure plan area. All vegetation and existing infrastructure will be cleared ahead of the proposed subdivision works. Class D Shrubland is present approximately 100 m east of the Site that will be cleared as part of the Hammond South subdivision. A small patch of vegetation occurs southwest of the Site that is likely to remain post-development.

2.1.3 Contours and Slope

The Site is located in an interdunal swale, where it rises gently from 18 m in the north to 22 m in all directions. Accordingly, the slope applied for the BAL-assessment component of this document is Upslope or Flat (Figure 1).

2.1.4 Land Use

Land use within the Site was a mix of grassy paddocks that have since been cleared (Lots 80, 815, and 78), residential housing (Lot 78), and commercial activities (Lot 813) (Figure 1 and Figure 2). All vegetation and infrastructure will be cleared to accommodate the development.

Figure 2: Current Land Use

2.1.5 Environmental Considerations

Given the absence of native vegetation and the current land-uses within the Site, there are no:

- Bush Forever Sites.
- Wetlands or waterways.
- No known presence of threatened or priority listed flora, fauna, or ecological communities.

2.1.6 Landscaping

Two POS areas will be created during the subdivision process, one in the north of the Site (1755 m^2), and one in the south of the Site, outside the development boundary (8467 m^2), adjacent to what will become an extension of Rowley Road. Both POS areas are expected to be landscaped with low threat vegetation consistent with the definition provided in *AS 3959:2018* and will be managed accordingly. If there any changes to the landscaping plans in the future, they will be reassessed to determine if there are any changes to the bushfire risk that could impact on BAL-ratings for the Site. A copy of the landscape masterplan is provided in Appendix 1. In the event a greater extent of native vegetation is retained or created BAL-ratings for the area may need to be reviewed and adjusted.

2.2 VEGETATION CLASSIFICATION

Vegetation on, and within 150 m of, the Site was assessed during the initial site visit on 15 March 2024 and subsequent site visits using descriptions provided in Table 2.3 and Figure 2.4 of *AS 3959:2018*; each vegetation class is discussed in Sections 2.2.1, 2.2.2, 2.2.3, and 2.2.4, with Site-specific examples of each shown in Figure 3, Figure 4, Figure 5, and Figure 6. The pre-development vegetation classifications for the Site are shown in Figure 7, with the post-development classifications shown in Figure 8.

2.2.1 Patch 1: Class D Scrub

Class D Scrub is characterised by vegetation 2 – 4 m high, with a continuous canopy from ground level to the crowns, noting that the occasional tree to 6 m may also be present. This vegetation class is present approximately 100 m east (since cleared), and in two small patches located approximately 95 m southwest and 115 m north west, from the Site boundary (Figure 3, Photo ID's 1 - 3 and Figure 7). The vegetation 100 m east of the Site boundary has since been cleared as part of the Hammond South subdivision. Vegetation within the patch located to the northwest and southwest of the Site boundary are likely to be retained in future. The vegetation to the northwest will not present an ongoing bushfire risk as it is more than 100 m from the Site boundary. The vegetation to the southwest is approximately 95 m from the front boundary of the southwestern lot, thus has little influence on the BAL-rating as the pines to the west that have been considered from a worst-case scenario as Class A Forest are the determinant of most BAL-ratings within 100 m of the Site.

Patch: 1	**Classification:**	Class D Scrub

Photo ID 1 (since cleared)

Photo ID 2

Photo ID 3 (since cleared)

Figure 3: Class D Scrub

2.2.2 Patch 2: Class G Grassland

Class G Grassland includes all forms of vegetation (except tussock moorlands) where the overstorey foliage cover is less than 10 %. This includes areas with the occasional tree or shrub, along with pasture and cropland. Grassland areas within the Site and for 30 m beyond the Site boundary to the south and east has since been cleared, while that within the future Rowley Rd Carriageway to the south and that around 100 m to the west remains (Figure 7). Grassland areas within and surrounding the Site are depicted in Figure 4, and shown in Photo ID's 4 and 5.

Patch: 2	**Classification:**	Class G Grassland

Photo ID 4

Photo ID 5

Figure 4: Class G Grassland

2.2.3 Patch 3: Low Threat Vegetation

Vegetation may be considered low threat due to characteristics including flammability, moisture content, or fuel load. Examples include managed parkland/reserve areas, grassland maintained with minimal fuel load through cropping to 20 mm or less, nature strips, wind breaks, market gardens, orchards, and playing fields. These locations are subject to Exclusion Clause 2.2.3.2 (f). Current Low Threat Vegetation subject to Exclusion Clause 2.2.3.2 (f) is present north and west of the Site boundary (Figure 5, Photo ID's 6 and 7):

- Residential backyards containing maintained lawns, gardens, and the occasional tree.
- Pine tree plantation planted in rows, containing small trees (< 2 m tall) cultivated for market as Christmas trees.

Note that for the purposes of the BAL-assessment process, the pines present to the east of the Site (Photo ID 7) will be considered from a worst-case scenario perspective as Class A Forest.

Patch: 3	**Exclusion Clause:**	Exclusion Clause 2.2.3.2 (f)

Photo ID 6

Photo ID 7 (note: will be considered as Class A Forest for the BAL-assessment process)

Figure 5: Low Threat Vegetation

2.2.4 Patch 4: Non-vegetated Areas

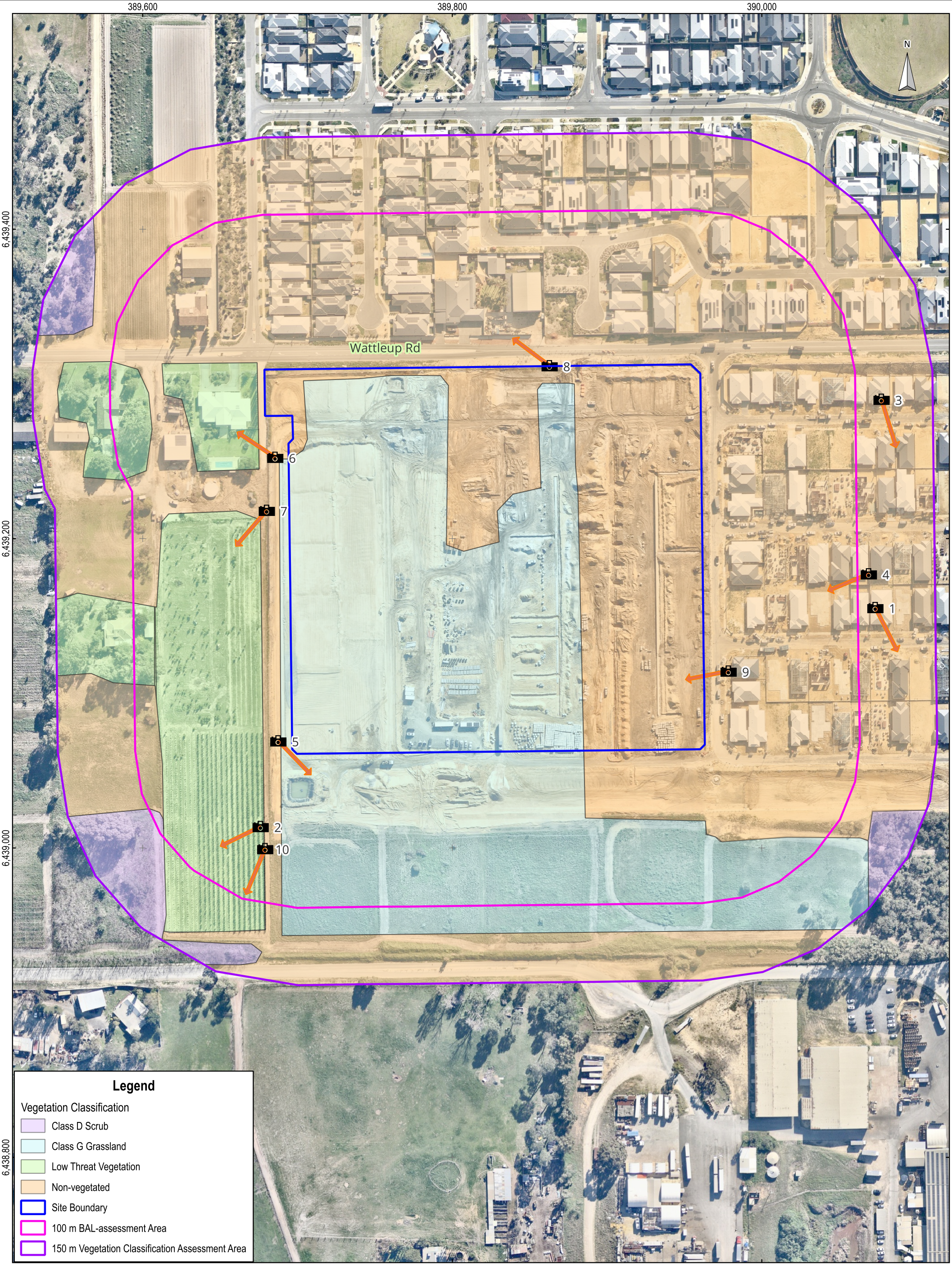
Non-vegetated areas are subject to Exclusion Clause 2.2.3.2 (e). Within and close to the Site, these including (Figure 6):

- Roads and footpaths (Photo ID 8).
- Residential and commercial buildings (Photo ID's 8 and 9).
- Land cleared of vegetation (Photo ID 10), noting that pines have since been planted in this location.

Patch: 4	**Exclusion Clause:**	Exclusion Clause 2.2.3.2 (e)
Photo ID 8		
Photo ID 9		

Photo ID 10 (pines since been planted in this area)

Figure 6: Non-vegetated Areas



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Grid: GDA94 / MGA zone 50 (EPSG:28350)
0 50 100 m

Bushfire Management Plan
Lots 78, 80, 813, and 815
Hammond Quarter West
Qube Hammon Quarter Pty Ltd

Figure 7

Pre-development Vegetation Classification

Surefire ENVIRONMENTAL

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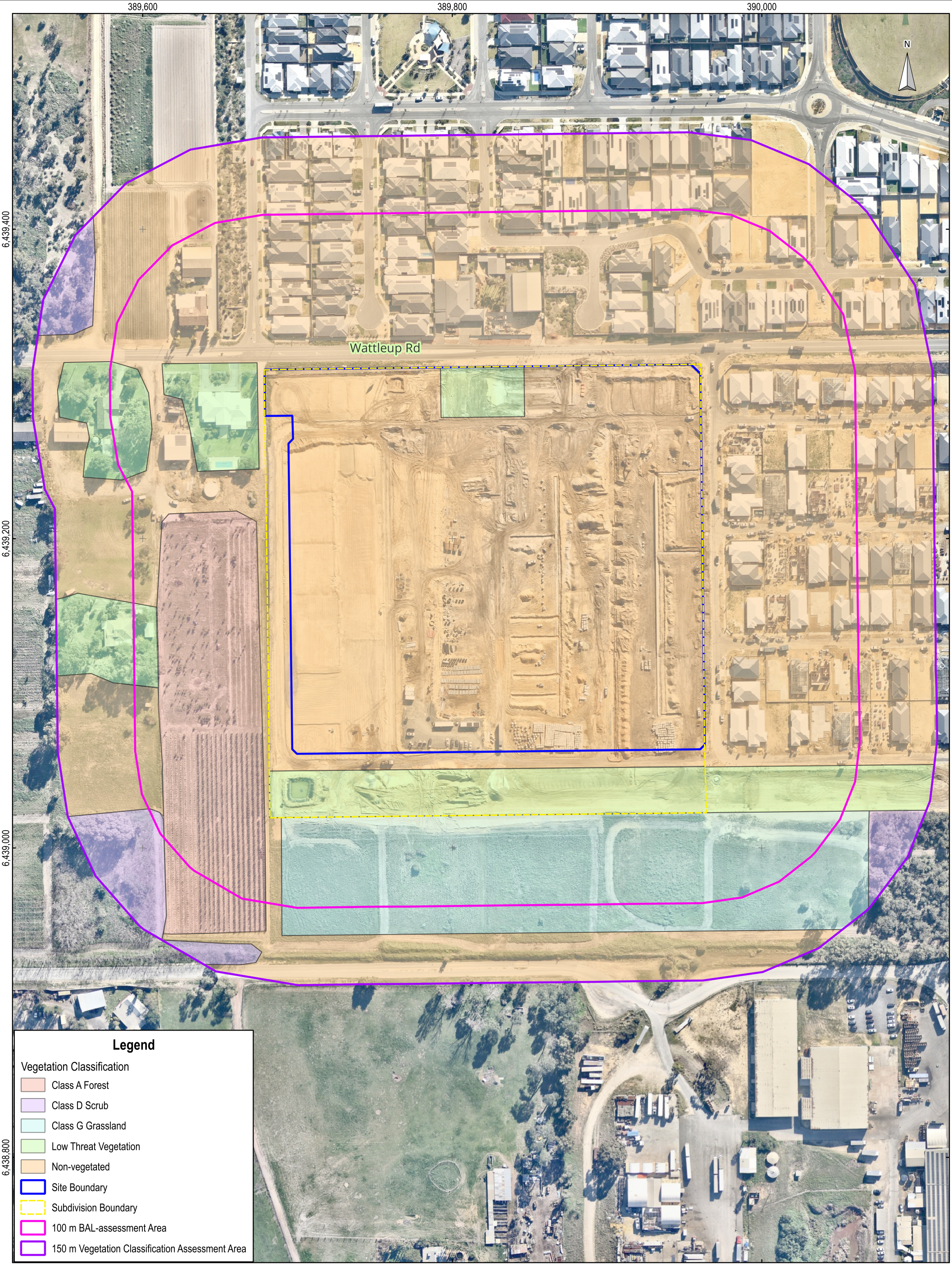

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Grid: GDA94 / MGA zone 50 (EPSG:28350)
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Bushfire Management Plan
Lots 78, 80, 813, and 815
Hammond Quarter West
Qube Hammon Quarter Pty Ltd

Figure 8

Post-development Vegetation Classification

Surefire ENVIRONMENTAL

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2.3 BUSHFIRE HAZARD LEVEL

2.3.1 Bushfire Hazard Assessment

Depending on the vegetation type, a hazard rating of low, moderate, or extreme is assigned. The nature of the vegetation in and around the development area means that the pre-development bushfire hazard rating ranges from Low to Extreme due to the pines being considered as Class A Forrest (Figure 7, Figure 9). All locations within 100 m of the Class A Forest are assigned a Moderate hazard rating due to the increased risk in those locations.

2.3.2 Fire Danger Index

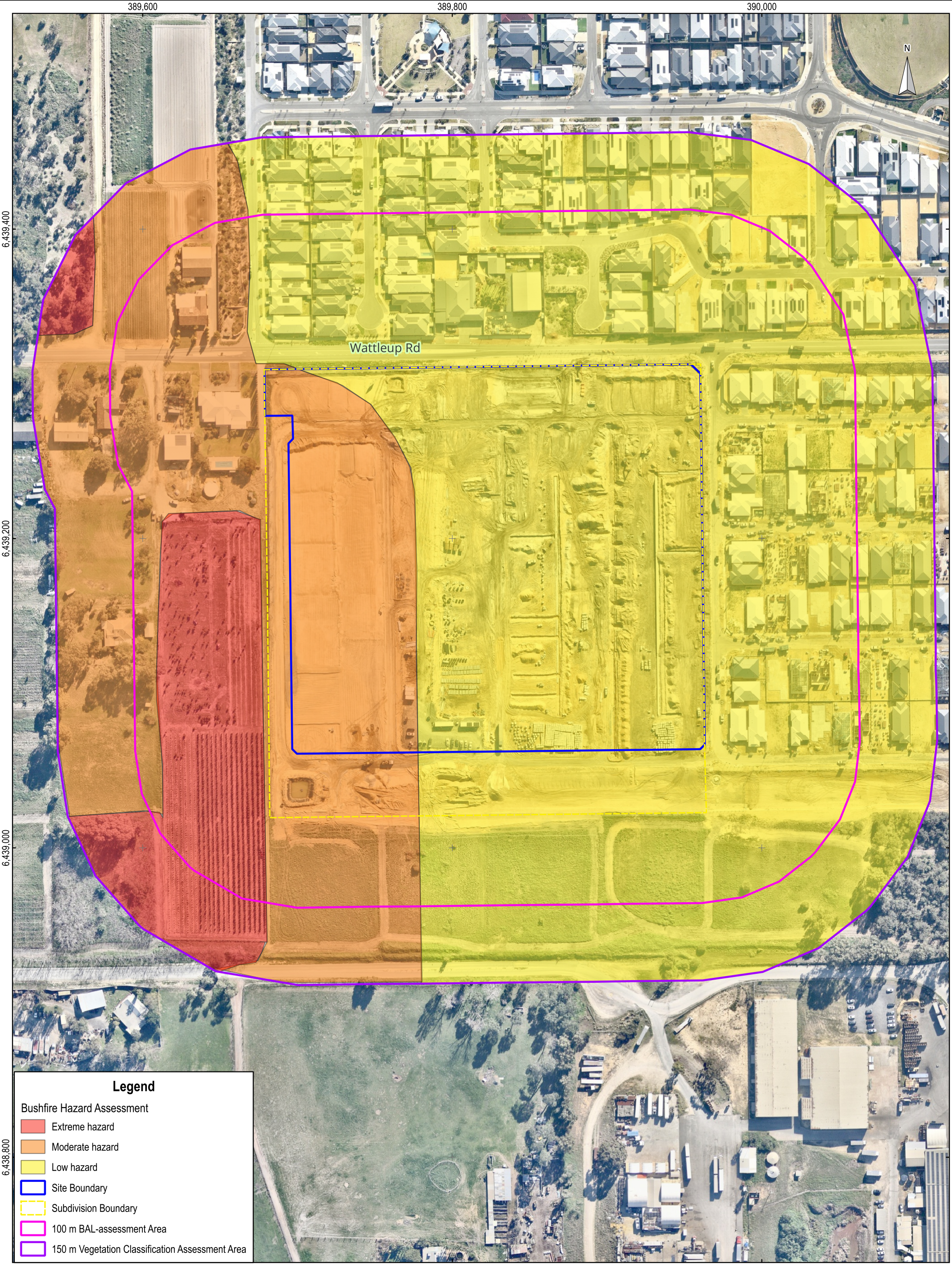
The fire danger index (FDI) for the Site is FDI 80, as documented in Table 2.4.3 of *AS 3959:2018*, and which is the nominated FDI for Western Australia.

2.3.3 Potential Fire Impacts

Potential fire impacts within the Site include smoke and ember attack, with the BAL analysis provided in Table 1.

Table 1: BAL Analysis

Patch	Vegetation Class	Slope	Separation Distance (m)	BAL rating
1	Class D Scrub	Upslope or flat	> 95	BAL-12.5
2	Class G Grassland	Upslope or flat	> 40	BAL-12.5
3	Low Threat Vegetation	Upslope or flat	N/A	BAL-Low
	Current Low Threat Vegetation that will be considered as Class A Forest	Upslope or Flat	> 20	BAL-29
4	Non-vegetated Areas	Upslope or flat	N/A	BAL-Low



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Aerial Imagery: NearMap November 2025
Grid: GDA94 / MGA zone 50 (EPSG:28350)
0 50 100 m

Bushfire Management Plan
Lots 78, 80, 813, and 815
Hammond Quarter West
Qube Hammon Quarter Pty Ltd

Figure 9

Bushfire Hazard Assessment

Surefire ENVIRONMENTAL

C:\Users\Sue. B\Documents\My Documents\Surefire Environmental\Client Folders\Qube Property\Hammond Quarter West\GIS\HQW - updated BAL-model.qgz 21/08/2026 F10 Bushfire Hazard

2.4 BAL-ASSESSMENT

As the Lot layout for the Site is known, it is possible to determine BAL-ratings for each Lot and these are shown in Figure 10. As the pines present to the west will be considered as Class A Forest for the purposes of the BAL-assessment process, this will mean that Lots within 100 m of this vegetation will be assigned a BAL-rating based on that classification. For Lots closest to the pine trees, a BAL-29 rating can be achieved with the application of a 3 m setback from the front Lot boundary; one Lot will be rated BAL-19, and the remaining Lots within 100 m of the pines will be rated BAL-12.5.

While the POS area that will be created south of the development will be landscaped and maintained to low threat condition as per *AS 3959:2018*, it is unknown when the Class G Grassland that is located within the road reserve further south that will accommodate the extension of Rowley Road will be cleared. Accordingly, it will be considered as a worst-case scenario situation, with it presence resulting in the BAL-ratings assigned to the most southerly Lots except the Lot closest to the pines. Note that, consistent with the *Guidelines*, Grassland is considered for a distance of 50 m rather than the 100 m of other vegetation classifications.

The Lot located in the south west corner of the Site will also be influenced by the Class D Scrub with a maximum BAL-12.5 rating being applicable as the scrub is located approximately 95 m south west, however, the BAL-29 assigned based on the consideration of the pines as Class A Forest takes precedence.

2.5 ASSET PROTECTION ZONE

The Asset Protection Zone (APZ) for the Site is the area that provides the separation distance between the edge of the classified vegetation and building walls, with the preferred width of the APZ being 100 m. For locations where a 100-m APZ width cannot be achieved, a reduced APZ can be implemented when a BAL-rating is determined for the building, as is the case for some of the Lots that are the subject of this BMP.

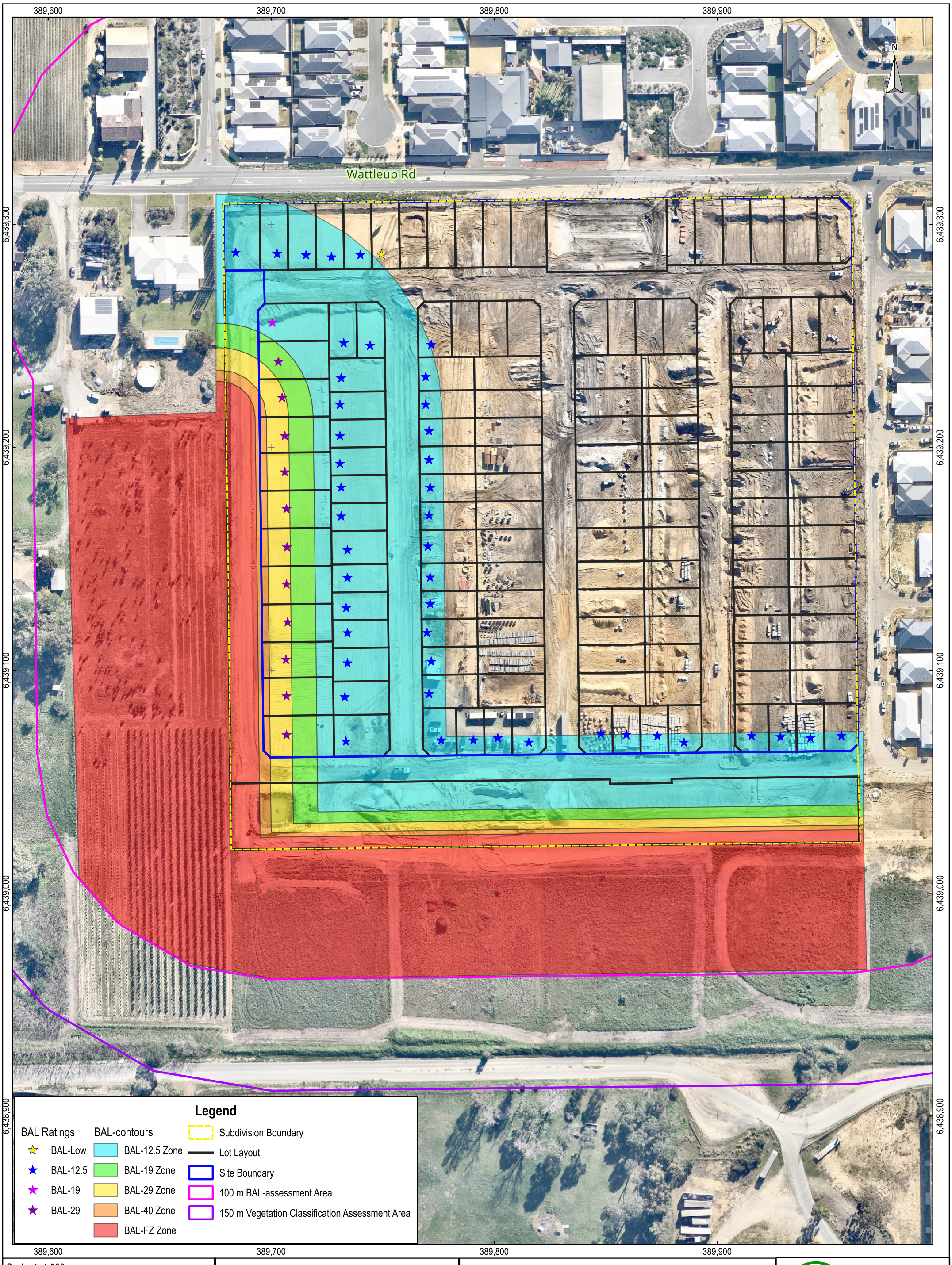
The reduced APZ commences at the junction of the BAL-40 and BAL-29 zones, or the junction of the orange and yellow zones shown in Figure 10, and will extend to the building walls which is the point where the potential radiant heat impact of a bushfire does not exceed 29 kW/m^2. As a suitable separation distance can be demonstrated for each of the Lots that will be created, it indicates that the bushfire risk can be managed within the subdivision area.

2.6 SHIELDING

Clause 3.5 of *AS 3959:2018* allows for a reduction in the nominated construction standard for a building in bushfire prone area where the elevation is not exposed to the source of the bushfire attack, noting that the reduction in building standard cannot reduce below BAL-12.5. As some Lots have a BAL-29 or BAL-19 rating, the shielding provisions of Clause 3.5 may apply.

2.7 OTHER BUSHFIRE PROTECTION MEASURES

No other bushfire protection measures are required for the Site other than those documented in this BMP.



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Grid: GDA94 / MGA zone 50 (EPSG:28350)
0 25 50 m

Bushfire Management Plan
Lots 78, 80, 813, and 815
Hammond Quarter West
Qube Hammon Quarter Pty Ltd

Figure 10

BAL-contours and Ratings

Surefire ENVIRONMENTAL

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2.8 IMPLEMENTATION

Implementation of this BMP will commence immediately and will be the responsibility of the Developer, Qube Hammond Corner Pty Ltd, both for installation and ongoing maintenance until the Site is developed and Lots are sold. The Developer is also responsible for ensuring the occupier or new owner of the Lots located within 100 m of classified vegetation (Figure 10) receives a copy of this BMP to support the building process.

When ownership arrangements change over time, the responsibility for the maintenance of bushfire management measures will devolve to the new owner or managing organisation, noting that landowners or managers are responsible for land under their direct control only. For example, Lot owners will be responsible for ensuring asset protection zones within their property are maintained. Activities that will be involved with the implementation of this plan are described in Table 2, which also includes an indication of maintenance responsibilities associated with a particular activity.

Table 2: Implementation Schedule

Item	Activity	Responsibility	Maintenance	Responsibility
1	Proposed building is constructed in accordance with assigned BAL-rating, with the Developer providing a copy of this BMP to purchasers to inform that process.	Owner/builder	Not required after construction	N/A
2	Planned POS areas are to be managed in a low threat condition as per clause 2.2.3.2 (f) of *AS 3959:2018*.	Developer	If required, review implications of any design changes that result in increased areas of classified vegetation.	Developer
3	The proposed subdivision design is reviewed at future planning phases to ensure the bushfire risk remains manageable.	Developer	As required at future planning phases and/or changes in the indicative design occur.	Developer
4	Hydrant design requirements will be in accordance with the Water Corporation Design Standard 63 for hydrants: • Installation of markings to indicate the presence of hydrants, including: — A blue 'cats eye' reflective indicator in the centre line of the road. — A small blue 'H' painted on the curbing. — A white and red stripe around the pole nearest to the hydrant. • Clearance on the placement of hydrants is required from Department of Fire and Emergency Services (DFES) and the Water Corporation. • Hydrants to be clearly identifiable, with markings installed by the developer prior to sign off.	Developer	As required during various future planning approval phases.	Developer
5	The design and installation of roads will be in accordance with requirements specified in Table 6, Column 1 on page 76 of the Guidelines, with approval required from the City of Cockburn before installation can commence.	Developer	As required during various future planning approval phases.	Developer
6	If required, undertake slashing of any long grass or other low vegetation to 50 mm and other weed control to reduce fuel load within POS areas and low fuel zones under their control.	Developer	As required to ensure grassed areas remain in low-fuel state as defined by *AS 3959:2018*.	Developer
7	Comply with the City of Cockburn's annual fire hazard reduction notice.	Developer	As per the requirements of the City of Cockburn annual fire hazard reduction notice.	Developer

2.9 RESPONSIBILITIES

Responsibilities for bushfire preparedness and response within the development area are shared by the Developer, Qube Hammond Corner Pty Ltd, the City of Cockburn, and building owners/occupiers.

2.9.1 Developer Responsibilities

The Developer is responsible for implementing key portions of this BMP, including:

- Providing a copy of this BMP to owner to inform future building construction standard and approvals.
- Installing and maintaining firebreak/low fuel/asset protection zones on their land.
- Arranging for a notification on titles to inform that some Lots are located within a designated bushfire prone area.
- Ensuring hydrant and road design is in accordance with relevant guidelines.
- Complying with City of Cockburn annual fire hazard reduction notice

2.9.2 City of Cockburn Responsibilities

It should be noted that the City of Cockburn has the responsibility and powers under the Local Planning Scheme and the *Bush Fires Act* 1954 (WA) to ensure that this BMP, annual firebreak notices, any bushfire Information, and any special orders issued under the *Bush Fires Act* 1954 (WA) are complied with.

The City will be responsible for:

- Providing appropriate bushfire advice in relation to firebreaks, hazard reduction, and similar.
- Ensuring appropriate information relating to bushfire prone status is included on titles.
- Ensure that buildings are constructed in accordance with the nominated BAL-rating.

2.9.3 Owner and/or Occupier Responsibilities

It is the responsibility of individual property owners building near the vegetated areas to:

- Ensure that residences are constructed in accordance with the relevant clauses of *AS 3959:2018* for the confirmed BAL-rating.
- Maintain the nominated asset protection zone between the edge of the classified vegetation and building walls.
- If evaporative air conditioners are installed on dwelling(s), install ember shields.
- Respond to/comply with bushfire advice issued by the developer, the City of Cockburn, and/or DFES.

3. COMPLIANCE AND JUSTIFICATIONS

3.1 SPP 3.7 OBJECTIVES AND APPLICATION OF POLICY MEASURES

The intent of *State Planning Policy (SPP) 3.7 Bushfire* (Department of Planning and Western Australian Planning Commission, 2024b) is to ensure that bushfire risks are considered in a timely manner and that planning documents demonstrate the appropriate application of the various policy measures. Table 3 summarises the intent and objectives of SPP 3.7 and provides the indication of how the Site planning is consistent with the intent of SPP 3.7.

Table 3: SPP 3.7 Compliance Indication

SPP Reference	Description	Compliance Indication
Intent	• Ensure that risks associated with bushfires are planned using a risk-based approach.	• Preparation of a BMP in accordance with SPP 3.7. • The assessment process implemented during preparation of this BMP indicates that the risks associated with bushfire are manageable.
Objective 1	• Avoid any increase in the threat of bushfire to people, property, and infrastructure. The preservation of life and the management of bushfire impact are paramount.	• The assessment process implemented during preparation of this BMP indicates that the risks associated with bushfire are manageable. • Some Lots within the Site will have a BAL-rating, with none higher than BAL-29 (Figure 10).
Objective 2	• Reduce vulnerability to bushfire through the identification and consideration of bushfire risks in decision-making at all stages of the planning and development process.	• The assessment process implemented during preparation of this BMP indicates that the risks associated with bushfire are manageable. • Some Lots within the Site will have a BAL-rating, with none higher than BAL-29 (Figure 10).
Objective 3	• Ensure that higher order strategic planning documents, strategic planning proposals, subdivisions and development applications consider bushfire protection requirements and include specified bushfire protection measures.	• The planning process has considered the risk of bushfire in an early stage, with this BMP being prepared at the first planning phase for the Site as it transitions to a residential area. • The preparation of this document has been completed to inform owners of BAL-ratings assigned to Lots ahead of sale and the later building process.
Objective 4	• Achieve an appropriate balance between bushfire risk management measures and, biodiversity conservation values environmental protection and biodiversity management and landscape amenity, with consideration of the potential impacts of climate change.	• Site environmental values have been considered during this, the first phase of the planning approvals process. • Given the lack of biodiversity conservation values nearby, no additional actions to reduce impacts to biodiversity are required.

3.2 BUSHFIRE PROTECTION CRITERIA

Appendix 4 of the *Planning for Bushfire Guidelines for the Implementation of State Planning Policy 3.7 Bushfire (the Guidelines) (*Department of Planning, Lands and Heritage and the Western Australian Planning Commission, 2024a) provides details of the acceptable bushfire protection solutions that can be used to demonstrate how a location can be developed in bushfire prone areas. Table 4 demonstrates the Site's Compliance with Bushfire Protection Criteria and Figure 10 provides the Lot layout with BAL-contours and ratings for the Lots.

Table 4: Compliance with Bushfire Protection Criteria

Intent	Acceptable Solutions	Solution
Element 1: Location		
Ensure that strategic planning proposals, subdivision and development applications are located in areas with the least possible risk of bushfire to facilitate the protection of people, property and infrastructure	**A1.1 Development Location**	
	Bushfire hazard assessment is or will on completion be moderate or low.	• The subdivision is in an area where the bushfire hazard level is manageable. • Several Lots within the Site will have a BAL rating, with none higher than BAL-29 (Figure 10).
	BAL rating is BAL-29 or lower.	• The bushfire hazard assessment process carried out during preparation of this BMP indicates that the bushfire risk is manageable. • Several Lots within the Site will have a BAL rating, with none higher than BAL-29 (Figure 10).
Element 2: Siting and Design of Development		
To ensure that the siting and design of development minimises the level of bushfire impact	**A2.1 Asset Protection Zone (APZ)**	
	Every habitable building is surrounded by, and every proposed lot can achieve an APZ depicted on plans that meets the following: • **Width** — bushfire radiant heat does not exceed radiant heat of 29 kW/m^2 (BAL-29) as measured from any external wall or supporting post or column in all circumstances. • **Location** — APZ contained solely within the boundaries of the Lot on which the building is situated, except in instances where the neighbouring lot(s) will be managed in a low-fuel state on an ongoing basis, in perpetuity. • **Management** — the APZ is managed in accordance with the requirements of '*Standards for Asset Protection Zones*' (Schedule 1 on page 71 of the Guidelines).	• The APZ coincides with the boundary between BAL-40 and BAL-29 zones (Figure 10) and includes roads and cleared areas. • The Subdivision design provides for a suitable APZ width to ensure that the radiant heat does not exceed 29 kW/m^2 (BAL-29) as measured from any external wall or supporting post or column in all circumstances. • Several Lots within the Site will have a BAL rating, with none higher than BAL-29 (Figure 10).

Intent	Acceptable Solutions	Solution
Element 3: Vehicular Access		
Ensure that the vehicular access serving a subdivision/ development is available and safe during a bushfire event. To achieve the intent, all applicable acceptable solutions must be addressed: • SP – Strategic planning proposal and structure plan where the lot layout is not known. • Sb – Structure plan where the lot layout is known and subdivision application. • Dd – Development application for a single dwelling, ancillary dwelling, or minor development. • Do – Development application for any other development that is not a single dwelling, ancillary dwelling, or minor development.	**A3.1 Public Roads (SP Sb Do)**	
	Public roads are to meet the minimum technical requirements in Table 6, Column 1 on page 76 of the Guidelines. The trafficable (carriageway/pavement) width is to be in accordance with the relevant class of road in the Local Government Guidelines for Subdivisional Development (IPWEA Subdivision Guidelines), Liveable Neighbourhoods, Austroad standards and/or any applicable standards for the local government area.	Public roads associated with these stages will be constructed in accordance with the technical requirements outlined in the *Guidelines* and be consistent with those constructed during the development of earlier subdivision stages.
	A3.2a Multiple Access Routes (SP Sb Do)	
	Public road access is to be provided in two different directions to at least two different suitable destinations with an all-weather surface (two-way access).	Access and egress from the subdivision is available to at least two different destinations, with several north/south and east-ward access options via the current and planned road network to Wattle-up Road, and later to what will become Rowley Road to the south (Figure 10).
	If the public road access is via a no-through road that cannot be avoided due to demonstrated site constraints, the road access is to be a maximum of 200 m from the subject lot(s) boundary to an intersection where two-way access is provided.	N/A —all roads are through roads.
	A no-through road may exceed 200 m if it is demonstrated that an alternative access way cannot be provided due to site constraints and the following requirements are met: • The no-through road travels towards a suitable destination. • The balance of the no-through road that is greater than 200 m from the subject site is wholly within BAL-Low or is in a residential built-out area (Figure 23 on page 81 of the guidelines).	N/A — all roads are through roads.
	A3.2b Emergency Access Way (SP Sb Do)	
	Where it is demonstrated that A3.2a cannot be achieved due to site constraints, or where an alternative design option does not exist, an emergency access way can be considered as an acceptable solution. An emergency access way is to meet all the following requirements: • Requirements in Table 6, Column 2 on page 76 of the guidelines. • Provides a through connection to a public road.	N/A — access will be the existing and planned road network.

Intent	Acceptable Solutions	Solution
	• Be no more than 500 m. • Must be signposted and if gated, gates must open the whole trafficable width and remain unlocked.	
	A3.3 Through-roads (SP Sb)	
	All public roads should be through-roads. No-through roads should be avoided and should only be considered as an acceptable solution where: • It is demonstrated that no alternative road layout exists due to site constraints, and • The no-through road is a maximum length of 200 m to an intersection providing two-way access unless it satisfies the exemption provisions in A3.2a.	N/A — all roads are through roads.
	A no-through road is to meet all the following requirements: • Requirements of a public road (Table 6, Column 1, Page 76). • Turn-around area as shown in Figure 24 on page 81 of the Guidelines.	N/A — all roads are through roads.
	A3.4a Perimeter Roads (SP Sb)	
	A perimeter road is a public road and should be provided for greenfield or infill development where 10 or more lots are being proposed, including as part of a staged subdivision, with the aim of: • Separating areas of classified vegetation under *AS 3959* that adjoin the subject site from the proposed lots, and • Removing the need for battle-axe lots that back onto areas of classified vegetation.	Perimeter roads include Wattleup Road to the north and planned roads around the subdivision area to the west, south, and east that provide access to Wattleup Road as well as to the subdivision that is being progressed to the east (Figure 10).
	A perimeter road is to the meet the requirements contained in Table 6, Column 1 on page 76 of the Guidelines.	Construction of interior perimeter roads will be in accordance with the *Guidelines* and be consistent with previous road construction within the broader subdivision
	A perimeter road may not be required where: • The adjoining classified vegetation is Class G Grassland. • Lots are zoned for rural living or equivalent. • It is demonstrated that it cannot be provided due to site constraints. • All lots have frontage to an existing public road.	N/A — perimeter roads have been provided in the subdivision design.

Intent	Acceptable Solutions	Solution
	A3.4b Fire Service Access Route (SP Sb)	
	Where proposed lots adjoin classified vegetation under *AS 3959* (excluding Class G Grassland) and a perimeter road is not required in accordance with A3.4a, a fire service access route can be considered as an acceptable solution to provide firefighter access, where access is not available, to the classified vegetation. A fire access route is to meet all the following requirements: • Requirements in Table 6 Column 3 on page 76 of the Guidelines. • Be through-routes with no dead-ends. • Linked to the internal road system at regular intervals, every 500 m. • Must be signposted. • No further than 500 m from a public road. • If gated, gates must open the required trafficable width and be locked by the local government and/or emergency services, if keys are provided for each gate. • Turn-around areas designed to accommodate type 3.4 fire appliances and to enable them to turn around safely every 500 m.	N/A — fire access will be via the existing and planned road network.
	A3.5 Battle-axe Access Legs (Sb)	
	Where it is demonstrated that a battle-axe access leg cannot be avoided due to site constraints, it can be considered as an acceptable solution. There are no battle-axe technical requirements where the point of the battle-axe access leg joins the effective area of the battle-axe lot is less than 50 m from a public road in a reticulated water area.	N/A — there are no battle-axe Lots planned.
	In circumstances where the above condition is not met, or the battle-axe lot is in a non-reticulated water area, the battle-axe access leg is to meet all the following requirements: • Requirements in Table 6, Column 4 on page 76 of the Guidelines. • Passing bays every 200 m with a minimum length of 20 m and minimum additional trafficable width of 2 m (i.e. the combined trafficable width of the passing bay and constructed driveway to be a minimum 6 m).	N/A — there will be no battle-axe Lots.

Intent	Acceptable Solutions	Solution
	A3.6 Private Driveways (Dd Do)	
	There are no private driveway technical requirements where the private driveway is: • Within a lot serviced by reticulated water. • No greater than 70 m in length between the most distant external part of the development site and the public road as measured as a hose lay. • Accessed by a public road where the road speed limit is not greater than 70 km/h.	N/A — there will be no private driveways.
	In circumstances where all the above conditions are not met, or the private driveway is in a non-reticulated water area, the private driveway is to meet all the following requirements: • Requirements in Table 6, Column 4 on page 76 of the Guidelines. • Passing bays every 200 m with a minimum length of 20 m and minimum additional trafficable width of 2 m (i.e. the combined trafficable width of the passing bay and constructed driveway to be a minimum 6 m). • Turn around areas as shown in Figure 28 on page 86 of the Guidelines and within 30 m of the habitable building.	N/A — there will be no private driveways.
Element 4: Water		
Ensure that water is available to enable people, property, and infrastructure to be defended from bushfire. To achieve the intent, all applicable acceptable solutions must be addressed: • SP – Strategic planning proposal and structure plan where the lot layout is not known. • Sb – Structure plan where the lot layout is known and subdivision application. • Dd – Development application for a single dwelling, ancillary	**A4.1 Identification of Future Water Supply (SP)**	
	Evidence that a reticulated or sufficient non-reticulated water supply for bushfire fighting can be provided at the subdivision and/or development application stage, in accordance with the specifications of the relevant water supply authority or the requirements of Schedule 2 on Page 90 of the Guidelines.	The Lots are located in an area with a reticulated water supply available for firefighting purposes.
	Where the provision of a strategic water tank(s) is required in a suitable area within a road reserve or a dedicated lot the location should be identified on the structure plan to the satisfaction of the local government.	N/A — subdivision will be connected to a reticulated water supply.
	A4.2 Provision of Water for Firefighting Purposes (Sb Dd Do)	
	Where a reticulated water supply is existing or proposed, hydrant connection(s) should be provided in accordance with the specifications of the relevant water supply authority. Where these specifications cannot be met, then the following applies: • The provision of a water tank(s) in accordance with the requirements of Schedule 2 on page 90 of the guidelines.	Hydrants will be installed in accordance with Water Corporation Design Standard DS 63.

Intent	Acceptable Solutions	Solution
dwelling, or minor development. • **Do** – Development application for any other development that is not a single dwelling, ancillary dwelling, or minor development.	• Where the provision of a strategic water tank(s) is applicable, then the following requirements apply: — Land to be ceded free of cost to the local government for the placement of the tank(s). — The lot or road reserve where the tank is to be located is identified on the plan of subdivision. — Tank capacity, construction, and fittings provided in accordance with the requirements of Schedule 2 on page 90 of the Guidelines. — A strategic water tank is to be located no more than 10 minutes from the subject site (at legal road speeds). Where a subdivision includes an existing habitable building(s) that is to be retained, a water supply should be provided to this existing habitable building(s) in accordance with the requirements listed above.	
Element 5: Vulnerable Tourism Land Uses		
Provide for bushfire protection for tourism land uses relevant to the characteristics of the occupants and/or the location, to preserve life and reduce the impact of bushfire on property and infrastructure. All applicable acceptable solutions must be addressed.	Every habitable building is surrounded by Asset Protection Zone (APZ) in accordance with Element 2: Siting and Design of Development — A2.1 APZ.	N/A
	Habitable buildings are sited and designed to: • Minimise clearing of existing vegetation. • Provide hazard separation between classified vegetation and a development site that is managed in perpetuity to protect life, prevent the spread of, and manage the impacts of fire.	N/A
	Suitable access/egress is provided for users of tourism sites.	N/A
	Adequate water is available for firefighting purposes in the event of a bushfire.	N/A

3.3 COMPLIANCE WITH RELEVANT DOCUMENTS

Sections 3.1 and 3.2 demonstrate how the Site within Hammond Quarter West will comply with State Planning Policy 3.7 Bushfire (Department of Planning, Lands and Heritage (DPLH)), and the Western Australian Planning Commission (WAPC) (2024b)), and *Planning for Bushfire Guidelines for the Implementation of State Planning Policy 3.7 Bushfire (*the *Guidelines)* (Department of Planning, Lands and Heritage and the Western Australian Planning Commission, 2024a).

Site owners/occupiers must comply with relevant sections of the annual firebreak notice and bushfire information prepared by the City of Cockburn, such as total fire ban and hazard reduction programs.

3.4 COMPLIANCE STATEMENT

This BMP has been prepared in accordance with the requirements of State Planning Policy 3.7 Bushfire (Department of Planning, Lands and Heritage (DPLH)), and the Western Australian Planning Commission (WAPC) (2024b)), and *Planning for Bushfire Guidelines for the Implementation of State Planning Policy 3.7 Bushfire (*the *Guidelines)* (Department of Planning, Lands and Heritage and the Western Australian Planning Commission, 2024a). The information contained in this document represents site conditions based on the initial site visit on 15 March 2024, subsequent site visits, and associated planning.

Signed:

Date: 25 August 2026

Accreditation Number: BPAD 36638

Accreditation Expiry Date: 30 April 2027

BPAD
Bushfire
Planning & Design
Accredited Practitioner
Level 2

4. REFERENCES

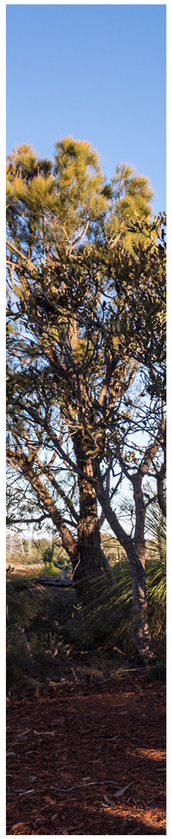
AS 3959:2018. Construction of Buildings in Bushfire-Prone Areas. Standards Australia, NSW.

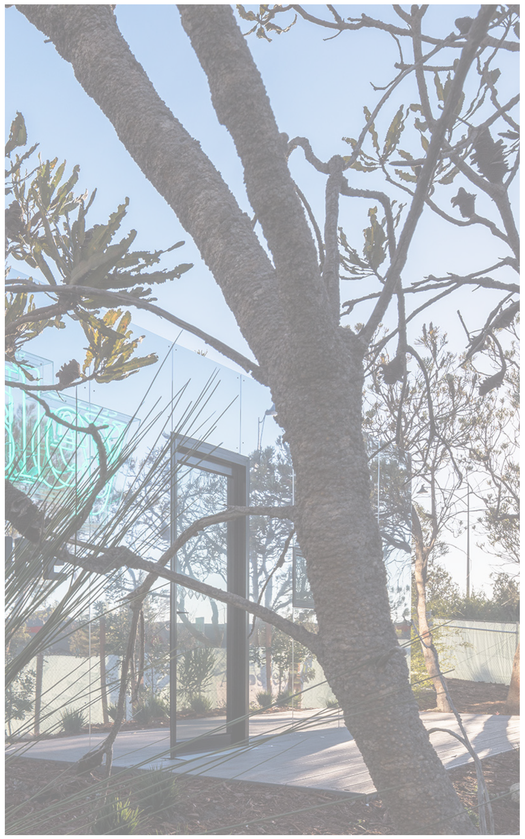
Department of Planning, Lands and Heritage (DPLH) and the Western Australian Planning Commission (WAPC), (2024a), *Planning for Bushfire Guidelines for the Implementation of State Planning Policy 3.7 Bushfire* (the *Guidelines*), Western Australian Planning Commission, Perth, Western Australia.

Department of Planning and Western Australian Planning Commission, (2024b) *State Planning Policy 3.7 Bushfire* (SPP 3.7), Western Australian Planning Commission, Perth Western Australia.

Mitchell, Williams and Desmond. 2002. *Swan Coastal Plain 2 (SWA2 – Swan Coastal Plain subregion*), Department of Conservation and Land Management.

APPENDIX 1: LANDSCAPE MASTERPLAN





HAMMOND QUARTER LSP AMENDMENT

landscape masterplan | July 2026 [E]

PLAN E

LANDSCAPE ARCHITECTS

LEVEL 1 278 RAILWAY PDE WEST LEEDERVILLE WA 6007
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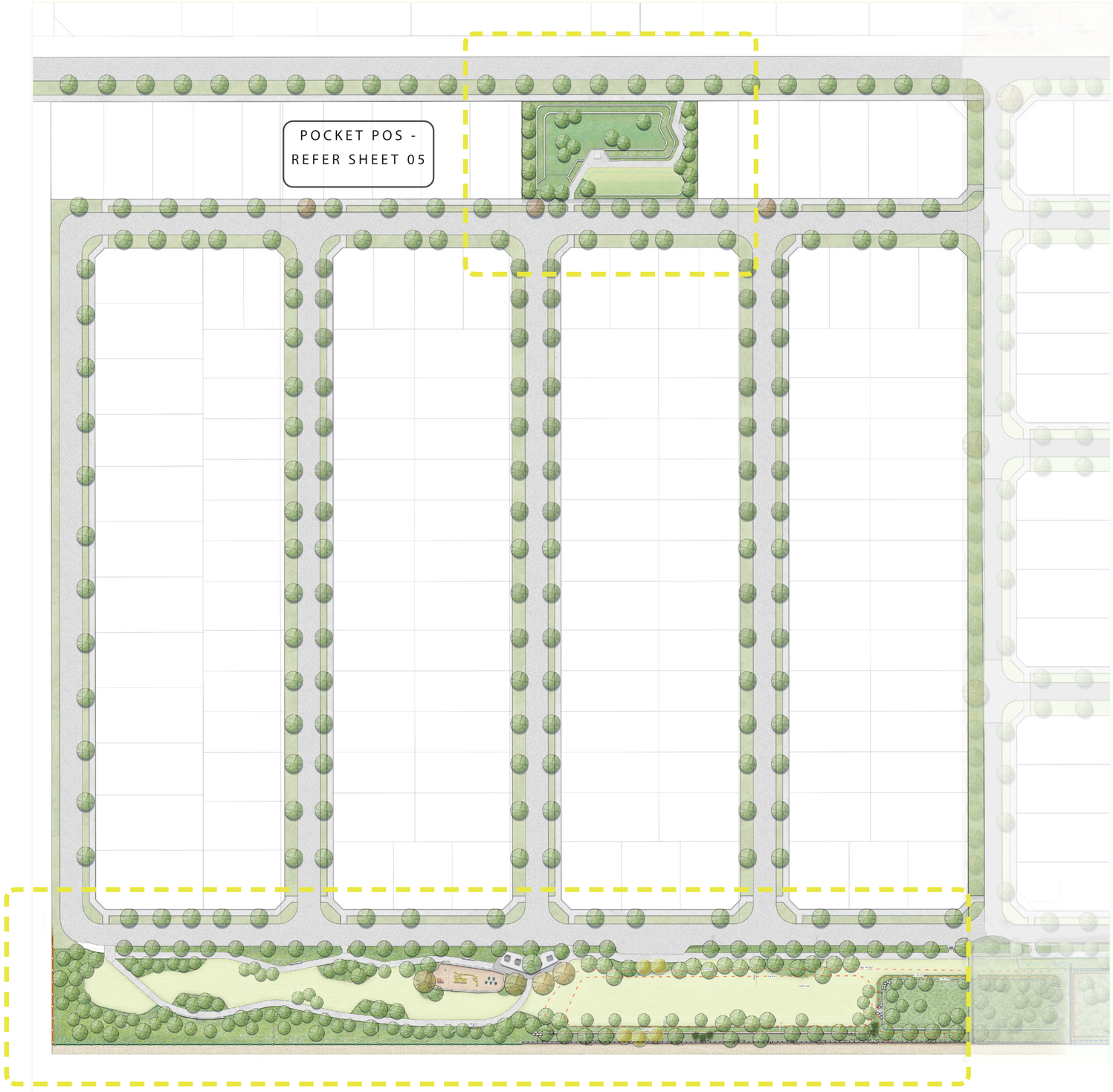
QUBE

01 | MASTERPLAN

TERRACING

MANUFACTURED SHADE



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JULY 2026

M1.102

REV E
1:700 @ A1

0 7 14 28 42 70m

2102805 HAMMOND CORNER- landscape concept

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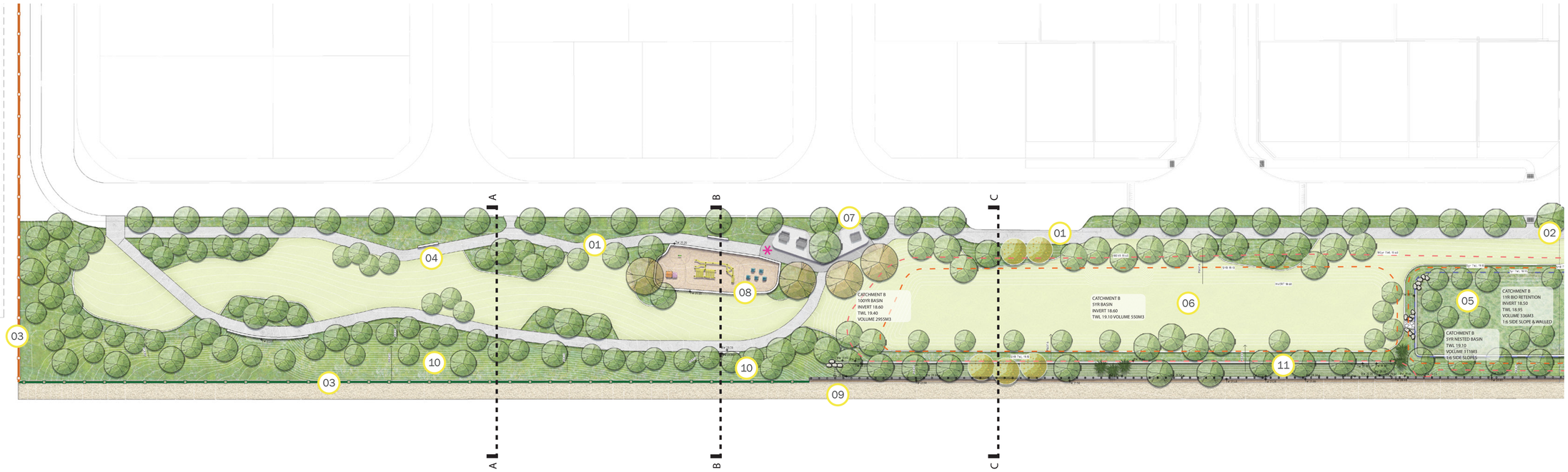
02 LINEAR POS
PLAN

LEGEND

- PROPOSED TREE PLANTING
- 01 CONCRETE FOOTPATH EXTENDS LINEAR POS WALKABLE NETWORK
- 02 FUTURE PATH CONNECTION WITH HAMMON SOUTH LINEAR POS
- 03 CONSERVATION FENCE
- 04 SEATING WALLS OVERLOOKING TURF & PLANTING
- 05 PLANTED BIORETENTION BASIN WITH WINTER-WET NATIVE TREES AND PLANT SPECIES.
- 06 TURFED 1:100 BASIN AREA
- 07 SHADE STRUCTURE WITH SEATING AND BBQ
- 08 PLAYGROUND AREA WITH SHADE TREES
- 09 CRUSHED GRAVEL ACCESS TRACK THROUGH POS
- 10 1:4 MAX EARTHWORKS BATTER
- 11 1:6 MAX EARTHWORKS BATTER
- ALL-AGES FITNESS EQUIPMENT NODE



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REV E
1:400 @ A1

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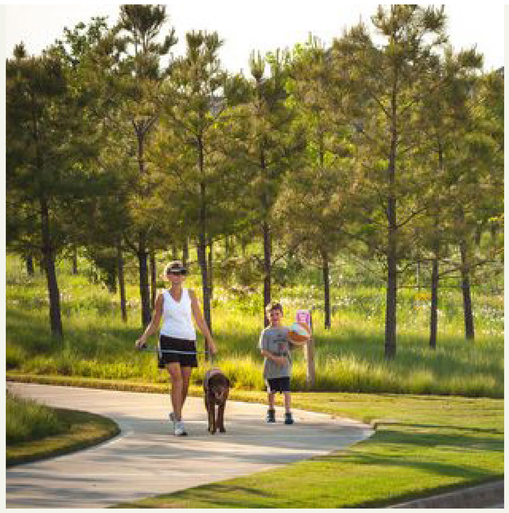
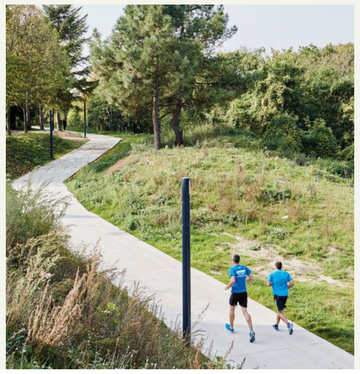
03 | IMAGERY





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M1.104

REV E
1:100 @ A1

0 1 2 4 6 10m

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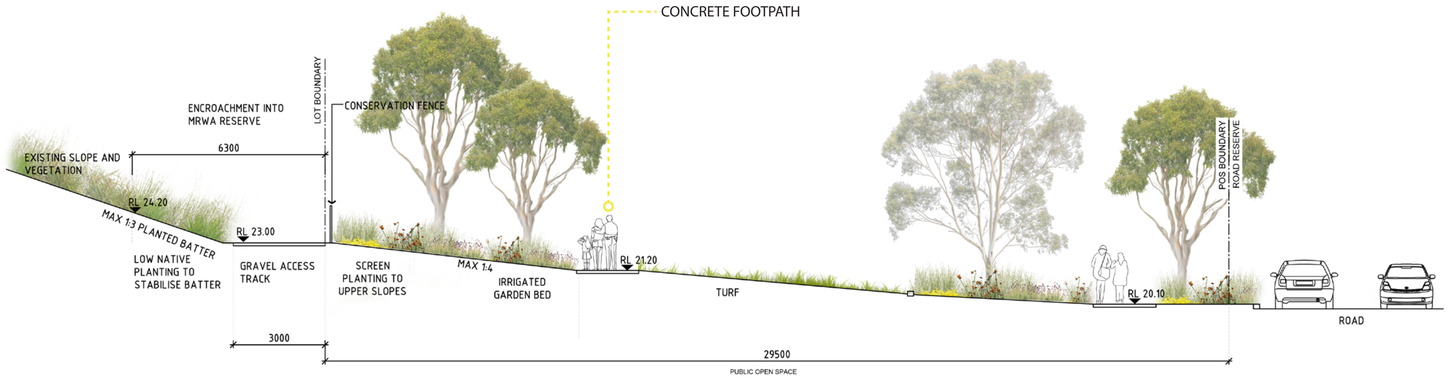
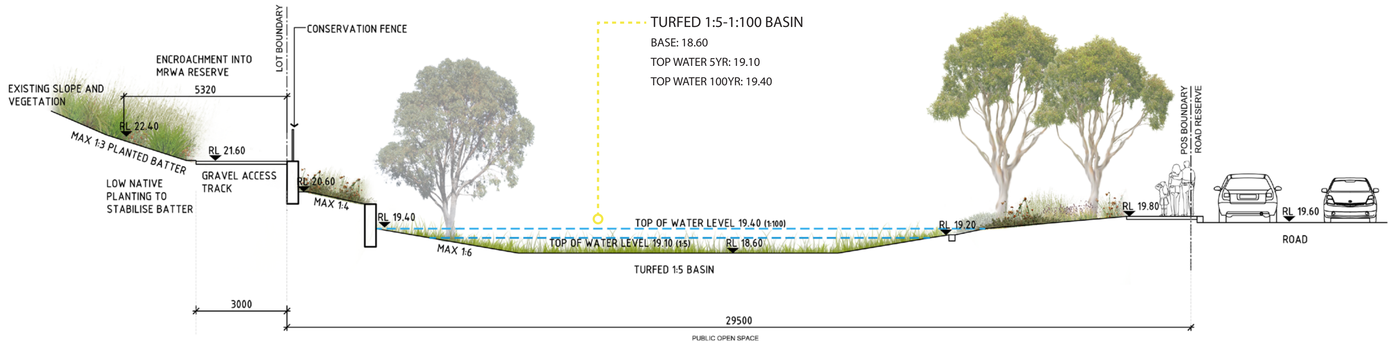
04 LINEAR POS
CROSS SECTIONS

SECTION A - A



SECTION B - B

SECTION C - C



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1:100 @ A1

0 1 2 4 6 10m

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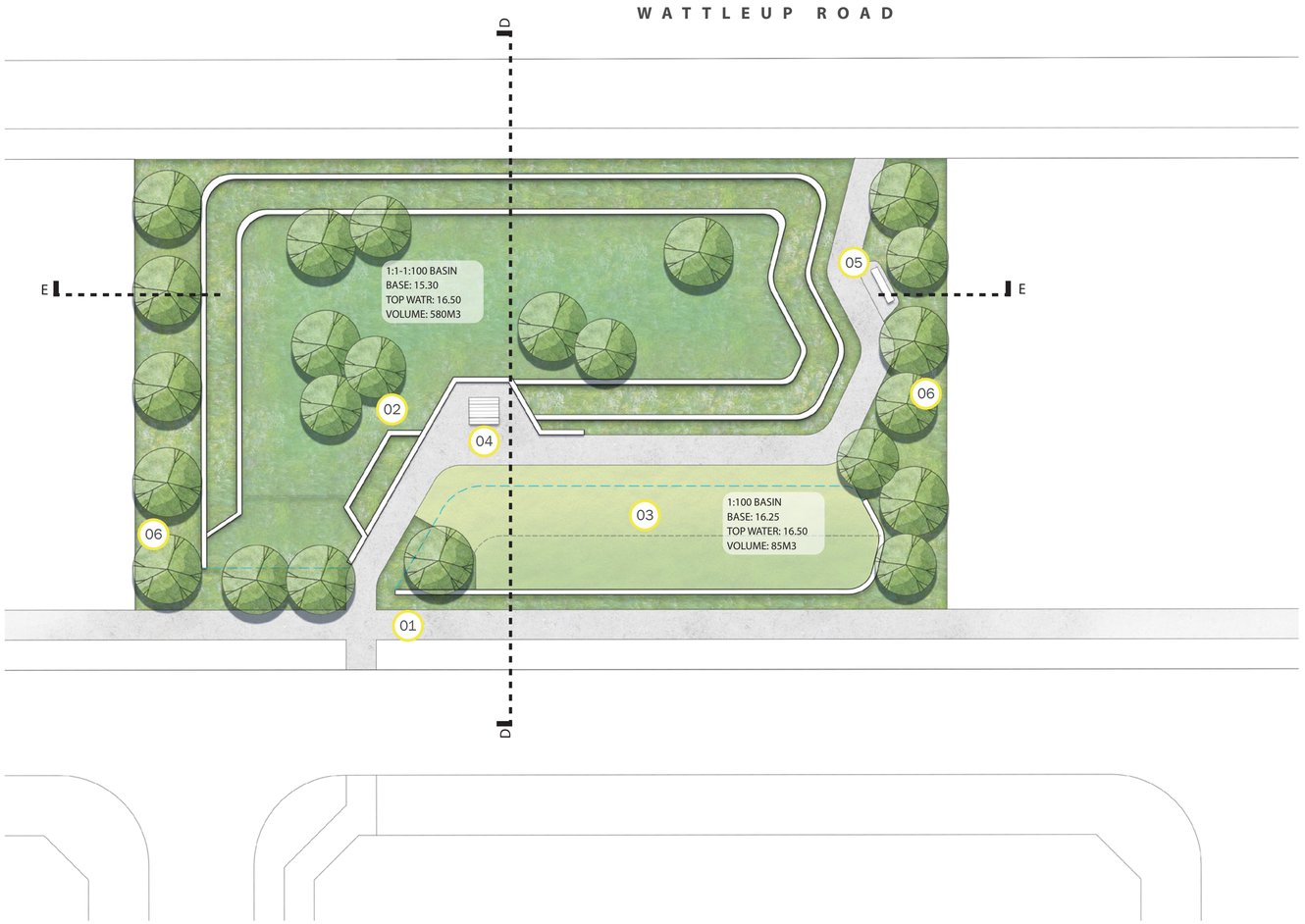
05 POCKET PARK
PLAN

LEGEND

- PROPOSED TREE PLANTING.
- 01 CONCRETE FOOTPATH CONNECTS TO WATTLEUP ROAD
- 02 PLANTED 1:1-1:100 BASIN
- 03 TURF 1:100 OVERFLOW BASIN
- 04 RAISED SEATING PLATFORM OVERLOOKING BASIN
- 05 SEATING NODE
- 06 SCREENING TREES AND PLANTING ALONG LOT BOUNDARY



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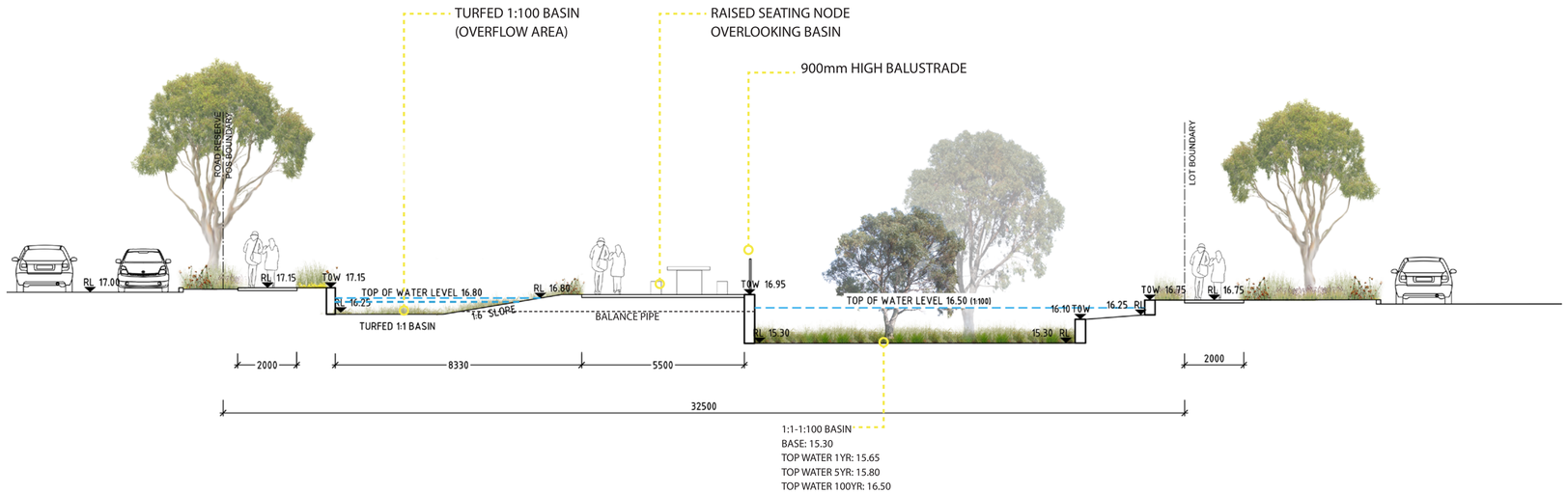
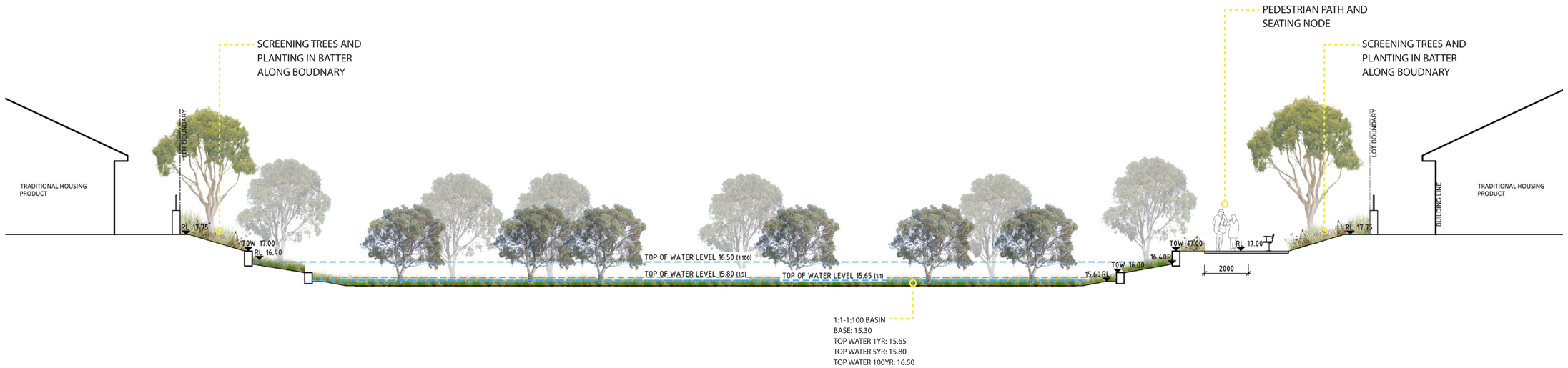
06 POCKET PARK
PLAN

SECTION D - D



SECTION E - E



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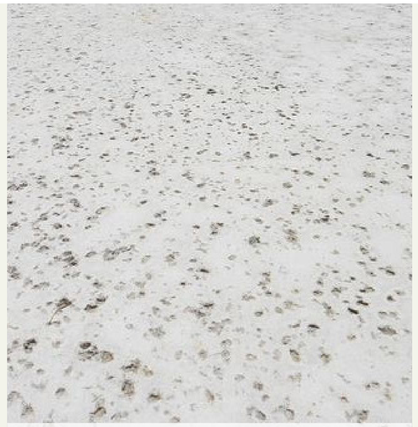
07 MATERIALS PALETTE
HARDWORKS

EXPOSED CONCRETE



ROCK SALT CONCRETE

COMPOSITE DECKING

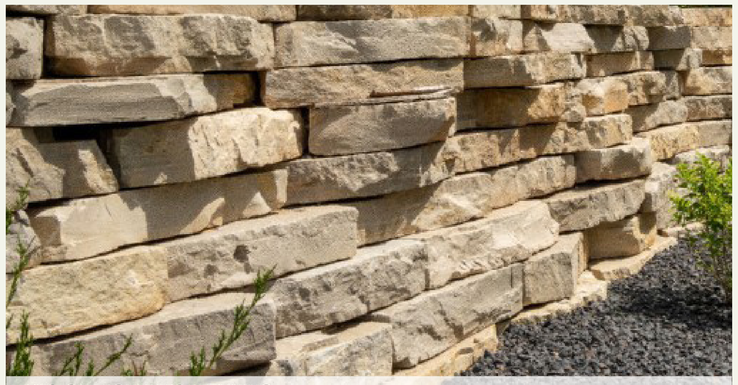
LIMESTONE RETAINING WALLS

POWDER COATING

FEATURE BRICK

EXPOSED CONCRETE

RAMMED EARTH WALL



LIMESTONE BOULDERS RETAINING

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08 PLANTING PALETTE
TREES

BANKSIA WOODLAND

BANKSIA ATTENUATTA

BANKSIA GRANDIS

BANKSIA ILLICIFOLIA

BANKSIA MENZIESSII

MACROZAMIA RIEDLEI

XANTHORRHOEA PRIESSII

SMALL TREES

ACACIA SALIGNA

CALLISTEMON KING S PARK SPECIAL

EUCALYPTUS VICTRIX

HAKEA LAURINA

KUNZEA GLABRASCENS

MELALEUCA LANCEOLATA

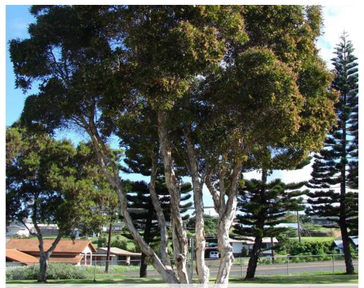
LARGE TREES

ALLOCASUARINA FRASERIANA

EUCALYPTUS GOMPHOCEPHALA

EUCALYPTUS MARGINATA

MELALEUCA LEUCADENDRA


MELALEUCA RHAPHIOPHYLLA

TRISTANIOPSIS LAURINA

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JULY 2026

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REV E

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09 PLANTING PALETTE
SHRUBS

GROUNDCOVERS

ACACIA SALIGNA GREEN CARPET

CONOSTYLIS CANDICANS

CALOTHAMNUS QUADRIFIDUS PROSTRATE

DAMPIERA LINEARIS

KENNEDIA PROSTRATA

MYOPORUM PARVIFOLIUM FINE LEAF

SHRUBS LOW

ANIGOZANTHOS HUMILIS

BANKSIA NIVEA PROSTRATE

CALOTHAMNUS CLEAN AND GREEN

CONOSTYLIS ACULEATA

DIANELLA REVOLUTA

PATTERSONIA OCCIDENTALIS

SHRUBS

ANIGOZANTHOS MANGLESSII

HAKEA PROSTRATA

HIBBERTIA HYPERICOIDES

MELALEUCA HUEGELII

SCAEVOLA CRASSIFOLIA

VERTICORDIA DENSIFLORA

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REV E

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Bushfire Management Plan Coversheet

This Coversheet and accompanying Bushfire Management Plan has been prepared and issued by a person accredited by Fire Protection Association Australia under the Bushfire Planning and Design (BPAD) Accreditation Scheme.

Bushfire Management Plan and Site Details

Site Address / Plan Reference:	Lots 117, 805, 809 and 9001 - 9003 Wattleup Road				
Suburb:	Hammond Park	**State:**	WA	**P/code:**	6164
Local government area:	City of Cockburn				
Description of the planning proposal:	Residential Development				
BMP Plan / Reference Number:		**Version:**	Revision 2.1	**Date of Issue:**	22 December 2023
Client / Business Name:	LWP Property Group Pty Ltd and Qube Property Group Pty Ltd				

Reason for referral to DFES	Yes	No
Has the BAL been calculated by a method other than method 1 as outlined in AS3959 (tick no if AS3959 method 1 has been used to calculate the BAL)?	☐	☒
Have any of the bushfire protection criteria elements been addressed through the use of a performance principle (tick no if only acceptable solutions have been used to address all of the BPC elements)?	☐	☒
Is the proposal any of the following special development types (see SPP 3.7 for definitions)?		
Unavoidable development (in BAL-40 or BAL-FZ)	☐	☒
Strategic planning proposal (including rezoning applications)	☐	☒
Minor development (in BAL-40 or BAL-FZ)	☐	☒
High risk land-use	☐	☒
Vulnerable land-use	☐	☒

If the development is a special development type as listed above, explain why the proposal is considered to be one of the above listed classifications (E.g. considered vulnerable land-use as the development is for accommodation of the elderly, etc.)?

Note: The decision maker (e.g. local government or the WAPC) should only refer the proposal to DFES for comment if one (or more) of the above answers are ticked "Yes".

BPAD Accredited Practitioner Details and Declaration

Name Sue Brand	**Accreditation Level** Level 2 BPAD Practitioner	**Accreditation No.** 36638	**Accreditation Expiry** 30 April 2024
Company MBS Environmental		**Contact No.** 0439 435 110	

I declare that the information provided within this bushfire management plan is to the best of my knowledge true and correct

Signature of Practitioner	SBrand	**Date**	22 December 2023

BUSHFIRE MANAGEMENT PLAN

LOTS 117, 805, 809 AND 9001 – 9003 WATTLEUP ROAD, HAMMOND PARK

PREPARED FOR:

LWP CAPITAL PTY LTD
FOR THE WATTLEUP SYNDICATE
AND
QUBE PROPERTY GROUP PTY LTD

DECEMBER 2023

PREPARED BY:

Martinick Bosch Sell Pty Ltd
4 Cook Street
West Perth WA 6005
Ph: (08) 9226 3166
Email: info@mbsenvironmental.com.au
Web: www.mbsenvironmental.com.au

MBS ENVIRONMENTAL

MARTINICK BOSCH SELL PTY LTD
ABN 60 102 614 479
MBS ENVIRONMENTAL
environmental and geoscience consultants

WATTLEUP ROAD PROPOSED SUBDIVISION
BUSHFIRE MANAGEMENT PLAN

Distribution List:

Company	Contact name	Copies	Date
Qube Property Group	Matt Cousins, Development Manager	[01]	22 December 2023
LWP Capital Pty Ltd	Alf Lay, Group Manager, Development	[02]	22 December 2023

Document Control for Job Number: LWPWBMP

Document Status	Prepared By	Authorised By	Date
Draft Report	Sue Brand	Colin Davies	18 July 2022
Final Report	Sue Brand	Colin Davies	14 September 2022
Revision 1	Sue Brand	Colin Davies	29 November 2022
Revision 2	Sue Brand	Sue Brand	31 October 2023
Revision 2.1	Sue Brand	Sue Brand	22 December 2023

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1. BACKGROUND INFORMATION

Qube Property Group Pty Ltd (Qube) and LWP Capital Pty Ltd (LWP Capital) for the Wattleup Syndicate in association with Primewest are planning to develop Lots 117, 805, 809 (now Lot 803), 9001, 9002, and 9003 Wattleup Road Hammond Park (the Site) within the City of Cockburn (the City) as a residential subdivision (Figure 1, Figure 2). Martinick Bosch Sell Pty Ltd (MBS Environmental, MBS) were engaged to prepare a bushfire management plan (BMP) to support the planning approvals process. The broad aim of the assessment process was to identify potential bushfire risks to future properties along with their management when the site is developed.

The Site is located within a bushfire prone area as designated by the Fire and Emergency Services Commissioner, Office of Bushfire Risk Management (OBRM), within the Department of Fire and Emergency Services (2021). Accordingly, there is a requirement for landowners to undertake an assessment to determine the risks and identify appropriate management strategies such that the development does not increase the inherent bushfire risk. Portions of the site that are located within 100 m of vegetation designated as being bushfire prone necessitate the need for a bushfire attack level assessment (BAL-assessment) and assigning a BAL-rating that will determine appropriate construction standards as per AS 3959:2018. The BAL-assessment component of this document considers current site conditions along with the provisions of State Planning Policy (SPP) 3.7 *Planning in Bushfire Prone Areas* (Department of Planning and the Western Australian Planning Commission (WAPC), 2015) and *Guidelines for Planning in Bushfire Prone Areas* (Department of Planning, Lands and Heritage (DPLH) and the Western Australian Planning Commission (WAPC), V1.4, 2021).

1.1 LOCATION

The Site is located approximately 25 km south of the Perth Central Business District, with all Lots currently being rural residential Lots. The six Lots front Wattleup Road, with existing development occurring to the north across Wattleup Road. Retained bushland is present in Lot 115 and Frankland Park to the west of Lot 9002, industrial premises and market gardens are present to the south, with and industrial facility and additional rural Lots present to the west (Figure 1).

1.2 AIMS AND OBJECTIVES

The aim of the BMP is to outline the fire management methods and requirements that will be implemented within the Site. Accordingly, broad aims include:

- Reduce the occurrence of and minimise the impact of bushfire to the life and property of future residents and the environment.
- Allow easy access of firefighters if a bushfire does occur.
- Protect the landscape within the site as far as is possible.
- Document bushfire prevention requirements of the area to which it relates.

The objectives of this BMP are to:

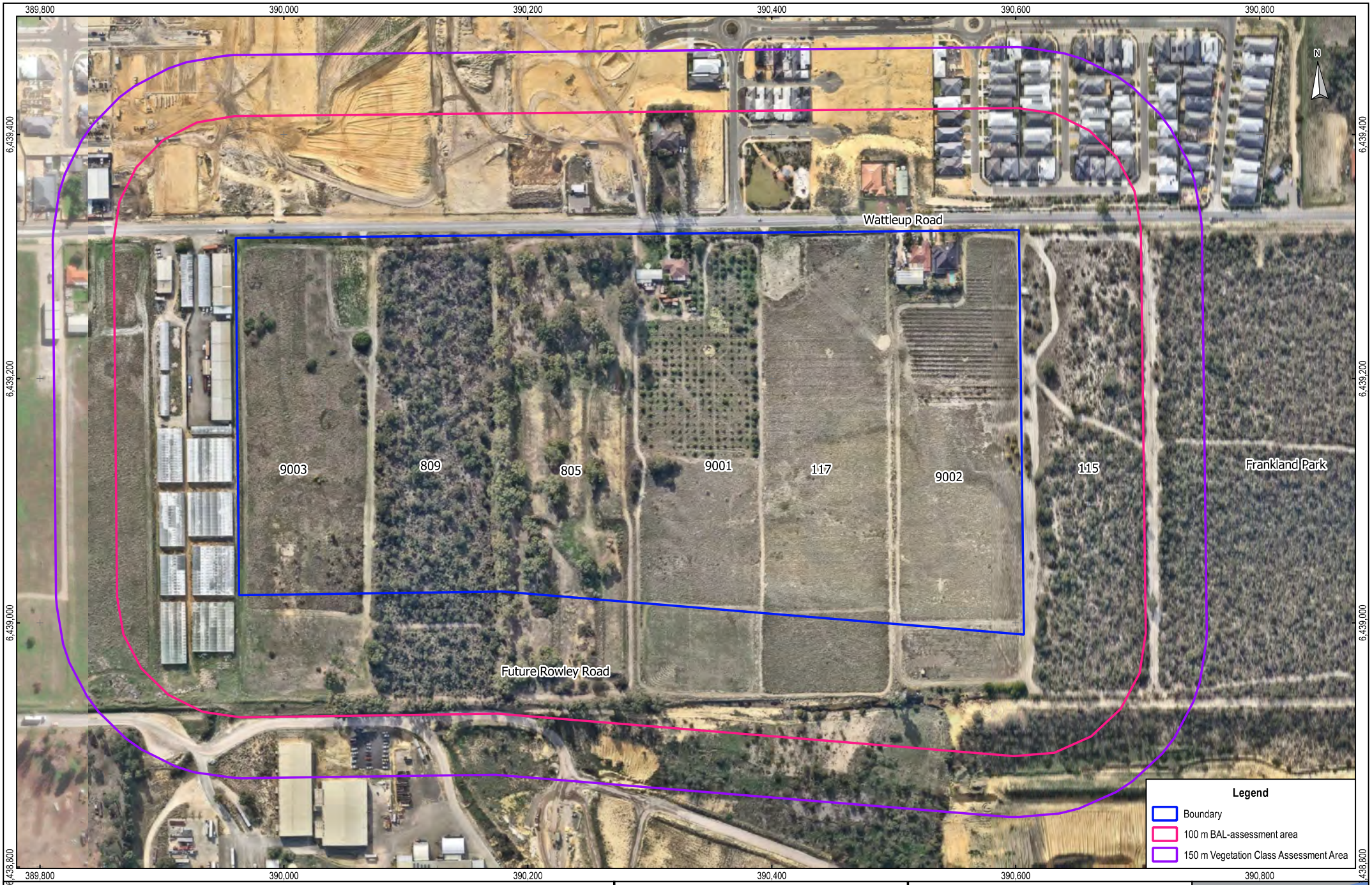
- Define land use areas and values within the subdivision, with the majority of the subdivision being developed as urban residential Lots, a recreation reserve within the subdivision, existing houses that will be retained, a linear public open space (POS) and road widening planning control areas to the south.
- Define and rank fire hazard areas according to the vegetation type and fire fuels present.

- Outline the roles and responsibilities of individuals and organisations in relation to fire management within the subdivision.
- Document fire management strategies for the subdivision, taking into consideration:
  - Vegetation to be retained on site in nominated POS areas.
  - The need for building construction standards where vegetated areas interface with the urban development.
  - Identify access for fire-fighting operations and daily maintenance in and around vegetated areas and stages of development.
  - Define an assessment procedure that will evaluate the effectiveness and impact of existing and proposed fire prevention activities and strategies.
  - Document the performance criteria and acceptable solutions adopted for the site.

1.3 DOCUMENT PREPARATION

This document has been prepared by Sue Brand, an accredited Level 2 Bushfire Planning and Design (BPAD) practitioner with the Fire Protection Association Australia. Activities involved with the plan preparation process included:

- Assessing the vegetation type and class present within and adjacent to the proposed development site using descriptions provided in *AS 3959:2018 Construction of Buildings in Bushfire Prone Areas*.
- Assigning hazard ratings based on the vegetation types present on and offsite.
- Determining bushfire attack level (BAL) ratings and suggesting management strategies that could be implemented based on current and projected site considerations.
- Preparing this BMP.



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Qube Property Group and LWP Capital
Bushfire Management Plan, Wattleup Road
Lots 117, 805, 809, 9001, 9002 and 9003

Figure 1

Location

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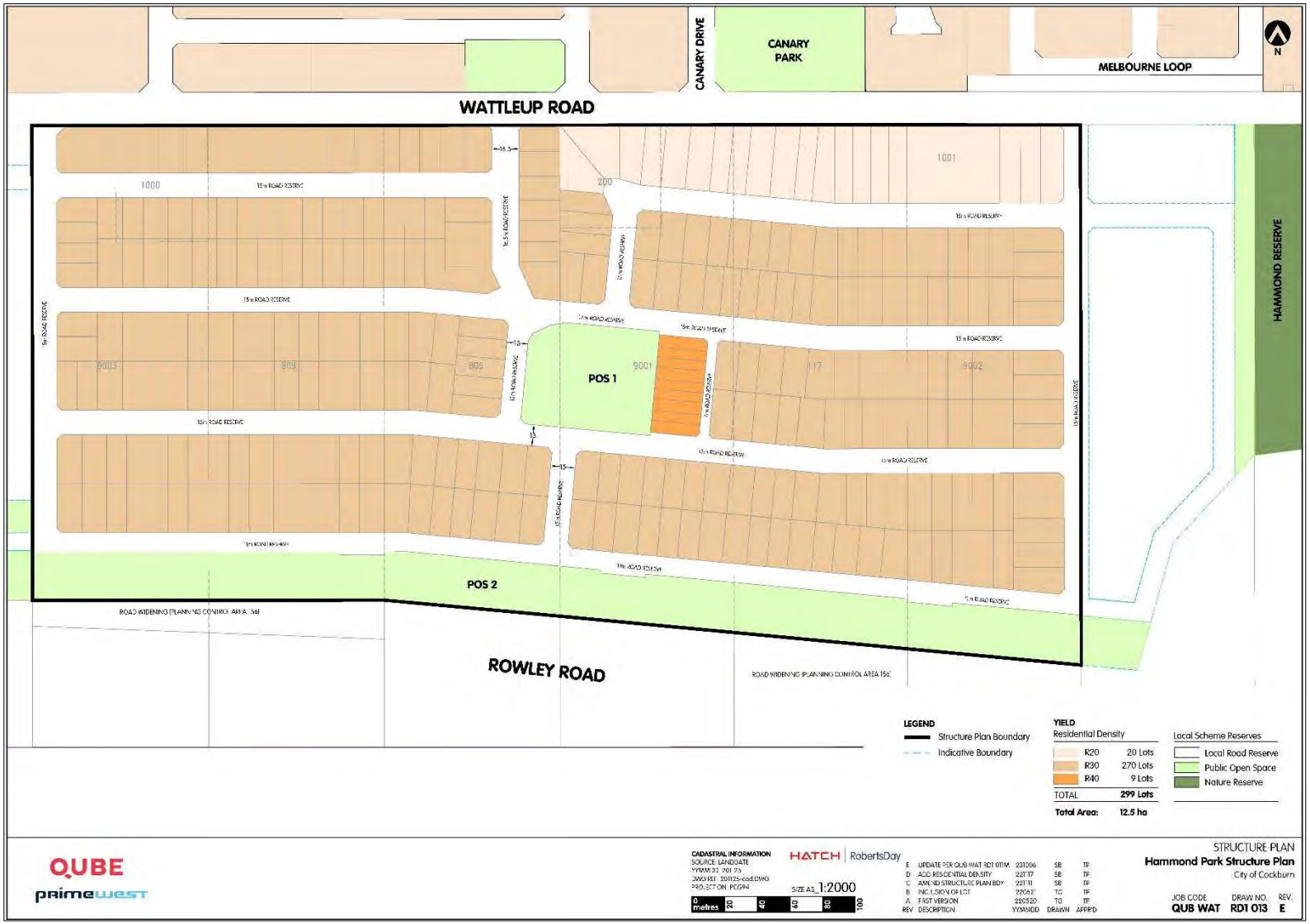


Figure 2: Hammond Park Structure Plan

2. CONSIDERATION OF BUSHFIRE THREAT

2.1 SITE CHARACTERISTICS

2.1.1 Regional Context

Perth is located within the Swan Coastal Plain region of the Interim Biogeographical Regionalisation of Australia (IBRA). The Swan Coastal Plain comprises of two major divisions, namely the Swan Coastal Plain 1 – Dandaragan Plateau and Swan Coastal Plain 2 – Perth Coastal Plain. The Site is in the Perth subregion, which is broadly characterised as including areas of Jarrah and Banksia woodlands on sandy soils in a series of sand dunes, along with wetland areas, often within the interdunal swales (Mitchell, Williams, and Desmond, 2002).

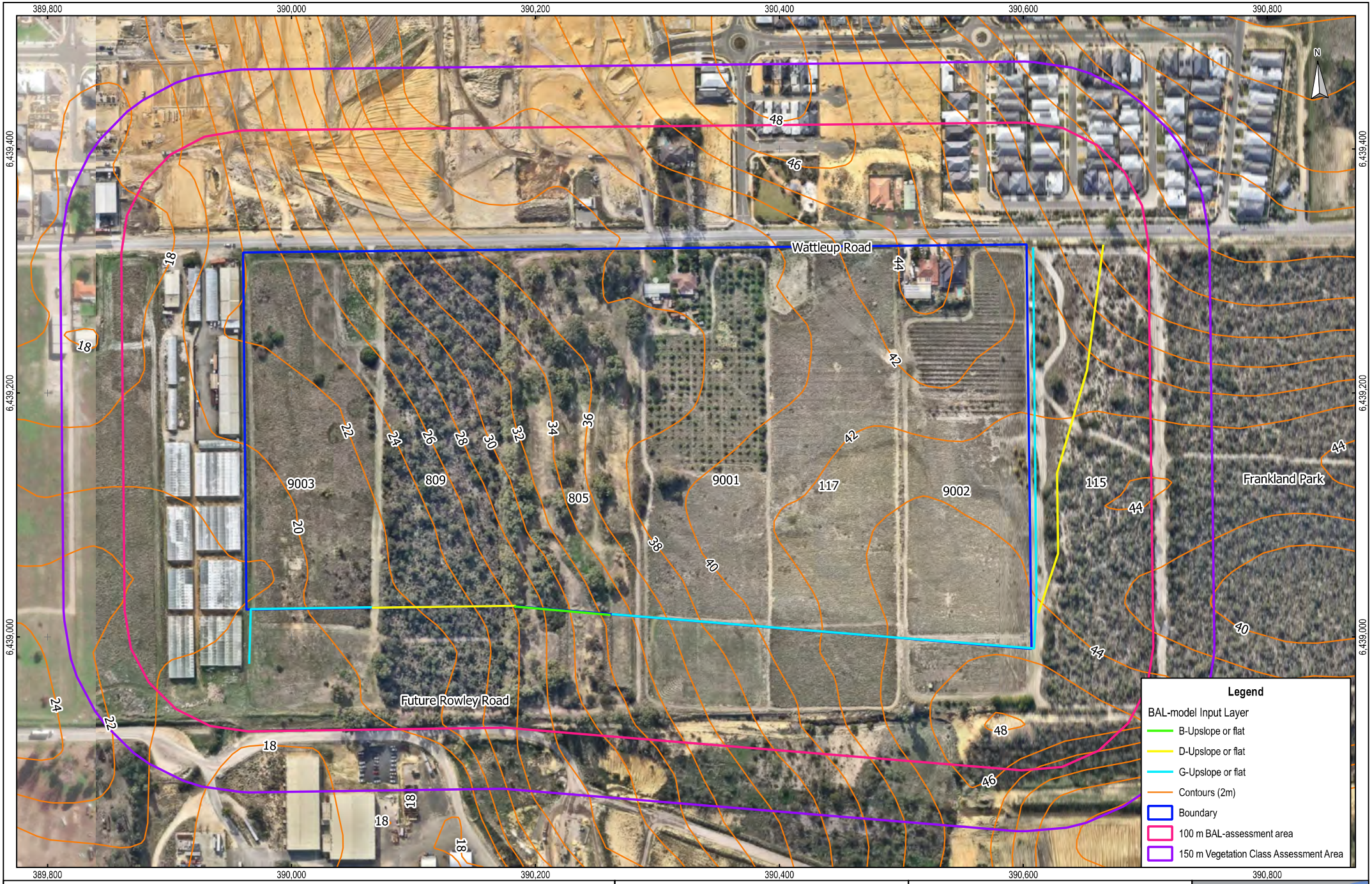
2.1.2 Vegetation

Native vegetation has been cleared from Lots 117, 9001, 9002, and 9003 with grassland and some overgrown orchards present. Some scattered trees remain within Lot 805, and denser woodland vegetation with the occasional tall tree present in Lot 809; vegetation within these Lots will be cleared to accommodate the proposed subdivision. Vegetation similar to that located within Lot 809 is present in Lot 115 immediately to the west of Lot 9002 and Frankland Park further west.

2.1.3 Contours and Slope

The Site is located on the Spearwood Dune System of the Swan Coastal Plain, thus is characterised by undulating land associated with the various dunes. The site rises from 20 m Australian Height Datum (AHD) in the west (Lot 9003), to 44 m AHD around Lots 117 and 9002. The topography begins to decrease in the interdunal swale that commences east of Frankland Park and Frankland Ave. Vegetation that will be retained in Lot 115 and Frankland Park is upslope or flat land for the purposes of the BAL-assessment component of this document.

The Site topography rises to the northwest up to approximately 48 m AHD, with no vegetation present that will influence the BAL-assessment process. To the south, the slope varies from downslope to upslope, with most of the retained vegetation to the south that will influence BAL-ratings being upslope or flat land, contours and slope are shown on Figure 3.



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Qube Property Group and LWP Capital
Bushfire Management Plan, Wattleup Road
Lots 117, 805, 809, 9001, 9002 and 9003

Figure 2

Contours and Slope

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2.1.4 Land Use

Land use within the Site is a mixture of grassland, native vegetation, retained dwellings, and woodland over a grassy understorey (Figure 4).

Figure 4: Current Land Use

2.1.5 Environmental Considerations

Emerge Associates carried out an assessment of the flora and vegetation and black cockatoo habitat values of the remnant bushland present within Lot 809 (now Lot 803) in November 2020, September 2021, and October 2021 (Emerge Associates, 2022). Their findings confirmed:

- The presence of 94 native and 24 non-native flora species.
- No threatened or priority flora species listed under the *Biodiversity Conservation Act 2016* (WA) (BC Act), with none likely based on the habitat present.
- No threatened flora species listed as matters of national environmental significance (MNES) under the *Environment Protection and Biodiversity Conservation Act 1999* (Cwlth) (EPBC Act).
- One vegetation type, *Banksia attenuata – Banksia menziesii* Woodland, that is representative of the floristic community type (FCT) 28 – Spearwood *Banksia attenuata* or *Banksia attenuata – Eucalyptus* Woodlands and the ecological community Banksia Woodlands of the Swan Coastal Plain listed as endangered under the EPBC Act and Priority 3 under the BC Act.
- Vegetation condition ranged from degraded to very good.
- Usage by threatened black cockatoos was more likely to be for foraging rather than roosting or nesting, with no evidence of foraging noted during the site surveys.

A referral to the then Department of Agriculture, Water, and Environment (DAWE), now the Department of Climate Change, Energy, the Environment and Water (DCCEEW) has resulted in DCCEEW issuing an approval under the *Environment Protection and Biodiversity Conservation Act 1999* (Cwlth) to clear Lot 809 (now 803) in September 2023.

In addition, MBS Environmental confirmed:

- There are no Bush Forever sites present, with the closest being more than 350 m to the southeast.
- There are no conservation category or resource enhancement category wetlands within the site boundary.

2.1.6 Landscaping

Two public open space (POS) areas will be created during the subdivision process, one in a central reserve and the other to the south of the development area adjacent to what will become the extension of Rowley Road. Both POS areas are expected to be landscaped and managed as low threat vegetation consistent with the definition provided in AS 3959:2018; the indicative landscape masterplan is provided in Figure 5. In the event a greater extent of native vegetation is retained or created BAL-ratings for the area will reassessed to confirm any changed bushfire risk.

Figure 5: Landscape Masterplan

2.2 VEGETATION CLASSIFICATION

Vegetation on and within 150 m of the Site was assessed during the site visit on 29 June 2022 using descriptions provided in Table 2.3 and Figure 2.4 of *AS 3959:2018*; each vegetation class is discussed and shown in Figure 6, Figure 7, Figure 8, Figure 9, and Figure 10. The pre-development vegetation classifications for the Site are shown collectively in Figure 11, with the post-development classifications shown in Figure 12.

2.2.1 Patch 1: Class B Woodland

Class B Woodland is characterised by trees 10 – 30 m with a 10 – 30% foliage cover, with a grassy understorey. This vegetation class is present in Lot 805 (photo ID 1) and will be cleared to accommodate the subdivision (Figure 6). A second patch of this vegetation class is inferred to the south in private property (photo ID 2), and it is assumed that a portion of this vegetation class to the south of what will become the linear POS area will be retained in the short-to-medium term as a minimum.

Patch: 1 **Classification or Exclusion Clause:** Class B Woodland

Photo ID: 1

Photo ID: 2

Figure 6: Class B Woodland

2.2.2 Patch 2: Class D Scrub

Class D Scrub is characterised by shrubs 2 - 4 m with a continuous canopy from ground level to the crowns, noting that the occasional tree to 6 m may also be present. This vegetation class is present in Lot 809 (photo ID 3), Lot 115 (photo ID 4), Frankland Park, and is inferred in an area to the south of what will become Rowley Road in private property (Figure 7). The vegetation in Lot 809 will be cleared to accommodate the subdivision, with that portion south of what will become the linear POS likely to be retained in the short-to-medium term as a minimum. Similarly, it is expected that the patch of vegetation within Lot 115 will also be retained in the short-to-medium term before being developed by others. Vegetation within Frankland Park will be retained into the future, and it is expected that the patch in private property to the south will also be retained in the short-term as a minimum.

Patch: 2 **Classification or Exclusion Clause:** Class D Scrub

Photo ID: 3

Photo ID: 4

Figure 7: Class D Scrub

2.2.3 Patch 3: Class G Grassland

Class G Grassland includes all forms to 0.5 - 0.75 m, typically in an unmanaged state (greater than 100 mm), noting that the occasional tree may be present. This vegetation class is present in Lots 117 (photo ID 5), and 9001 – 9003 (photo ID 6) (Figure 8), with a patch also present along the western boundary of Lot 115 (photo ID 7). Its presence is inferred to the south of Lots 117, 9001 and 9002. The northern portion of Lot 9001 includes grassland in association with an overgrown orchard, while that in Lot 9002 includes a patch of old grape vines (Figure 8).

Patch: 3	**Classification or Exclusion Clause:**	Class G Grassland

Photo ID: 5

Photo ID: 6

Photo ID: 7

Figure 8: Class G Grassland

2.2.4 Patch 4: Low-threat Vegetation

Vegetation is regarded as low-threat due to factors such as its flammability, moisture content or fuel load. Low-threat vegetation can include areas that are managed in a low-fuel condition such as maintained lawns, parklands, sporting fields, and public reserves, and are subject to exclusion clause 2.2.3.2 (f) of AS 3959:2018. Low-threat vegetation is present in Canary Park at the corner of Canary Drive and Wattleup Road (photo ID 8), street verges, and gardens and lawns in private property (Figure 9); note that the road verge shown in Photo ID: 9 is not shown as a separate vegetation Patch in Figure 11 due to its small size).

Patch: 4 **Classification or Exclusion Clause:** Low-threat vegetation – Exclusion Clause 2.2.3.2 (f)

Photo ID: 8

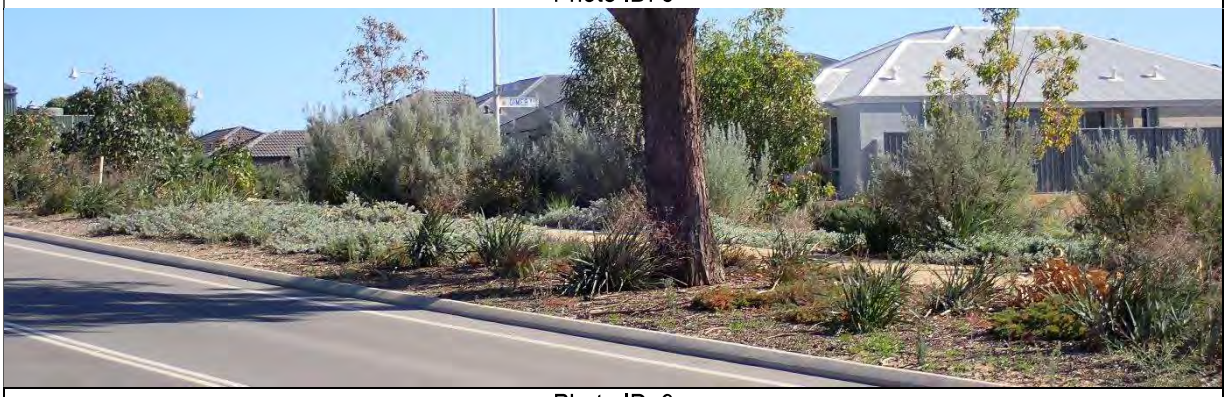

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Figure 9: Low-threat Vegetation

2.2.5 Patch 5: Non-vegetated Areas

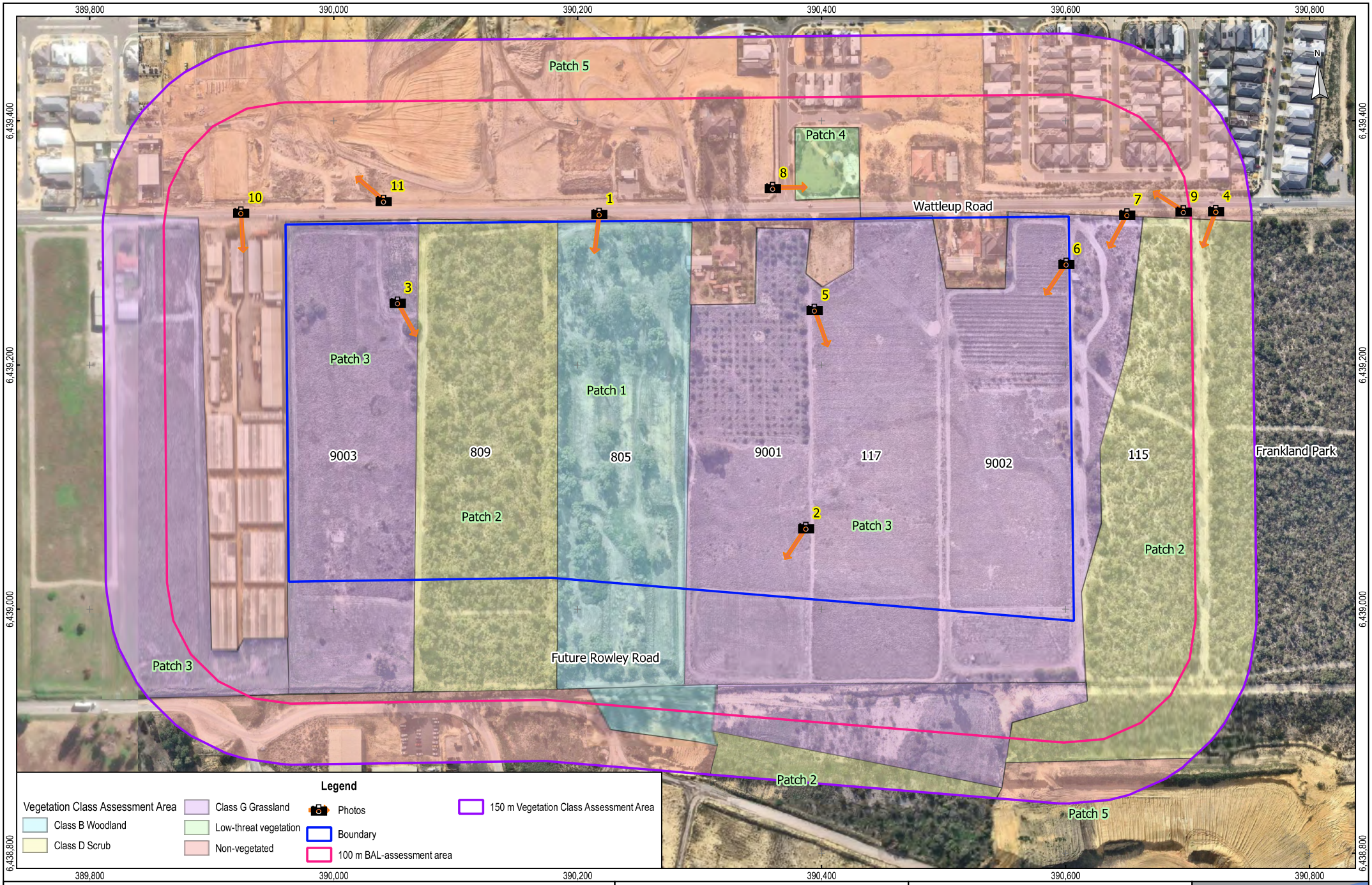
Non-vegetated areas are those locations devoid of vegetation, such as roads, footpaths, sandy areas, and buildings. Several non-vegetated areas area present around the Site, including areas where sand mining is occurring to the north of Wattleup Road (photo ID 11) and to the south of what will become Rowley Road, Wattleup Road, and existing buildings in various locations (photo ID 10) (Figure 10); these areas are subject to exclusion clause 2.2.3.2 (e) of AS 3959:2018.

Patch: 5	**Classification or Exclusion Clause:**	Non-vegetated – Exclusion Clause 2.2.3.2 (e)

Photo ID: 10

Photo ID: 11

Figure 10: Non-vegetated Areas



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Qube Property Group and LWP Capital
Bushfire Management Plan, Wattleup Road
Lots 117, 805, 809, 9001, 9002 and 9003

Figure 11

Pre-development Vegetation Classification as per AS 3959:2018

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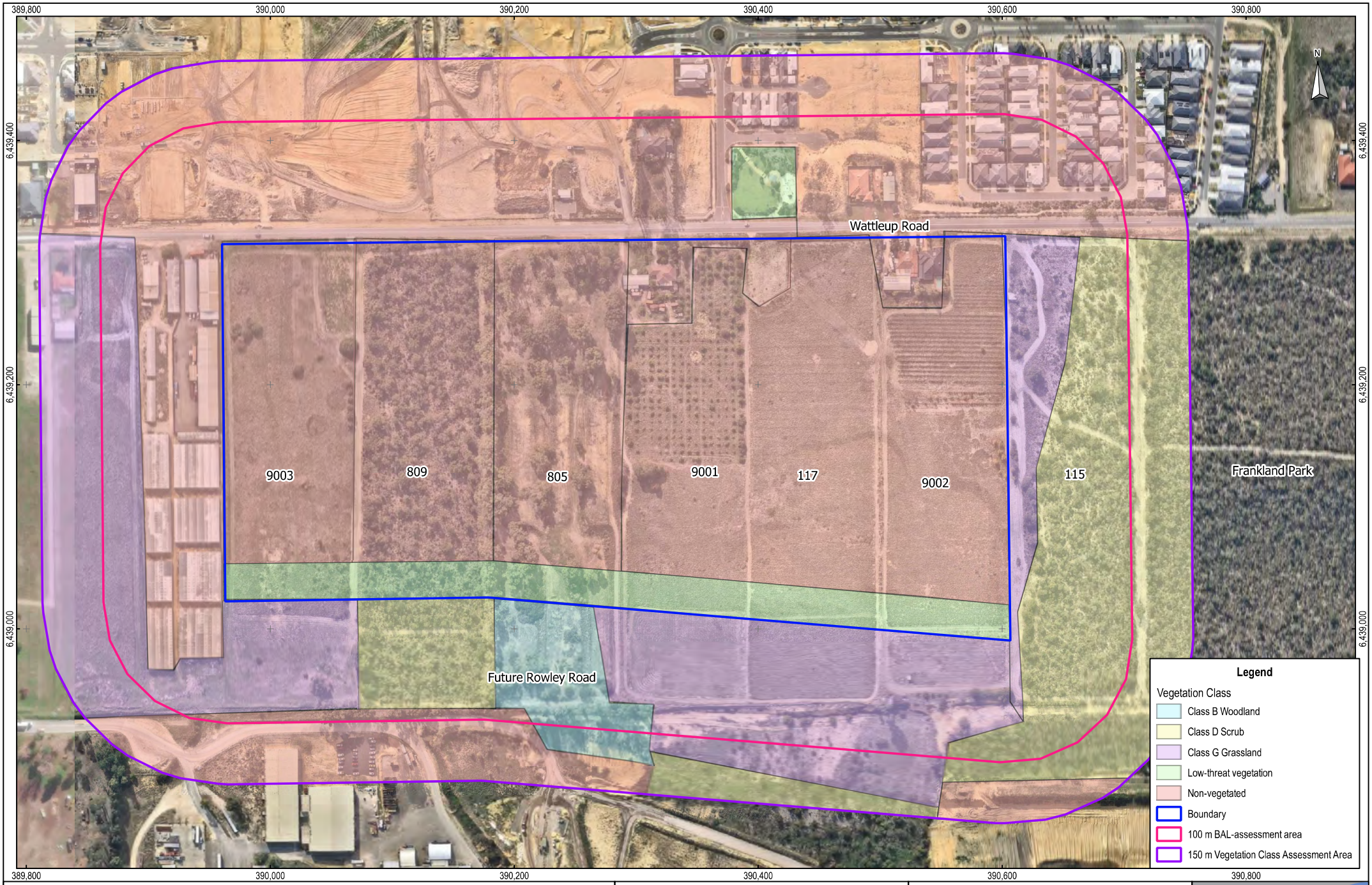

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Lots 117, 805, 809, 9001, 9002 and 9003

Figure 12

Post-development Vegetation Classification as per AS 3959:2018

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2.3 BUSHFIRE HAZARD LEVEL

2.3.1 Bushfire Hazard Assessment

Depending on the vegetation type, a hazard rating of low, moderate, or extreme is assigned (Figure 13). The nature of the vegetation in and around the development area means that the pre-development bushfire hazard rating ranges from Low to Extreme due to the presence of the Class B Woodland and the Class D Scrub. Those portions of the Site that are within 100 m of vegetation with an Extreme hazard rating are shown as having a moderate hazard rating due to the increased risk. All other locations within the Site will have a low hazard rating.

2.3.2 Fire Danger Index

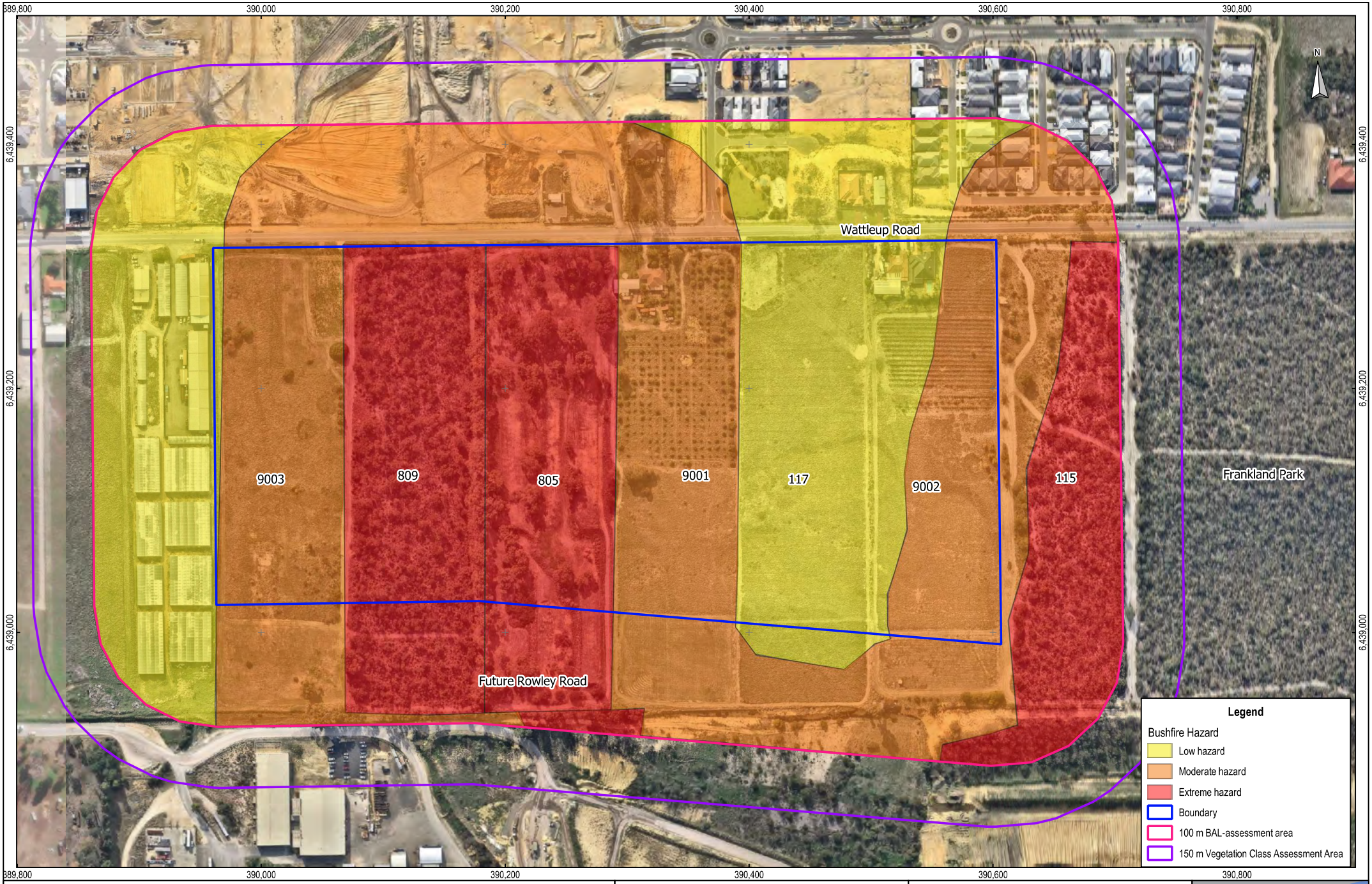
The fire danger index (FDI) for the Site is FDI 80, as documented in Table 2.4.3 of AS 3959:2018, and which is the nominated FDI for Western Australia.

2.3.3 Potential Fire Impacts

Potential fire impacts within the Site include smoke and ember attack. An analysis of the vegetation class, slope, and separation distances from the classified vegetation to the edge of Lots is provided in Table 1. This assessment assumes that POS areas will be landscaped and managed as low-threat vegetation as defined by AS 3959:2018. If a greater amount of remnant vegetation is retained or restored that result in classified vegetation being present within the linear POS, for example, BAL-ratings within the vicinity will need to be reassessed to accommodate the altered bushfire risk. Note that separation distances for Class G Grassland extend for 50 m from the edge of the vegetation, while those for all other vegetation classes extend for 100 m (Figure 14).

Table 1: BAL-analysis

Patch	Vegetation Class	Slope	Separation Distance (m)	BAL-rating
1	Class B Woodland	Upslope or flat	> 40	BAL-12.5
2	Class D Scrub – Lot 809	Upslope or flat	> 40	BAL-12.5
	Class D Scrub – Lot 115	Upslope or flat	> 25	BAL-19
	Class D Scrub – south of proposed Rowley Road near Lot 115	Upslope or flat	> 100	BAL-Low
3	Class G Grassland – Lot 9003	Upslope or flat	> 35	BAL-12.5
	Class G Grassland – Lot 9001	Upslope or flat	> 40	BAL-12.5
	Class G Grassland – Lot 117	Upslope or flat	> 40	BAL-12.5
	Class G Grassland – Lot 9002	Upslope or flat	> 40	BAL-12.5
	Class G Grassland – Lot 115	Upslope or flat	> 19	BAL-12.5
4	Low threat vegetation – Exclusion clause 2.2.3.2 (f)	Upslope or flat	N/A	N/A
5	Non-vegetated areas – Exclusion clause 2.2.3.2 (e)	Upslope or flat	N/A	N/A



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Qube Property Group and LWP Capital
Bushfire Management Plan, Wattleup Road
Lots 117, 805, 809, 9001, 9002 and 9003

Figure 13

Bushfire Hazard

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2.4 BAL-ASSESSMENT

Planning for the Site is well progressed in that there as a preliminary subdivision design available to inform the BAL-assessment process. Using the expected post-development vegetation extent in relation to the preliminary subdivision design, BAL-contours have been generated that inform the projected BAL-rating for Lots. Lots along the eastern boundary to Lot 115 with its Class D Scrub, BAL-ratings will range from BAL-19 for the closest Lots, down to BAL-12.5 for Lots further away (Figure 14).

BAL-ratings for Lots along the southern boundary of the subdivision have been measured from the southern extent of the linear POS and assume that any vegetation below that area will be retained, at least in the short-to-medium term. The greater than 30 m separation distance associated with the perimeter road and the low threat vegetation that is expected in the linear POS mean that BAL-ratings for Lots within 100 m of the Class B Woodland and Class D Scrub will be BAL-12.5, as will those Lots within 50 m of the Class G Grassland (Figure 14

2.4.1 Asset Protection Zone

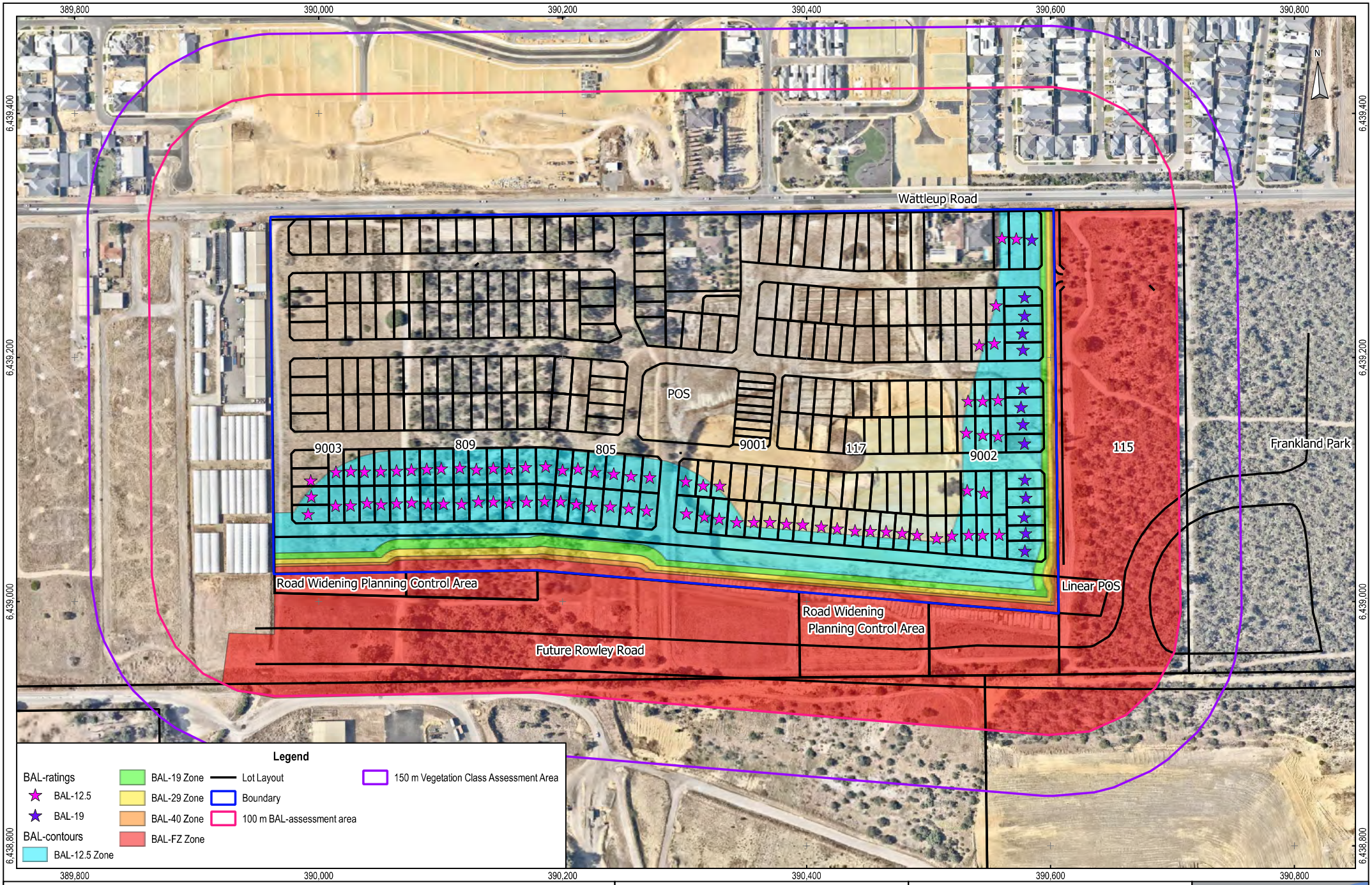
The asset protection zone for the Site is that area that provides the separation distance between the classified vegetation and building walls. It commences at the junction of the BAL-40 and BAL-29 zones, or the junction of the orange and yellow zones in Figure 14, and will extend to the building walls as that is the point where the potential radiant heat impact of a bushfire does not exceed 29 kW/m^2; this point also demonstrates that bushfire risks on site can be managed.

2.4.2 Shielding

Clause 3.5 of AS 3959:2018 allows for a reduction in building standards for buildings with a BAL-19 or higher rating to be constructed to the next lower BAL-rating where an elevation is not exposed to the source of the bushfire attack, noting that the BAL-rating cannot be reduced below BAL-12.5. As the Lots closest to the Class D Scrub vegetation in Lot 115 to the east of the Site are rated BAL-19, this clause may be relevant.

2.4.3 Other Bushfire Protection Measures

The subdivision design has considered the presence of the classified vegetation in various locations and included a perimeter road to the south and east to ensure a suitable separation distance is achieved. Three access/egress options are available to Wattleup Road to the north, from which the road network provides a range of options for movement away from any bushfires. No other bushfire protection measures will be required for this Site.



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Qube Property Group and LWP Capital
Bushfire Management Plan, Wattleup Road
Lots 117, 805, 809, 9001, 9002 and 9003

Figure 14

BAL-contours and Ratings

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2.5 IMPLEMENTATION

Implementation of this BMP will commence immediately and will be the responsibility of the Developer, Qube Property Group Pty and LWP Capital Pty Ltd for the Wattleup Syndicate, both for installation and ongoing maintenance until the Site is developed and Lots are sold. The Developer is also responsible for ensuring the occupier or new owner of the Lots located within 100 m of classified vegetation (Figure 14) receive a copy of this BMP.

When ownership arrangements change over time, the responsibility for the maintenance of fire management measures will devolve to the new owner or managing organisation, noting that landowners or managers are responsible for land under their direct control only. For example, Lot owners will be responsible for ensuring asset protection zones within their property are maintained. Activities that will be involved with the implementation of this plan are described in Table 2, which also includes an indication of maintenance responsibilities associated with a particular activity.

Table 2: Implementation Schedule

Item	Required Actions	Responsibility	Maintenance	Responsibility
1	Proposed building is constructed in accordance with assigned BAL-rating.	Developer/builder	Not required after construction	N/A
2	Planned POS areas are to be managed in a low threat condition as per clause 2.2.3.2 (f) of AS 3959:2018.	Developer	If required, review implications of any design changes that result in increased areas of classified vegetation.	Developer
3	Installation of hydrants within the structure plan area that are in accordance with the Water Corporation Design Standard 63 for hydrants, including: • Installation of markings to indicate the presence of hydrants, including: — A blue 'cats eye' reflective indicator in the centre line of the road. — A small blue 'H' painted on the curbing. — A white and red stripe around the pole nearest to the hydrant. • Clearance on the placement of hydrants will be required from Department of Fire and Emergency Services (DFES) and the Water Corporation. • Hydrants will need to be clearly identifiable, with markings installed by the developer prior to sign off.	Developer		
4	Install and maintain firebreak/low fuel zones and comply with the City of Cockburn annual fire break notice.	Developer or owner/occupier	As required, in accordance with City of Cockburn annual firebreak notice.	Developer or landowner/occupier
5	The clearing of classified vegetation to 50 m for Class G Grassland or 100 m for other vegetation classes within the structure plan boundary to provide a low-fuel load area around the development zone that will prevent the assigning of temporary BAL-ratings to Lots.	Developer	As required.	Developer
6	Ensure a Section 165 Notification is lodged on the titles of Lots with a BAL-rating of BAL-12.5 or higher.	Developer	N/A	N/A
7	All roads, including the perimeter road, are constructed to the standards specified in Appendix 4 Element 3 Table 6 Column 1 on page 76 of the Guidelines.	Developer	As required	City of Cockburn
8	All Lots to have two access/egress options to Wattleup Road in the event of a bushfire; access/egress will be via the planned internal road network.	Developer	General road maintenance as required, after subdivision completion.	City of Cockburn
9	An appropriate asset protection zone is to be maintained within the boundaries of the structure plan, based on separation distances specified in AS 3959:2018 and as indicated in Table 1 of Section 2.3.3 of this BMP.	Developer during development process	As required, ongoing	Individual Lot owners and/or land managers after sale of Lots

2.6 RESPONSIBILITIES

Responsibilities for bushfire preparedness and response within the development area are shared by the City of Cockburn, the Developer, and building owners/occupiers.

2.6.1 Developer Responsibilities

The Developer is responsible for implementing key portions of this BMP, including:

- Providing appropriate information, including a copy of this BMP, to potential Site purchasers or occupiers.
- Implementing the provisions of Table 2.

2.6.2 City of Cockburn Responsibilities

It should be noted that the City of Cockburn has the responsibility and powers under the Town Planning Scheme and the *Bush Fires Act* 1954 (WA) to ensure that this BMP, their annual firebreak notice, any bushfire Information, and any Special orders issued under the *Bush Fires Act* 1954 are complied with.

The City of Cockburn will be responsible for:

- Providing appropriate advice in relation to City requirements for firebreaks, hazard reduction, and any other fire management aspects it requires landowners to comply with to the Developer and property owners as required.
- Ensuring appropriate information is included on the title indicating the requirement to comply with this BMP.

2.6.3 Owner and/or Occupier Responsibilities

It is the responsibility of individual property owners building near the vegetated areas to:

- Ensure that the proposed building is constructed in accordance with the requirements of relevant sections of AS 3959:2018 for the assigned BAL rating.
- Where required, maintain the required asset protection zone.
- Include ember shields to evaporative air conditioners if installed.
- Inform DFES as soon as practicable after a fire is noticed within nearby bushland.
- Respond to advice from the City of Cockburn, DFES, or the Developer in relation to maintaining properties in a manner that will reduce potential damage from ember attack.

3. COMPLIANCE AND JUSTIFICATIONS

3.1 SPP 3.7 OBJECTIVES AND APPLICATION OF POLICY MEASURES

The intent of *State Planning Policy (SPP) 3.7 Planning in Bushfire Prone Areas* (Department of Planning and Western Australian Planning Commission, 2015) is to ensure that bushfire risks are considered in a timely manner and that planning documents demonstrate the appropriate application of the various policy measures. Table 3 summarises the intent and objectives of SPP 3.7 and provides evidence of how the proposed subdivision complies.

Table 3: SPP 3.7 Compliance Evidence

SPP Reference	Description	Evidence of Compliance
Intent	• Ensure that risks associated with bushfires are planned using a risk-based approach.	• Preparation of a BMP in accordance with SPP 3.7. • Hazard assessment indicates risks associated with bushfire are manageable.
Objective 1	• Avoid any increase in the threat of bushfire to people, property, and infrastructure.	• Hazard assessment indicates risks associated with bushfire are manageable. • BAL-ratings will be assigned to those Lots within 100 m of classified vegetation, with none higher than BAL-19 expected.
Objective 2	• Reduce vulnerability to bushfire.	• Hazard assessment indicates risks associated with bushfire are manageable. • BAL-ratings will be assigned to those Lots within 100 m of classified vegetation, with none higher than BAL-19 expected.
Objective 3	• Ensure that higher order strategic planning documents and proposals consider bushfire protection requirements at an early stage.	• The planning process has considered the risk of bushfire in an early stage, with this phase being the initial subdivision design. • Bushfire will continue to be considered at future development phases of the project.
Objective 4	• Achieve an appropriate balance between bushfire risk management and biodiversity conservation.	• Site environmental values have been considered during the early phase of the planning approvals process, with DCCEEW issuing an approval to clear Lot 809 (now 803) in September 2022.

3.2 BUSHFIRE PROTECTION CRITERIA

Appendix 4 of the *Guidelines for Planning in Bushfire Prone Areas* (DPLH and WAPC, v1.4_0, 2021) provides details of the acceptable bushfire protection solutions that can be used to demonstrate how a location can be developed in bushfire prone areas. Table 4 provides evidence of how the proposed subdivision of Lots 117, 805, 809, and 9001 - 9003 complies with the bushfire protection criteria.

Table 4: Compliance with Bushfire Protection Criteria

Intent	Acceptable Solutions	Solution
Element 1: Location		
Ensure that strategic planning proposals, subdivision and development applications are located in areas with the least possible risk of bushfire to facilitate the protection of people, property and infrastructure.	**A1.1 Development Location**	
	Bushfire hazard assessment is or will on completion be moderate or low.	• The subdivision is in an area where the bushfire hazard level is manageable. • BAL-ratings will be assigned to those Lots within 100 m of classified vegetation, with none higher than BAL-19 expected.
	BAL-rating is BAL-29 or lower.	• Bushfire hazard assessment indicates manageable bushfire risk. • BAL-ratings will be assigned to those Lots within 100 m of classified vegetation, with none higher than BAL-19 expected.
Element 2: Siting and Design of Development		
To ensure that the siting and design of development minimises the level of bushfire impact.	**A2.1 Asset Protection Zone (APZ)**	
	Every habitable building is surrounded by, and every proposed lot can achieve an APZ depicted on plans that meets the following: • **Width** – bushfire radiant heat does not exceed radiant heat of 29 kW/m^2 (BAL-29) as measured from any external wall or supporting post or column in all circumstances. • **Location** – APZ contained solely within the boundaries of the Lot on which the building is situated, except in instances where the neighbouring lot(s) will be managed in a low-fuel state on an ongoing basis, in perpetuity. • **Management** – the APZ is managed in accordance with the requirements of '*Standards for Asset Protection Zones*' (Schedule 1 on page 71 of the Guidelines).	• The APZ coincides with the boundary between BAL-40 and BAL-29 zones (Figure 14) and includes roads and cleared areas. • Subdivision design ensures the APZ width is suitable to ensure radiant heat does not exceed 29 kW/m^2 (BAL-29) as measured from any external wall or supporting post or column in all circumstances. • BAL-ratings will be assigned to those Lots within 100 m of classified vegetation, with none higher than BAL-19 expected.

Intent	Acceptable Solutions	Solution
Element 3: Vehicular Access		
Ensure that the vehicular access serving a subdivision/ development is available and safe during a bushfire event. To achieve the intent, all applicable acceptable solutions must be addressed: SP – Strategic planning proposal and structure plan where the lot layout is not known. Sb – Structure plan where the lot layout is known and subdivision application. Dd – Development application for a single dwelling, ancillary dwelling, or minor development. Do – Development application for any other development that is not a single dwelling, ancillary dwelling, or minor development.	**A3.1 Public Roads (SP Sb Do)**	
	Public roads are to meet the minimum technical requirements in Table 6, Column 1 on page 76 of the Guidelines. The trafficable (carriageway/pavement) width is to be in accordance with the relevant class of road in the Local Government Guidelines for Subdivisional Development (IPWEA Subdivision Guidelines), Liveable Neighbourhoods, Austroad standards and/or any applicable standards for the local government area.	Public roads will be constructed in accordance with the technical requirements outlined in Column 1 of Table 5 on page 76 of the Guidelines.
	A3.2a Multiple Access Routes (SP Sb Do)	
	Public road access is to be provided in two different directions to at least two different suitable destinations with an all-weather surface (two-way access).	Three roads will exit the subdivision to Wattleup Road to the north, from which access to both the east and west can occur.
	If the public road access is via a no-through road that cannot be avoided due to demonstrated site constraints, the road access is to be a maximum of 200 m from the subject lot(s) boundary to an intersection where two-way access is provided.	N/A
	A no-through road may exceed 200 m if it is demonstrated that an alternative access way cannot be provided due to site constraints and the following requirements are met: • The no-through road travels towards a suitable destination. • The balance of the no-through road that is greater than 200 m from the subject site is wholly within BAL-Low or is in a residential built-out area (Figure 23 on page 81 of the guidelines).	N/A
	A3.2b Emergency Access Way (SP Sb Do)	
	Where it is demonstrated that A3.2a cannot be achieved due to site constraints, or where an alternative design option does not exist, an emergency access way can be considered as an acceptable solution. An emergency access way is to meet all the following requirements: • Requirements in Table 6, Column 2 on page 76 of the guidelines. • Provides a through connection to a public road. • Be no more than 500 m. • Must be signposted and if gated, gates must open the whole trafficable width and remain unlocked.	N/A – access will be via the existing and planned road network.

Intent	Acceptable Solutions	Solution
	A3.3 Through-roads (SP Sb)	
	All public roads should be through-roads. No-through roads should be avoided and should only be considered as an acceptable solution where: • It is demonstrated that no alternative road layout exists due to site constraints, and • The no-through road is a maximum length of 200 m to an intersection providing two-way access unless it satisfies the exemption provisions in A3.2a.	All public roads will be through roads.
	A no-through road is to meet all the following requirements: • Requirements of a public road (Table 6, Column 1, Page 76). • Turn-around area as shown in Figure 24 on page 81 of the Guidelines.	N/A
	A3.4a Perimeter Roads (SP Sb)	
	A perimeter road is a public road and should be provided for greenfield or infill development where 10 or more lots are being proposed, including as part of a staged subdivision, with the aim of: • Separating areas of classified vegetation under AS 3959 that adjoin the subject site from the proposed lots, and • Removing the need for battle-axe lots that back onto areas of classified vegetation.	A perimeter road is provided along the southern and eastern boundaries of the development that provides separation between vegetation and planned Lots.
	A perimeter road is to the meet the requirements contained in Table 6, Column 1 on page 76 of the Guidelines.	The perimeter road will be constructed in accordance with the requirements outlined in Column 1 of Table 6 on page 76 of the Guidelines.
	A perimeter road may not be required where: • The adjoining classified vegetation is Class G Grassland. • Lots are zoned for rural living or equivalent. • It is demonstrated that it cannot be provided due to site constraints. • All lots have frontage to an existing public road.	N/A
	A3.4b Fire Service Access Route (SP Sb)	
	Where proposed lots adjoin classified vegetation under AS 3959 (excluding Class G Grassland) and a perimeter road is not required in accordance with A3.4a, a fire service access route can be considered as an acceptable solution to provide firefighter access, where access is not available, to the classified vegetation. A fire access route is to meet all the following requirements:	N/A

Intent	Acceptable Solutions	Solution
	• Requirements in Table 6 Column 3 on page 76 of the Guidelines. • Be through-routes with no dead-ends. • Linked to the internal road system at regular intervals, every 500 m. • Must be signposted. • No further than 500 m from a public road. • If gated, gates must open the required trafficable width and be locked by the local government and/or emergency services, if keys are provided for each gate. • Turn-around areas designed to accommodate type 3.4 fire appliances and to enable them to turn around safely every 500 m.	
	A3.5 Battle-axe Access Legs (Sb)	
	Where it is demonstrated that a battle-axe access leg cannot be avoided due to site constraints, it can be considered as an acceptable solution. There are no battle-axe technical requirements where the point of the battle-axe access leg joins the effective area of the battle-axe lot is less than 50 m from a public road in a reticulated water area.	• One battle-axe leg is planned for the development and is located behind an existing building that will be retained. • The battle-axe leg is located more than 100 m from any classified vegetation.
	In circumstances where the above condition is not met, or the battle-axe lot is in a non-reticulated water area, the battle-axe access leg is to meet all the following requirements: • Requirements in Table 6, Column 4 on page 76 of the Guidelines. • Passing bays every 200 m with a minimum length of 20 m and minimum additional trafficable width of two metres (i.e. the combined trafficable width of the passing bay and constructed driveway to be a minimum six metres).	N/A
	A3.6 Private Driveways (Dd Do)	
	There are no private driveway technical requirements where the private driveway is: • Within a lot serviced by reticulated water. • No greater than 70 m in length between the most distant external part of the development site and the public road as measured as a hose lay. • Accessed by a public road where the road speed limit is not greater than 70 km/h.	N/A

Intent	Acceptable Solutions	Solution
	In circumstances where all the above conditions are not met, or the private driveway is in a non-reticulated water area, the private driveway is to meet all the following requirements: • Requirements in Table 6, Column 4 on page 76 of the Guidelines. • Passing bays every 200 m with a minimum length of 20 m and minimum additional trafficable width of two metres (i.e. the combined trafficable width of the passing bay and constructed driveway to be a minimum six metres). • Turn around areas as shown in Figure 28 on page 86 of the Guidelines and within 30 m of the habitable building.	
Element 4: Water		
Ensure that water is available to enable people, property, and infrastructure to be defended from bushfire. To achieve the intent, all applicable acceptable solutions must be addressed: SP – Strategic planning proposal and structure plan where the lot layout is not known. Sb – Structure plan where the lot layout is known and subdivision application. Dd – Development application for a single dwelling, ancillary dwelling, or minor development. Do – Development application for any other development that is not a single dwelling, ancillary dwelling, or minor development.	**A4.1 Identification of Future Water Supply (SP)**	
	Evidence that a reticulated or sufficient non-reticulated water supply for bushfire fighting can be provided at the subdivision and/or development application stage, in accordance with the specifications of the relevant water supply authority or the requirements of Schedule 2 on Page 90 of the Guidelines.	The subdivision will be connected to a reticulated water supply and will comply with Water Corporation specifications.
	Where the provision of a strategic water tank(s) is required in a suitable area within a road reserve or a dedicated lot the location should be identified on the structure plan to the satisfaction of the local government.	N/A
	A4.2 Provision of Water for Firefighting Purposes (Sb Dd Do)	
	Where a reticulated water supply is existing or proposed, hydrant connection(s) should be provided in accordance with the specifications of the relevant water supply authority. Where these specifications cannot be met, then the following applies: • The provision of a water tank(s) in accordance with the requirements of Schedule 2 on page 90 of the guidelines. • Where the provision of a strategic water tank(s) is applicable, then the following requirements apply: • Land to be ceded free of cost to the local government for the placement of the tank(s). • The lot or road reserve where the tank is to be located is identified on the plan of subdivision.	Hydrants will be installed in accordance with Water Corporation requirements.

Intent	Acceptable Solutions	Solution
	• Tank capacity, construction, and fittings provided in accordance with the requirements of Schedule 2 on page 90 of the Guidelines. • A strategic water tank is to be located no more than 10 minutes from the subject site (at legal road speeds). • Where a subdivision includes an existing habitable building(s) that is to be retained, a water supply should be provided to this existing habitable building(s) in accordance with the requirements listed above.	
Element 5: Vulnerable Tourism Land Uses		
Provide for bushfire protection for tourism land uses relevant to the characteristics of the occupants and/or the location, to preserve life and reduce the impact of bushfire on property and infrastructure. All applicable acceptable solutions must be addressed.	Every habitable building is surrounded by Asset Protection Zone (APZ) in accordance with Element 2: Siting and Design of Development – A2.1 Asset Protection Zone.	N/A – subdivision is a residential subdivision.
	Habitable buildings are sited and designed to: • Minimise clearing of existing vegetation. • Provide hazard separation between classified vegetation and a development site that is managed in perpetuity to protect life, prevent the spread of, and manage the impacts of fire.	N/A
	Suitable access/egress is provided for users of tourism sites.	N/A
	Adequate water is available for firefighting purposes in the event of a bushfire.	N/A

3.3 COMPLIANCE WITH RELEVANT DOCUMENTS

Sections 3.1 and 3.2 demonstrate how the proposed subdivision of Lots 117, 805, 809 and 9001 – 9003 complies with State Planning Policy 3.7 (Department of Planning and WA Planning Commission, 2015) and *Guidelines for Planning in Bushfire Prone Areas* (Department of Planning, and the Western Australian Planning Commission, V1.4_0, 2021). Site owners/occupiers must comply with relevant sections of the annual firebreak notice and bushfire information prepared by the City of Cockburn, such as total fire ban and hazard reduction programs.

3.4 COMPLIANCE STATEMENT

This BMP has been prepared in accordance with the requirements of *State Planning Policy 3.7 Planning in Bushfire Prone Areas* (Department of Planning and Western Australian Planning Commission, 2015) and *Guidelines for Planning in Bushfire Prone Areas* (Department of Planning, and the Western Australian Planning Commission, V1.4, 2021). The information contained in this document represents current site conditions based on a visit to the site on 29 June 2022 and associated planning.

Signed:

Date: 22 December 2023

Accreditation Number: BPAD 36638

Accreditation Expiry Date: 30 April 2024

BPAD
Bushfire
Planning & Design
Accredited Practitioner
Level 2

4. REFERENCES

Australian Standard, *AS 3959:2018, Construction of Buildings in Bushfire-Prone Areas*, Standards Australia, NSW.

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Appendix E

Environmental Report & EPBC Approval

Environmental Assessment and Management Strategy

Hammond Quarter West: Local Structure Plan Amendment

Project No: EP24-053(01)

Prepared for Qube Property Group
July 2024

Document Control

Doc name:	Environmental Assessment and Management Strategy Hammond Quarter West: Local Structure Plan Amendment				
Doc no.:	EP24-053(01)--001 AS				
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1	July 2024	Ash Singh	AS	Jason Hick	JDH
	Issued to client and project team.				

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Executive Summary

This *Environmental Assessment and Management Strategy* (EAMS) has been prepared in support of the proposed amendment to the Hammond Quarter Structure Plan (SPN/2348) to incorporate Hammond Quarter West, which comprises Lots 813 and 815, and parts of Lots 78 and 80 Wattleup Road, Hammond Park (herein referred to as 'the site'). The proposed Structure Plan (SP) amendment prepared by Hatch is attached as **Appendix A** and outlines the proposed residential development of the site.

The SP layout indicates that the future development of the site will include residential (standard), residential (transition), public open space (POS), and a local road network. This SP provides an intended development layout for the site and is generally in accordance with the *Southern Suburbs District Structure Plan – Stage 3, Hammond Park/Wattleup* (DSP) (CoC 2012).

This EAMS has been prepared to address the requirements of the Western Australian Planning Commission's (WAPC) *Structure Plan Framework* (WAPC 2015b) to support the preparation and implementation of the proposed SP. This report synthesises information from a range of sources to determine the environmental features of the site.

The site comprises a total area of approximately 8.16 hectares (ha) and is located approximately 25 km south of the Perth Central Business District (CBD), as shown in **Figure 1**. The site is zoned 'Development' under the Local Planning Scheme No. 3, and 'Urban' under the Metropolitan Region Scheme (MRS). The lots immediately to the east are identified for residential development under the previously approved portion of the SP, and the lots immediately to the north are currently being developed under the Hammond Park West Structure Plan. The south of the site has been identified for the future extension of Rowley Road.

The relevant environmental attributes and values of site are summarised as follows:

- Topography across the site ranges between 17 m and 23 m Australian height datum.
- The site has been historically cleared and doesn't support any native vegetation, but areas of non-native vegetation.
- There is no black cockatoo habitat within the site.
- No wetlands are mapped as occurring within or in close proximity to the site.
- No Registered Aboriginal Heritage Sites or Other Heritage Places are mapped within the site.
- The site is generally vacant, but until recently supported a steel distributor ('Best Buy Steel') and a rural-residential dwelling.
- There are no existing land uses in proximity to the site would be incompatible with the proposed residential land uses within the site.

The SP has been developed with specific consideration to the identified environmental values of the site. Management responses have been incorporated into the SP, including:

- Preparation of an Urban Water Management Plan (UWMP) addendum to support the future subdivision of the site.

- Preparation of a Bushfire Management Plan (BMP), which outlines how the SP responds the bushfire protection criteria specified in the *Guidelines for Planning in Bushfire Prone Areas* (WAPC and DFES 2015).
- Preparation of the Transport Noise Assessment (TNA), which outlines how the SP responds to the noise impacts presented by the future Rowley Road extension.

This EAMS also outlines the environmental framework to be implemented across the site as part of future subdivision and development phases of the residential development process, including:

- Completion of detailed Bushfire Attack Level (BAL) assessment and imposition of determined BAL ratings on affected lots. New dwellings within 100 m of the bushfire threat should demonstrate compliance with AS 3959 corresponding to the assigned BAL rating.

Overall, the environmental factors can be managed appropriately through the future subdivision and development phases in line with the relevant state and local government legislation, policies and guidelines and best management practices.

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Appendix A

Hammond Quarter West Structure Plan Amendment (Hatch 2024)

Appendix B

Transport and Noise Assessment (Lloyd George Acoustics, 2024)

1 Introduction

1.1 Background

Hatch, on behalf of Qube Property Group (the proponent), have prepared an amendment to the approved Hammond Quarter Structure Plan (SPN/2348) which adds the previously excluded Lots 813 and 815, and the northern section of Lots 78 and 80 Wattleup Road, Hammond Park (herein referred to as 'Hammond Quarter West' or 'the site') to the approved structure plan (SP) area. (**Appendix A**). This Environmental Assessment and Management Strategy (EAMS) has been prepared to support the proposed SP amendment and the future development of the site.

The SP layout indicates that the future development of the site will include residential (standard), residential (transition), public open space (POS), and a local road network. This SP provides a more detailed layout for the site and is in accordance with the *Southern Suburbs District Structure Plan – Stage 3, Hammond Park/Wattleup* (DSP) (CoC 2012).

The site is located within the City of Cockburn (CoC) approximately 25 km south of the Perth Central Business District, as shown in **Figure 1**. The site comprises a total area of 8.16 ha and is zoned 'Development' under the CoC Local Planning Scheme No. 3, and 'Urban' under the Metropolitan Region Scheme (MRS) as shown in **Figure 2**. Land to the west is characterised by rural land uses and is zoned 'Rural' under the MRS. Land immediately to the south of the site is zoned 'Urban deferred' under the MRS and has been identified for the future extension of Rowley Road. The east of the site is identified for development under the approved SP, and is zoned 'Urban' under the MRS.

1.2 Purpose of this report

The purpose of this EAMS is to provide a synthesis of information regarding the environmental values and attributes of the site. It is a key supporting document for the SP amendment process, facilitating the consideration of any environmental issues by the various State agencies and the CoC. This EAMS has been prepared to be consistent with the EPA's current *Guidance Statement No. 33 Environmental Guidance for Planning and Development* (EPA 2008) and the Western Australian Planning Commission's (WAPC) *Structure Plan Framework* (WAPC 2015b). This EAMS:

- Identifies the existing environmental values and attributes of the site (**Section 2**).
- Discusses the land use planning context and the proposed SP (**Section 3**).
- Discusses how the SP design responds to the existing environment and outlines the future environmental management framework (**Section 4**).
- Outlines how the environmental management framework will be implemented (**Section 5**).

1.3 Scope of work

Emerge Associates (Emerge) was engaged by the proponent to undertake an environmental assessment to document the existing environmental attributes and values of the site and ensure any relevant environmental values can be accommodated within by SP layout, as well as through the

future stages of subdivision and development within the site. This involved utilising a range of information sources including local and regional assessments, databases, publicly available mapping, and site-specific investigations.

The assessment incorproated a comprehensive desktop review of the available information on environmental conditions within and surrounding the site. The outcomes of these findings include information on the following attributes:

- Landforms and soils.
- Biodiversity and natural assets.
- Terrestrial fauna.
- Hydrology.
- Heritage.
- Historical and existing land uses within and surrounding the site.
- Bushfire hazards.
- Land use compatibility and potential noise impacts.

In addition to the preparation of this EAMS, Emerge have prepared, commissioned or reviewed the following documents to support the updated SP:

- *Bushfire Management Plan* (BMP) (Emerge Associates 2020).
- *Transport and Noise Assessment* (TNA) (Lloyd George Acoustics 2024).

2 Existing Environment

2.1 Landform and soils

2.1.1 Topography

The elevation of the site ranges from 17 metres (m) relative to the Australian Height Datum (m AHD) in the central northern portion of the site, to 23 m AHD in the central southern portion (DoW 2008). The topographic contours for the site and surrounding areas are shown in (**Figure 3**).

As part of the proposed development, it is unlikely that the topographic contours of the site will change significantly to accommodate engineering and service infrastructure (i.e. sewer, power, water) requirements.

More broadly, the site is located within an area where urban development is currently being progressed and connects with an existing/established road network.

2.1.2 Regional geomorphology

The site located on the Swan Coastal Plain, which is approximately 500 km long and 20 to 30 km wide and is roughly bound by the Indian Ocean to the west and the Darling Scarp to the east. Broadly, the Swan Coastal Plain consists of two sedimentary belts of different origin. Its eastern side has formed from the deposition of alluvial material washed down from the Darling Scarp, while its western side is comprised of three dune systems that run roughly parallel to the Indian Ocean coastline (Seddon 2004). These dune systems, referred to as Quindalup, Spearwood and Bassendean associations, represent a succession of coastal deposition that has occurred since the late Quaternary period (approximately two million years ago) (Kendrick *et al.* 1991) and, as a result, they contain soils at different stages of leaching and formation.

The site is situated at the interface between the Spearwood and Basendean associations, but is situated within and characterised by the Spearwood association.

2.1.3 Landform, soils, and geology

The *Perth Metropolitan Region 1: 50,000 Environmental Geology Series, Rockingham (Part of sheets 2033 II and 2033 III)* (Gozzard 1983) maps the site as 'sand' (map unit S7). Areas to the north and south-east of the site include 'peaty clay' (map unit Cps) and areas to the south-west include 'sandy silt' (map unit Ms5). The descriptions of these soil types are provided in **Table 1** and their spatial extent are shown in **Figure 4**.

Table 1: Environmental Geology Series map unit descriptions (Gozzard 1983).

Map unit	Name	Description
S7	Sand	Pale yellowish brown, medium to coarse-grained sub-angular quartz, trace of feldspar, moderately sorted, of residual origin.
Cps	Peaty clay	Dark grey and black, soft, variable organic content, some quartz sand in places, of lacustrine origin.
Ms5	Sandy silt	Dark brownish grey silt, with disseminated fine-grained quartz sand, firm, variable clay content, of lacustrine origin.

The best available soil landscape mapping from the Department of Primary Industries and Regional Development (DPIRD) places the site within the Spearwood association (**Figure 5)**. Refined soil mapping places the site largely within the Spearwood S4a Phase, which consists of flat to gently undulating sandplain with deep, pale, and sometimes bleached sands with yellow-brown subsoils. The north-eastern corner of the site is within the Spearwood S1b Phase, which consists of dune ridges with deep siliceous yellow-brown sands or pale sands with yellow-brown subsoil and slopes up to 15%.

The site is not known to contain any restricted landforms or unique geological features.

2.1.4 Acid sulfate soils

Acid sulfate soils (ASS) is the name commonly given to naturally occurring soils and sediment containing iron sulfide (iron pyrite) materials. In their natural state, ASS are generally present in waterlogged anoxic conditions and do not present any risk to the environment. ASS can present issues when oxidised, producing sulfuric acid, which can impart a range of impacts on the surrounding environment, infrastructure, and human health. Projects involving the disturbance of ASS must therefore assess the risk associated with disturbance by considering potential impacts.

Mapping prepared by the Department of Water and Environment Regulation (DWER) (2024) to support the WAPC's *Planning Bulletin No. 64: Acid Sulfate Soils* (2009) provides broad-scale mapping indicating areas of potential ASS risk. The mapping identifies the following ASS risk classification areas as:

- Class 1 – high to moderate risk of ASS occurring within 3 m of natural soil surface.
- Class 2 – moderate to low risk of ASS occurring within 3 m of natural soil surface but high to moderate risk of ASS beyond 3 m of natural soil surface.

The risk maps do not describe the actual severity of ASS in a particular area but provide an indication of whether ASS could be present based on surface elevations and landforms. For each classification, the maps identify the type of works likely to present an environmental risk.

The mapping indicates that the site has no known risk of ASS occurring, although there is high-moderate risk of ASS occurring to the immediate central-north of the site and to the south-east and south-west of the site (**Figure 6**).

2.2 Biodiversity and natural assets

2.2.1 Flora and vegetation

At a national scale, the *Interim Biogeographic Regionalisation of Australia* divides the Swan Coastal Plain into two floristic subregions (Environment Australia 2000). The site is contained within the Perth subregion, which is characterised as mainly containing *Banksia* low woodland on leached sands with *Melaleuca* swamps where ill-drained; and woodland of *Eucalyptus gomphocephala* (tuart), *E. marginata* (jarrah) and *Corymbia calophylla* (marri) on less leached soils (Beard 1990).

Heddle *et al.* (1980) mapping shows the site as comprising the 'Bassendean central and south complex' which is described as vegetation ranging from woodland of *Eucalyptus marginata* - *Allocasuarina fraseriana* - *Banksia* spp. to low woodland of *Melaleuca* spp. and sedgelands on the moister sites.

A review of relevant databases has revealed that the site has been historically cleared and does not contain any remnant native vegetation. Therefore, the native flora and vegetation values associated with the site are non-existent.

2.2.2 Terrestrial fauna

As the site is historically cleared and does not contain any native remnant vegetation, it is of very limited value to terrestrial fauna from a habitat perspective.

2.2.3 *Bush Forever*

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 WA 2000). The *Bush Forever* policy is only applicable within the Swan Coastal Plain portion of the Metropolitan Region Scheme (MRS).

No *Bush Forever* sites occur within the site.

2.2.4 Ecological linkages

Ecological or biodiversity linkages are described as areas of native vegetation which provide a corridor or linkage (typically linear) between patches of vegetation to allow movement of flora and fauna and their genetic material through the landscape, helping to maintain metapopulations. Ecological linkages are often continuous or near-continuous as the more fractured a linkage is, the less ease flora and fauna have in moving within the corridor (Alan Tingay and Associates 1998).

The Perth Biodiversity Project, supported by the Western Australia Local Government Association (WALGA), have identified and mapped Regional Ecological Linkages within the Perth Metropolitan Region (PBP 2007). In order to extend this study outside of the Perth Metropolitan Region, the South

West Biodiversity Project was established, resulting in the identification and mapping of the South West Regional Ecological Linkages (Molloy *et al.* 2009).

A review of the data from the Perth Biodiversity Project reveal that a regional ecological linkage occurs around 200m to the west of the site (WALGA and PBP 2004) (**Figure 7**). These ecological linkages connect areas of *Bush Forever* and intact vegetation located in the wider local area. The development of the site is unlikely to impact the function of this ecological linkage.

2.2.5 Environmentally sensitive areas

Within Western Australia, the clearing of native vegetation can only be undertaken once a Clearing Permit has been attained under Part V of the EP Act, or if the clearing activity is in accordance with a valid exemption, including:

- Exemptions listed in Schedule 6 of EP Act. These include, but are not limited to:
  - Clearing undertaken in accordance with a subdivision approval.
  - Clearing that is required under other laws (for example, Local Governments may require landholders to establish and maintain firebreaks under the *Bush Fires Act 1954*).
- Exemptions listed in the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004* (the Regulations). These are associated with low impact land management practices and include, but are not limited to:
  - Clearing to allow for the construction of fence-lines.
  - Clearing for vehicular and walking tracks.
  - Burning to reduce fire hazards.
  - The collection of firewood.

'Environmentally sensitive areas' (ESAs) are prescribed under the Regulations to protect native vegetation values in proximity to significant threatened flora, ecological communities, wetlands or ecosystems. Within ESAs, exemptions listed in the Regulations (i.e. those associated with low impact land management practices) do not apply and a Clearing Permit is required to undertake such clearing activities. The relevance of ESAs is limited to this specific context.

There are no ESAs within the site, and there is no native vegetation pursuant to the EP Act occurring within the site.

2.3 Hydrology

2.3.1 Groundwater

The *Perth Groundwater Map* indicates that the historical maximum groundwater levels (MGL) range between 10 m AHD in the south-west of the site and 13 m AHD in the north-east of the site.

Existing groundwater levels are shown in **Figure 8**.

2.3.2 Surface water

No defined streamlines or floodways occur within or in close proximity to the site. This is consistent with the high permeability of the underlying sand. Surface runoff is unlikely to occur, however in extreme rainfall events could result in sheet flow directed towards the lower lying areas of the site.

2.3.3 Wetlands

The *Geomorphic Wetlands Swan Coastal Plain dataset* indicates that there are no identified wetlands within the site.

2.3.4 Public Drinking Water Source Areas

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

The site is not located within or in proximity to any proclaimed or proposed Public Drinking Water Source Areas (PDWSAs).

2.4 Heritage

2.4.1 Aboriginal heritage

The *Aboriginal Heritage Inquiry System* (AHIS) is maintained pursuant to Section 38 of the *Aboriginal Heritage Act 1972* (AH Act) by the Department of Planning, Lands and Heritage (DPLH), containing information on Registered Aboriginal Heritages Sites and Other Heritage Places throughout Western Australia. In accordance with the *Aboriginal Heritage Due Diligence Guidelines* (DAA 2013), a search of the AHIS online database (DPLH 2024) was undertaken.

No Registered Aboriginal Heritage Sites or Other Heritage Places are mapped by the DPLH over any part of the site.

2.4.2 Non-indigenous heritage

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

- World Heritage Sites.
- National Heritage Places.
- Commonwealth Heritage Places.

- Sites listed in the State Register of Heritage Places.
- Sites listed in the City of Mandurah Heritage Register.

The review did not identify any such features within the site.

2.5 Land use considerations

2.5.1 Historical land uses

2.5.1.1 Changes in land use

Review of historical images available from 1953 (Landgate 2024) onwards shows that the site was completely cleared of remnant vegetation between 1965 and 1989.

Lot 80 appears to have been the first lot to be completely cleared, with a shed being built within it between 1965 and 1970.

Lot 78 appears to have been progressively cleared between 1965 and 1974, and a residence being built on the north side of the lot between 1970 and 1977.

Lot 815 was cleared between 1974 and 1977. Vegetation regrowth occurred before the lot was cleared again between 1985 and 1989, and a shed was built on the north side of the lot. There appears to be evidence of light industrial activity on this lot between 2008 and 2017.

Lot 813 was completely cleared of vegetation between 1985 and 1989, and appears to have been progressively built-up between 1995 and 2004 and until recently supported a steel distributor ("Best Buy Steel").

2.5.1.2 Potential contamination

A desktop study of the potential presence of historical contamination within the site was conducted. The State Government, through the DWER, has the overall responsibility for developing, administering, and enforcing the *Contaminated Sites Act 2003* and its associated procedures. Part of this responsibility includes maintenance of the *Contaminated Sites Database* which holds information on known, previously or potentially contaminated sites within Western Australia. The *Contaminated Sites Database* holds information on known contaminated sites that have been classified by the DWER as:

- Contaminated – remediation required.
- Contaminated – restricted use.
- Remediated for restricted use.

A search of the *Contaminated Sites Database* indicated the site is not recorded on the database, and there are no sites classified as contaminated within 1 km of the site (DWER 2024).

2.5.2 Surrounding land uses

The site is surrounded by a variety of existing land uses, including:

- Wattleup Road to the north of the site.
- Rural land uses to the west.
- Future urban land use (residential) to the east.
- The future extension of Rowley Road to the south.

None of the identified land uses surrounding the site would preclude the site from being suitable for residential development, however the future Rowley Road will need consideration in terms of potential noise impacts on the proposed residential (i.e. noise sensitive) uses within the site.

State Planning Policy 5.4 Road and Rail Noise (WAPC 2019) requires a Transport Noise Assessment (TNA) to be undertaken prior to subdivision works being commenced within the site. A TNA has been prepared by Lloyd George Acoustics to support the amendment to the SP.

2.6 Bushfire hazard

The site is partially designated as a 'Bushfire Prone Area' in the *Map of Bush Fire Prone Areas* (Office of Bushfire Risk Management 2021) (**Figure 9**). *State Planning Policy 3.7 Planning in Bushfire Prone Areas* (WAPC 2015a) sets out a requirement for the preparation of a Bushfire Management Plan (BMP) to support any planning proposal (such as a SP or subdivision application) which intersects a designated bushfire prone area. On this basis, a BMP has been prepared to support the lodgement of the updated SP.

2.7 Summary of relevant environmental factors

The environmental factors that have been investigated for the site, and those that will require further specific consideration as part of the future development within the site, are summarised in **Table 2**. These considerations are discussed further in **Section 4**.

Table 2: Relevant environmental factors and considerations for the proposed SP.

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.
Landform and soils	No issues posed and therefore no further consideration of this factor is required.
Acid sulfate soils	No issues posed and therefore no further consideration of this factor is required.
Flora and vegetation	No issues posed and therefore no further consideration of this factor is required.
Terrestrial fauna	No issues posed and therefore no further consideration of this factor is required.
Bush Forever	No Bush Forever sites occur within the site and therefore no further consideration of this factor is required.
Ecological linkages	No issues posed and therefore no further consideration of this factor is required.
ESAs	No ESAs and no native vegetation is located within the site and therefore no further consideration of this factor is required.
Groundwater	The MGL for the site ranges between 10 m AHD and 13 m AHD. This is discussed further in **Section 4.1**.
Surface water	No surface water features have been identified within, or within proximity to the site and therefore no further consideration of this factor is required.
Wetlands	No wetlands have been identified within, or within proximity to the site and therefore no further consideration of this factor is required.
PDWSAs	No PDWSAs are located within, or within proximity to the site and therefore no further consideration is required.
Aboriginal heritage	No indigenous heritage values have been identified within, or within proximity to the site and therefore no further consideration of this factor is required.
Non-indigenous heritage	No non-indigenous heritage values have been identified within, or within proximity to the site and therefore no further consideration of this factor is required.
Historic land uses	No potentially contaminating land use is known to have occurred on the site. No further consideration of this factor is required.
Bushfire hazard	The site is partially designated as a 'Bush Fire Prone Area'. This is addressed further in **Section 4.2** and within the updated BMP.
Surrounding land uses	The extension of Rowley Road to the south of the site requires a TNA to be prepared. This is addressed further in **Section 4.3** and within the TNA.

3 Planning Framework and Proposal

3.1 Historical planning and environmental assessment context

The *Southern Suburbs District Structure Plan Stage 3* (SSDSP3) was released by the CoC in September 2012 (CoC 2012). The SSDSP3 acts as a guiding document, providing a broad land use framework and basis for co-ordinating and considering SPs which may be prepared within the district area. The SP has been designed to generally align with the relevant SSDSP, which considers areas for conservation, such as regional open space (ROS) and wetlands within its defined spatial extent. The SSDSP3 does not identify any conservation areas (through ROS or POS) within the site.

3.2 Updated Structure Plan

The current proposal is for an amendment to the Hammond Quarter SP (SPN/2348). The Hammond Quarter SP currently comprises Lots 117, 200, 803, 805, 816, 1000, 1001, 9001, 9002, and 9003 Wattleup Road, Hammond Park. The proposed amendment will add Lots 813 and 815, and the northern section of Lots 78 and 80 Wattleup Road, Hammond Park to the Hammond Quarter SP.

The proposed amendment to the SP is provided in **Appendix A**.

3.3 Future planning approvals and environmental management framework

The SP will be submitted to the CoC for consideration, with final approval to be given by the WAPC. Following SP approval, subdivision and development will be progressed in accordance with the SP.

It is usual for SP approval to involve the imposition of subdivision conditions in accordance with the WAPC's *Model Subdivision Conditions Schedule* (WAPC 2024) which cover the following relevant areas:

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

A key component of implementing the future subdivision and development of the site is the environmental management framework. Where required, subdivision conditions will implement the identified environmental management requirements. The future environmental management framework is discussed further in **Section 4**.

4 Environmental Assessment and Management Framework

4.1 Hydrology

The *Perth Groundwater Map* indicates that the historical maximum groundwater levels (MGL) range between 10 m AHD in the south-west of the site and 13 m AHD in the north-east of the site.

4.1.1 Policy framework and management objective

The documents *State Water Strategy for Western Australia* (Government of WA 2003) and *Better Urban Water Management* (WAPC 2008) endorse 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.

The EPA's *Environmental Assessment Guideline No. 8* (2015) outlines the following key objectives for the management of groundwater:

- To maintain the hydrological regimes of groundwater so that existing and potential uses, including ecosystem maintenance, are protected.
- To maintain the quality of groundwater, 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.
- Promote and assist in the management and sustainable use of water resources.

4.1.2 Structure Plan considerations for hydrology

The proposed SP amendment does not require the preparation of a Local Water Management Strategy but will require an addendum to the existing UWMP that has been prepared and approved for the existing and approved SP. The UWMP Addendum has been prepared by Hyd2o Hydrology (Hyd2o Hydrology, 2024).

4.1.3 Future groundwater management requirements

Depth to groundwater varies between 10 m and 13 m below the natural surface. Groundwater level management measures are therefore not required.

A key objective for the management of the surface water and groundwater quality is to maintain or improve the existing groundwater quality. This can be achieved by reducing the total nutrient load into the groundwater that originates from the development compared to historic and existing land uses. Improving groundwater quality can be achieved by the treatment of surface runoff prior to infiltrating to groundwater. The retention and infiltration of surface runoff also helps to recharge the superficial aquifer.

4.1.4 Predicted environmental outcomes

The UWMP addendum provides the framework for the SP to manage water quality in accordance with the WAPC and EPA guidelines and policy frameworks. The UWMP addendum provides the framework based on *Better Urban Water Management* (WAPC 2008) practices to support future subdivision and will contribute to improvement in water quality and the sustainable use of groundwater resources.

4.2 Bushfire management

4.2.1 Policy framework and management objective

State Planning Policy 3.7 Planning in Bushfire Prone Areas (WAPC 2015a) stipulates that any development proposal which occurs partly or wholly within a bushfire prone area is considers effective, risk-based land use planning and development to preserve life and reduce the impact of bushfire on property and infrastructure.

4.2.2 Structure Plan considerations for bushfire management

The south-west corner of the site is deemed 'bushfire prone' (**Figure 9**). Therefore, a Bushfire Management Plan (BMP) has been prepared by MBS Environment (MBS Environment, 2024) to support the LSP. Further discussion is provided in the BMP.

4.2.3 Future bushfire management requirements

Per the requirements of SPP 3.7, any future subdivision applications for the site must be accompanied by a new or updated BMP specific to the application. In addition, the WAPC may include standard conditions relating to bushfire risk management on any future subdivision approval for the site.

Future development of lots within 100 m of classified vegetation will require a final Bushfire Attack Level (BAL) assessment to be completed and certified prior to dwelling construction. This BAL assessment will inform any requirement for increased construction standards in accordance with AS 3959, which will then be implemented through the building licence process. An indicative BAL

assessment has been completed as part of the BMP and indicates that no future dwelling will be subject to a BAL rating higher than BAL-29.

As part of future subdivision and development, roads will be provided to support access routes, hydrants will be constructed, and POS will be implemented and maintained as 'low threat' in accordance with Clause 2.2.3.2(f) of AS 3959.

4.2.4 Predicted environmental outcomes

By preparing a BMP at this early stage of planning process, the LSP has been able to incorporate bushfire hazard management considerations into the design of the development. This will assist in ensuring that future dwellings will not be subject to an unacceptable level of risk (such that BAL-29 is not exceeded), and that if there is a bushfire within or near the site, the threat to residents, property and emergency response personnel will be reduced.

There is no requirement to clear native vegetation within or immediately adjacent to the site to achieve the bushfire management requirements as specified in the BMP, and therefore the bushfire management requirements in themselves do not create any environmental impacts or considerations.

4.3 Land use compatibility

4.3.1 Policy framework and management objective

State Planning Policy 5.4 Road and Rail Noise requires that development proposals account for acoustic impacts presented by the surrounding area. The objectives of SPP 5.4 are to:

- Protect the community from unreasonable levels of transport noise.
- Protect strategic and other significant freight transport corridors from incompatible urban encroachment.
- Ensure transport infrastructure and land-use can mutually exist within urban corridors.
- Ensure that noise impacts are addressed as early as possible in the planning process.
- Encourage best practice noise mitigation design and construction standards.

4.3.2 Structure plan considerations for acoustic impacts

The site occurs immediately adjacent to the the proposed Rowley Road extension, which is considered a 'Strategic Freight/Major Traffic Route'. This places the site within a road and rail noise-affected area (**Figure 10**). Therefore, a TNA has been prepared by Lloyd George Acoustics to support the LSP. Further discussion is provided in the TNA (**Appendix B**).

4.3.3 Future acoustic impact management requirements

The application of *State Planning Policy 5.4* requires that the TNA considers future developments and associated increases in traffic anticipated for the next 20 years. The TNA provides information on the noise controls proposed for the site.

4.3.4 Predicted environmental outcomes

By preparing a TNA at this early stage of planning process, the LSP has been able to incorporate acoustic impact considerations into the design of the development. This will assist in ensuring that future dwellings will not be subject to an unacceptable level of risk, i.e. that 55 dB $L_{Aeq(Day)}$ and 50 dB $L_{Aeq(Night)}$ is not exceeded.

5 Implementation

A summary of the LSP responses to the environmental values and attributes within the site is provided in **Table 3**. The table also outlines the proposed future management required as part of the subdivision and development process.

Table 3: Environmental management framework implementation.

Factor	SP phase	Subdivision phase	Development phase
Hydrology	• Preparation of an Urban Water Management Plan addendum.	• Incorporation of stormwater management infrastructure in subdivision designs in accordance with the UWMP addendum.	• Implementation/delivery of proposed stormwater management infrastructure.
Bushfire management	• Preparation of BMP. • Provision of POS and road reserves to accommodate appropriate APZs.	• Prepare/update BMP to support subdivision application/s. • Complete detailed BAL assessment to support dwelling construction.	• Dwellings within 100 m of bushfire threat to demonstrate compliance with AS 3959. • POS to be maintained as low threat in accordance with Clause 2.2.3.2(f) of AS 3959.
Noise management	• Preparation of TNA.	• Update TNA to support subdivision application/s	• Implementation of the TNA requirements.

6 Conclusions

This *Environmental Assessment and Management Strategy* (EAMS) which relates to Lots 813 and 815, and the northern section of Lots 78 and 80 Wattleup Road, Hammond Park, has been prepared in support of the proposed amendment to the Hammond Quarter Structure Plan (SPN/2348).

The SP amendment will include the site into the currently approved SP area. Management responses have been incorporated into the SP, including:

- Preparation of an UWMP addendum.
- Preparation of a BMP, which outlines how the SP responds the bushfire protection criteria specified in the *Guidelines for Planning in Bushfire Prone Areas* (WAPC and DFES 2015).
- Preparation of the TNA, which outlines how the LSP responds to the noise impacts presented by the Rowley Road extension.

This EAMS also outlines the environmental framework to be implemented across the site as part of future subdivision and development phases of the residential development process, including:

- Completion of detailed BAL assessment and imposition of determined BAL ratings on affected lots. New dwellings within 100 m of the bushfire threat should demonstrate compliance with AS 3959 corresponding to the assigned BAL rating.

Overall, the environmental attributes and values of the site can be accommodated within the SP design or can be managed appropriately through the future subdivision and development phases in line with the relevant state and local government legislation, policies and guidelines and best management practices.

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Figure 7: Regional Ecological Linkages

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Figure 10: Road and Rail Noise

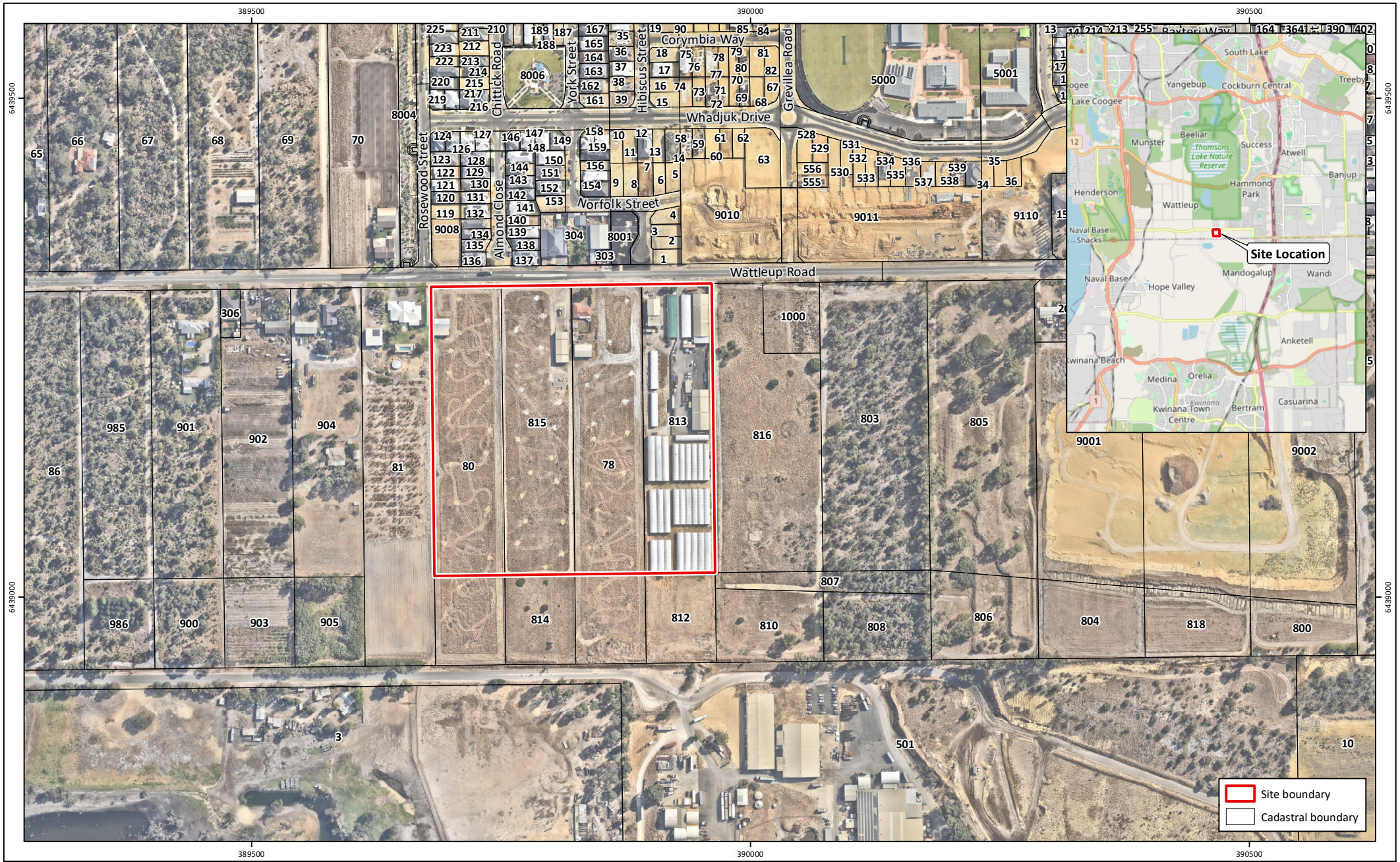

Figure 1: Site Location

Project: Environmental Assessment and Management Strategy
Hammond Quarter West

Client: Qube Property Group

Plan Number:
EP24-053(01)--F01

Drawn:	AS
Date:	06/05/2024
Checked:	JDH
Approved:	JDH
Date:	08/07/2024

N

0 50 100 150
Metres

Scale: 1:5,000@A4

GDA2020 MGA Zone 50

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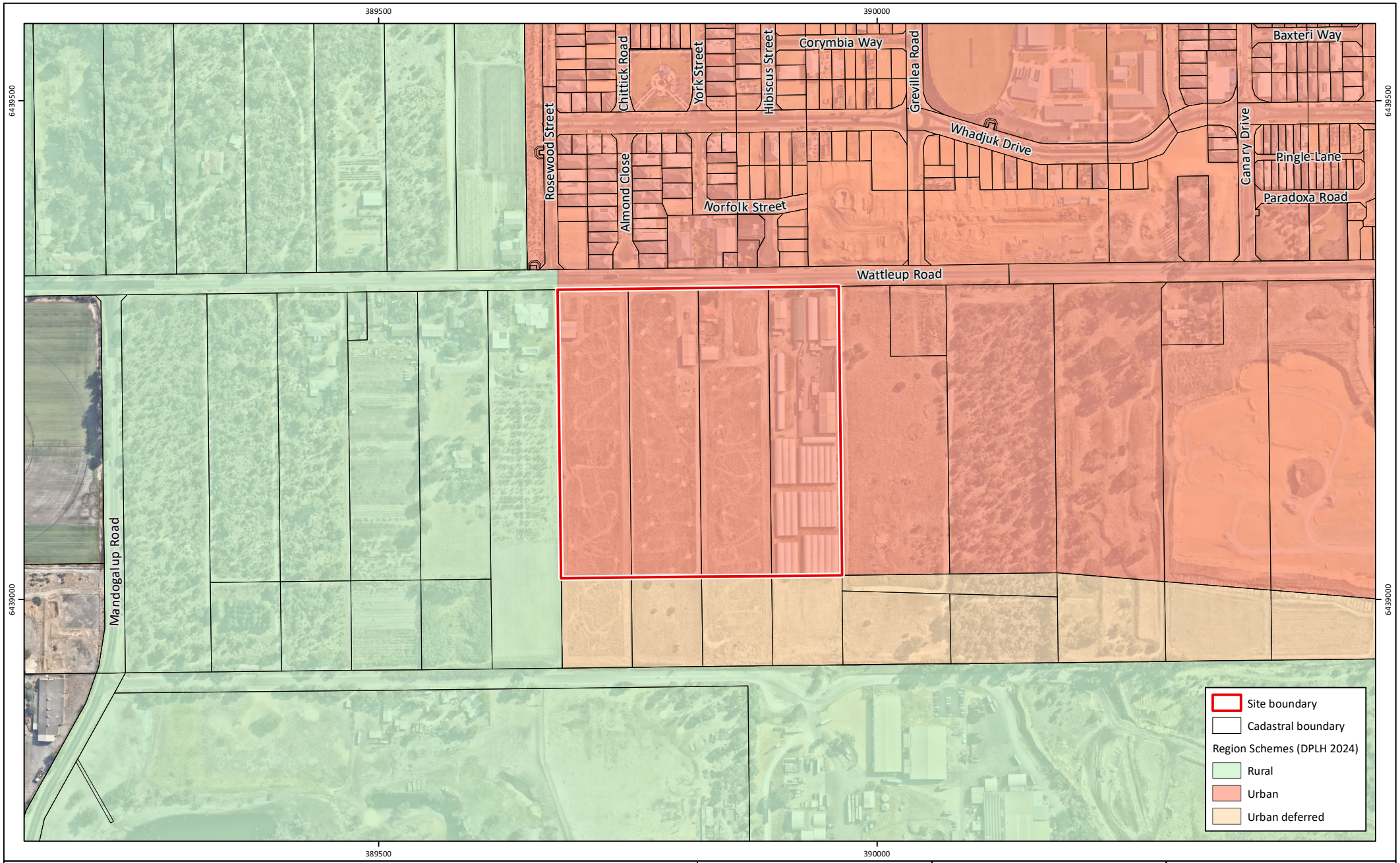

Figure 2: Metropolitan Region Scheme Zones and Reserves

Project: Environmental Assessment and Management Strategy
Hammond Quarter West

Client: Qube Property Group

Plan Number:
EP24-053(01)--F02

Drawn:	AS
Date:	06/05/2024
Checked:	JDH
Approved:	JDH
Date:	08/07/2024

N

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Metres

Scale: 1:5,000@A4

GDA2020 MGA Zone 50

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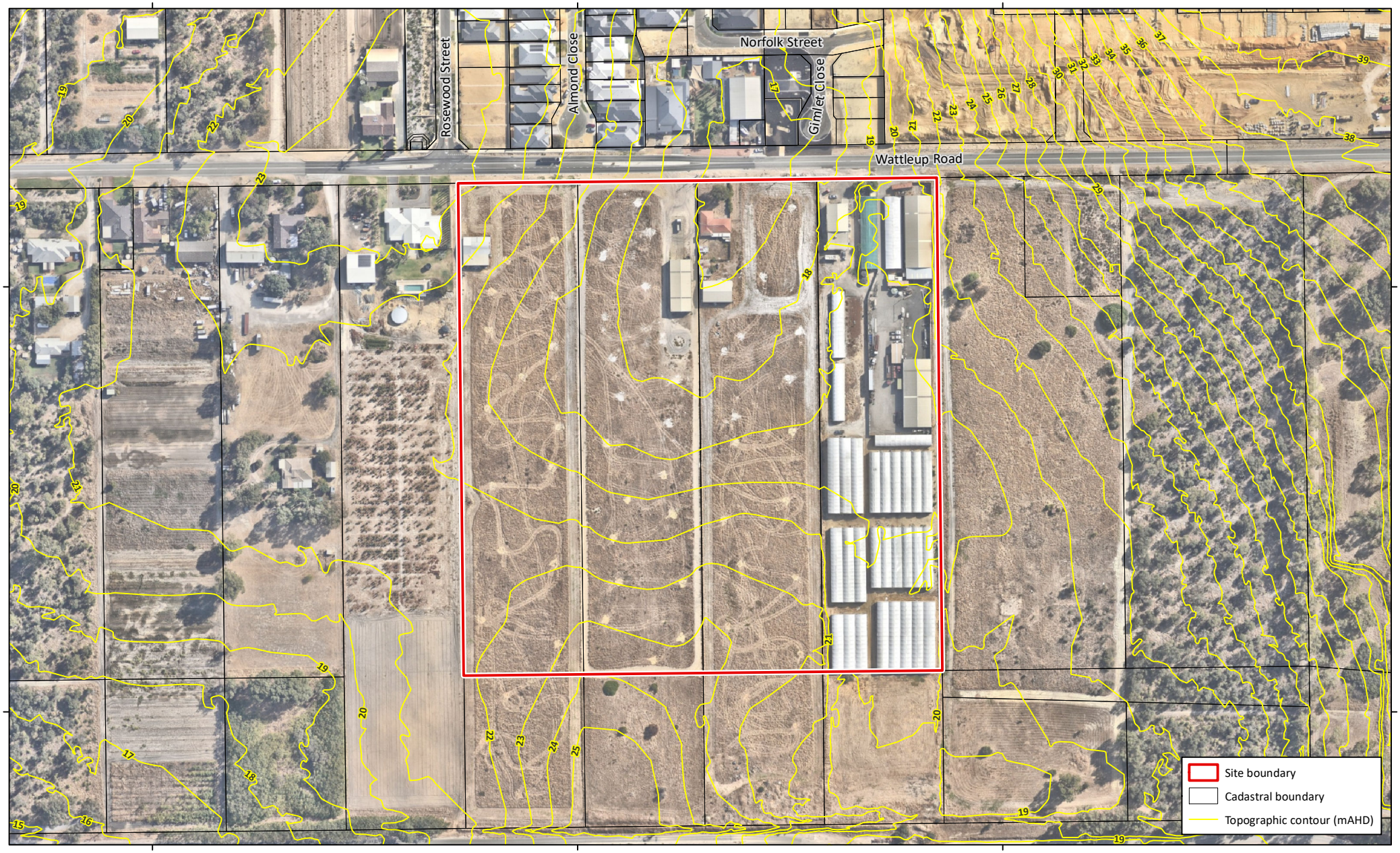

Figure 3: Topography

Project: Environmental Assessment and Management Strategy
Hammond Quarter West

Client: Qube Property Group

Plan Number:
EP24-053(01)--F03

Drawn:	AS
Date:	06/05/2024
Checked:	JDH
Approved:	JDH
Date:	08/07/2024

N

0 50 100
Metres

Scale: 1:3,000@A4

GDA2020 MGA Zone 50

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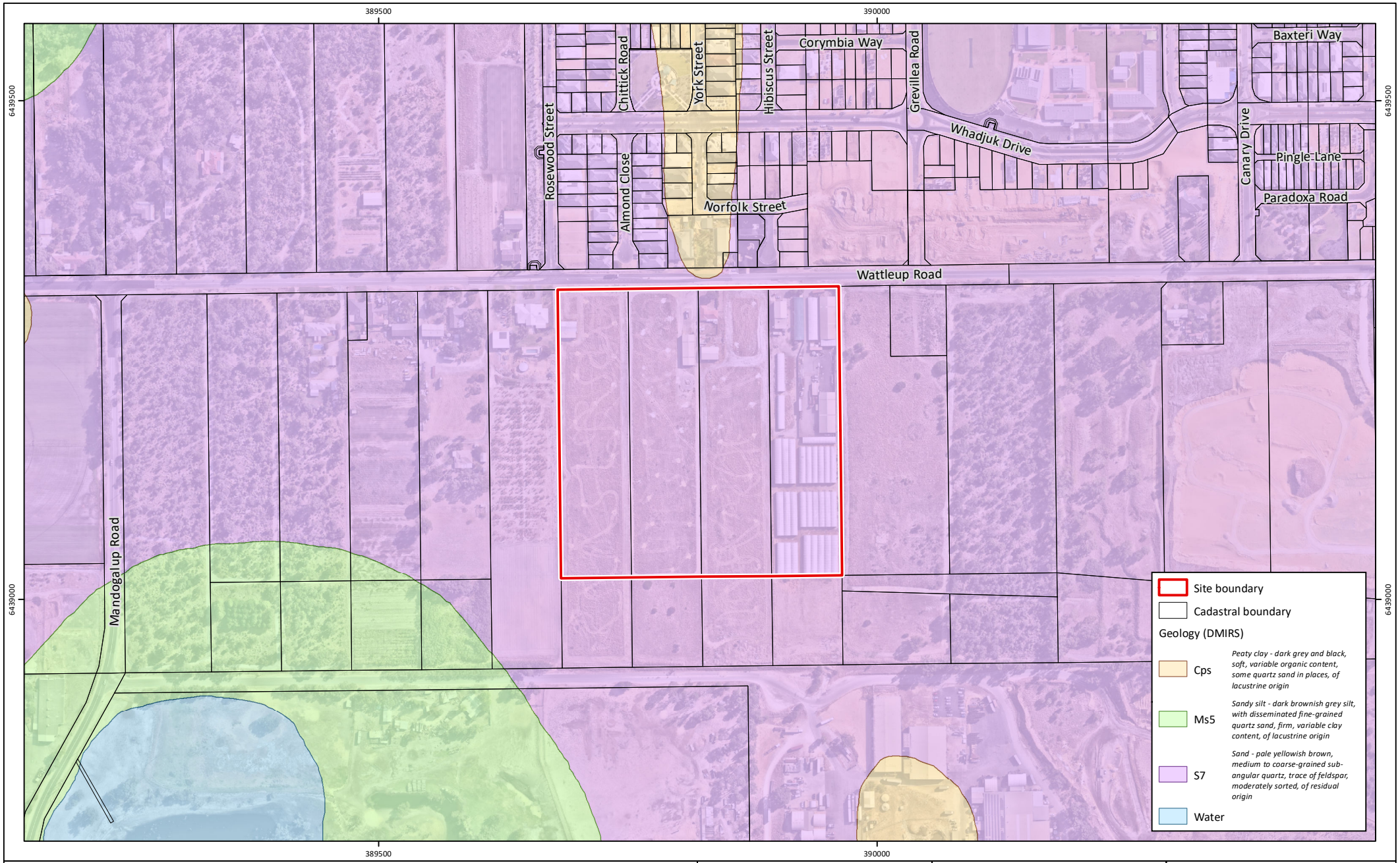

Figure 4: Geology

Project: Environmental Assessment and Management Strategy
Hammond Quarter West

Client: Qube Property Group

Plan Number:
EP24-053(01)--F04

Drawn:	AS
Date:	06/05/2024
Checked:	JDH
Approved:	JDH
Date:	08/07/2024

N

0 50 100 150
Metres

Scale: 1:5,000@A4

GDA2020 MGA Zone 50

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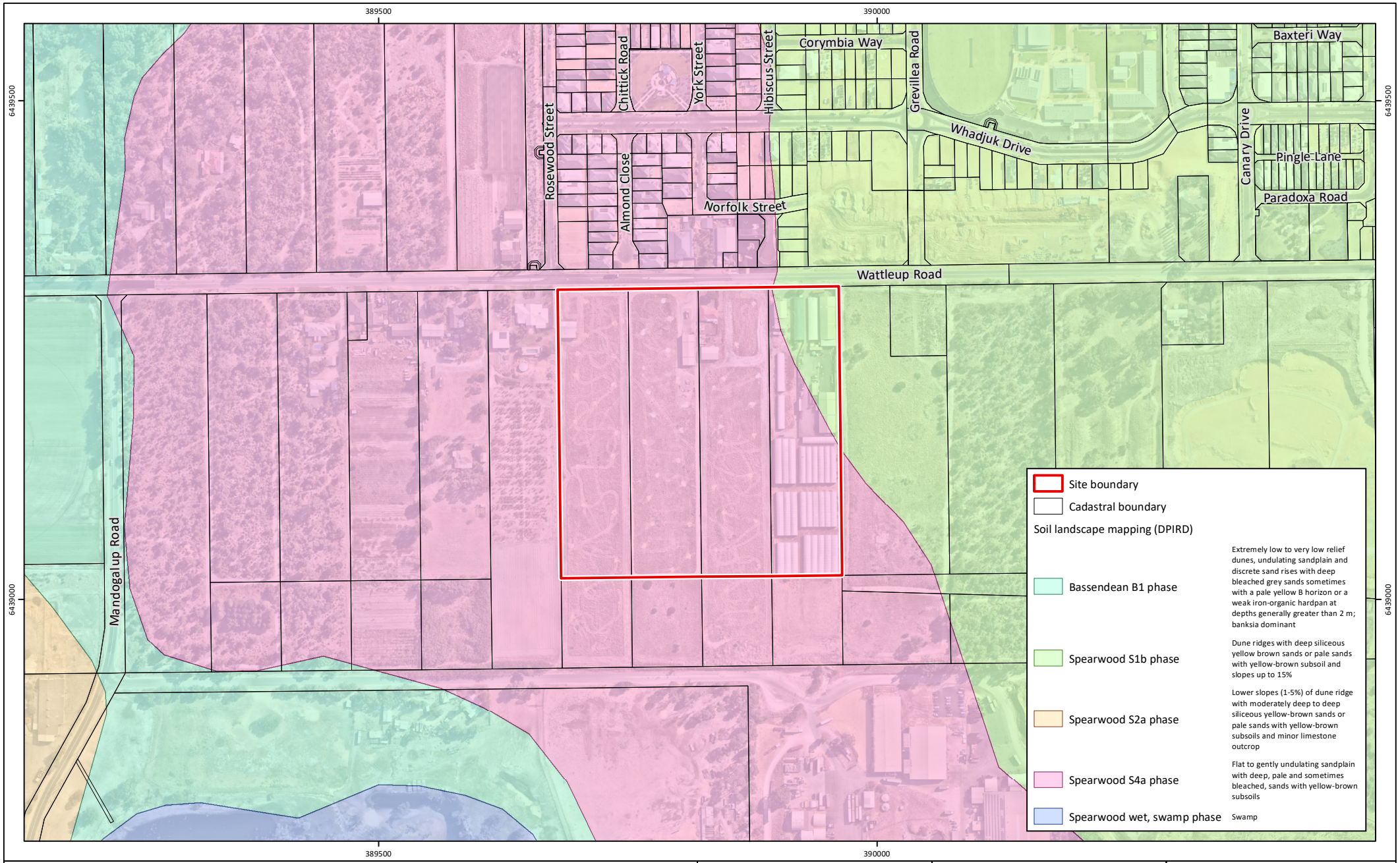

Figure 5: Soils

Project: Environmental Assessment and Management Strategy
Hammond Quarter West

Client: Qube Property Group

Plan Number:
EP24-053(01)--F05

Drawn:	AS
Date:	06/05/2024
Checked:	JDH
Approved:	JDH
Date:	08/07/2024

N

0 50 100 150
Metres

Scale: 1:5,000@A4

GDA2020 MGA Zone 50

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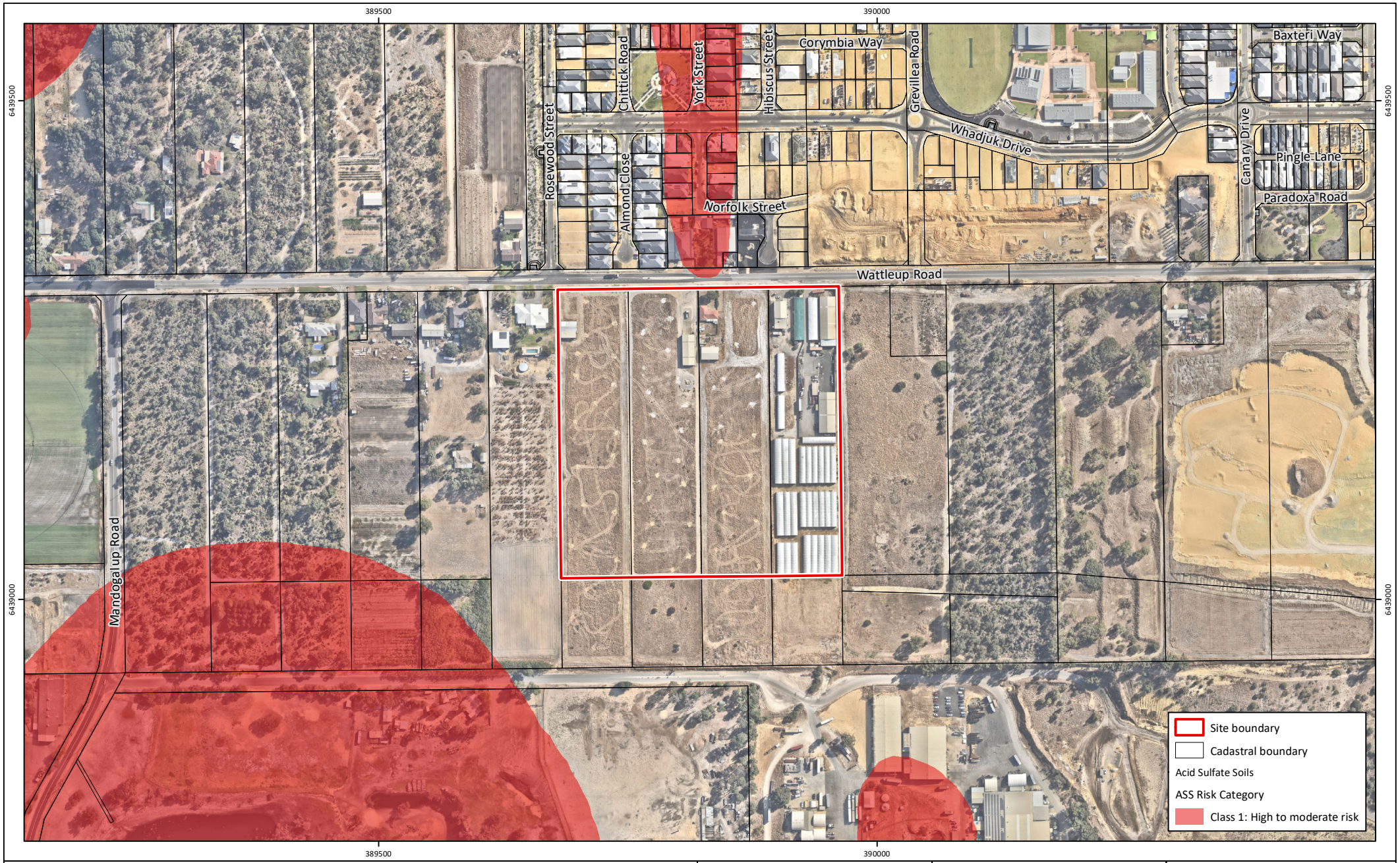

Figure 6: Acid Sulfate Soils

Project: Environmental Assessment and Management Strategy
Hammond Quarter West

Client: Qube Property Group

Plan Number:
EP24-053(01)--F06

Drawn:	AS
Date:	06/05/2024
Checked:	JDH
Approved:	JDH
Date:	08/07/2024

N

0 50 100 150
Metres

Scale: 1:5,000@A4

GDA2020 MGA Zone 50

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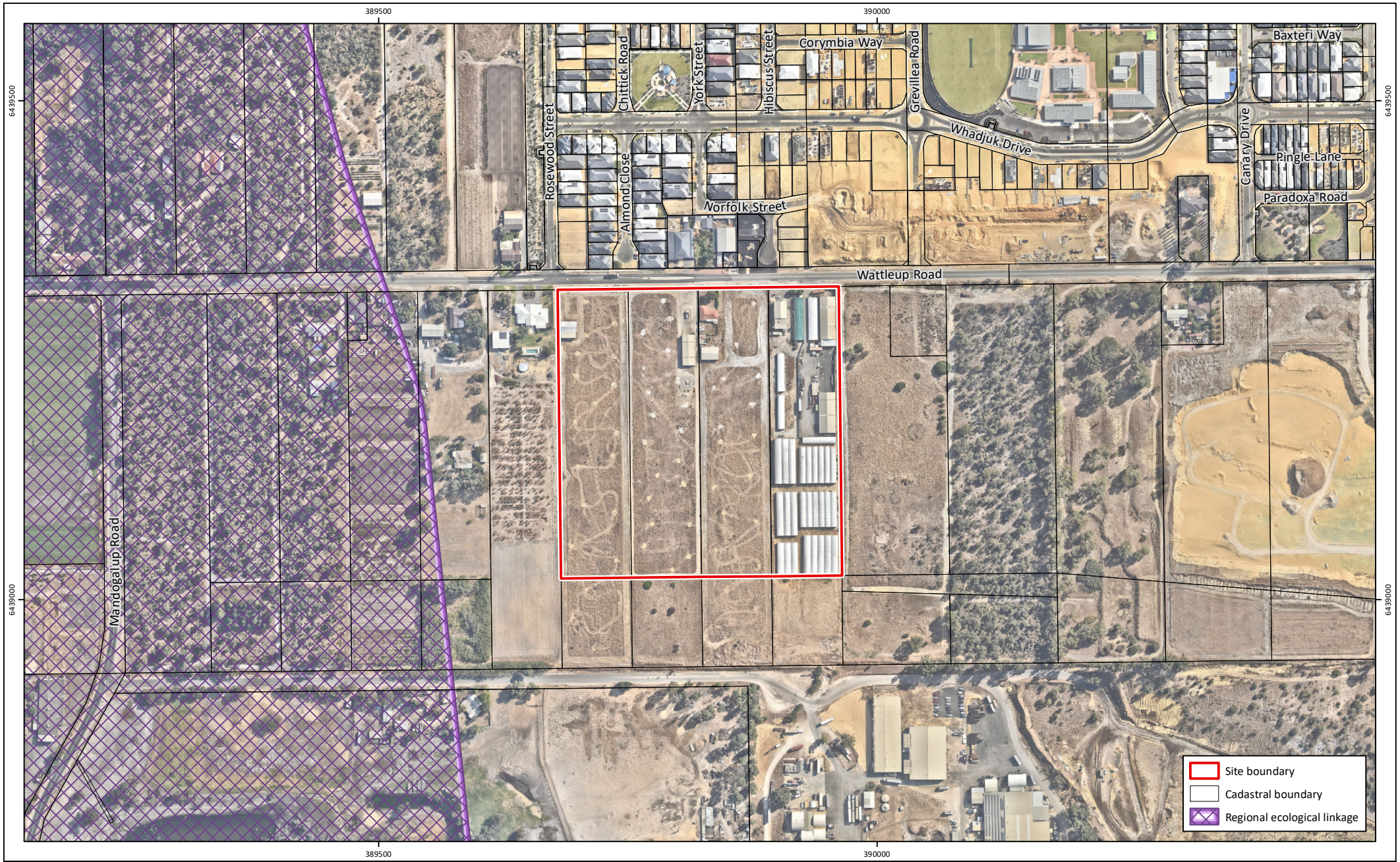

Figure 7: Regional Ecological Linkages

Project: Environmental Assessment and Management Strategy
Hammond Quarter West

Client: Qube Property Group

Plan Number:
EP24-053(01)--F07

Drawn:	AS
Date:	06/05/2024
Checked:	JDH
Approved:	JDH
Date:	08/07/2024

N

0 50 100 150
Metres

Scale: 1:5,000@A4

GDA2020 MGA Zone 50

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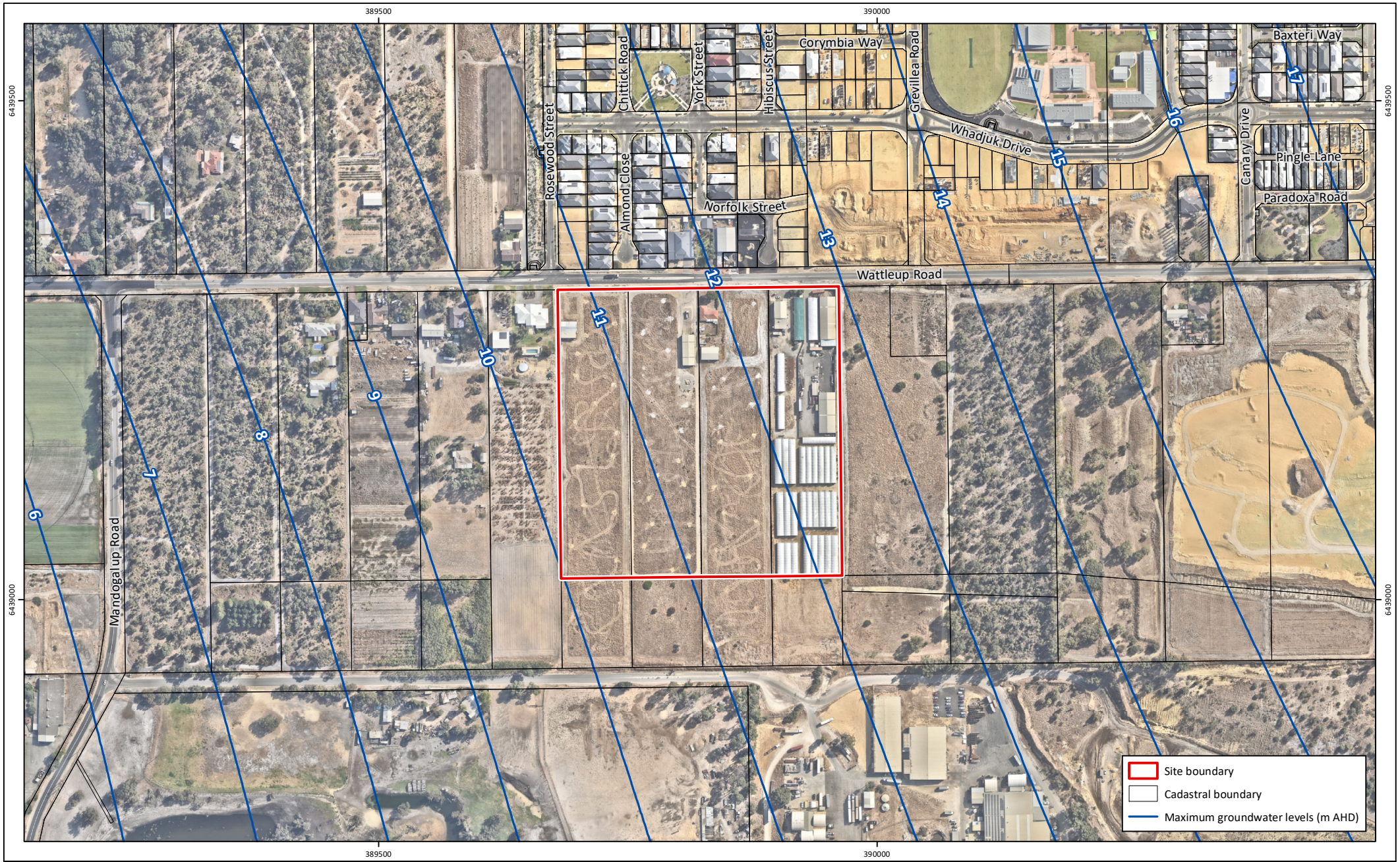

Figure 8: Groundwater Contours

Project: Environmental Assessment and Management Strategy
Hammond Quarter West

Client: Qube Property Group

Plan Number:
EP24-053(01)--F08

Drawn:	AS
Date:	06/05/2024
Checked:	JDH
Approved:	JDH
Date:	08/07/2024

N

0 50 100 150
Metres

Scale: 1:5,000@A4

GDA2020 MGA Zone 50

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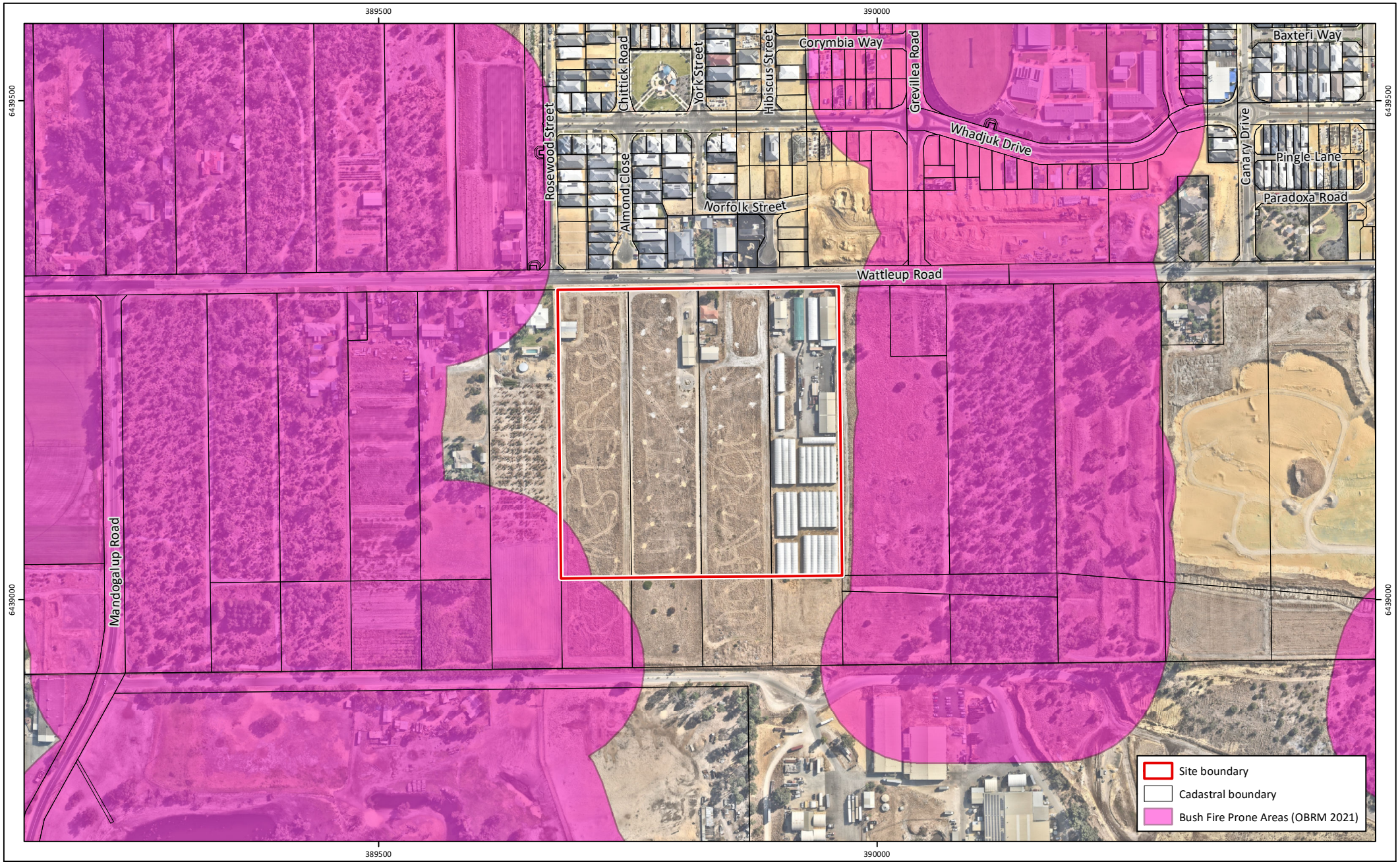

Figure 9: Bush Fire Prone Areas

Project: Environmental Assessment and Management Strategy
Hammond Quarter West

Client: Qube Property Group

Plan Number:
EP24-053(01)--F09

Drawn:	AS
Date:	06/05/2024
Checked:	JDH
Approved:	JDH
Date:	08/07/2024

N

0 50 100 150
Metres

Scale: 1:5,000@A4

GDA2020 MGA Zone 50

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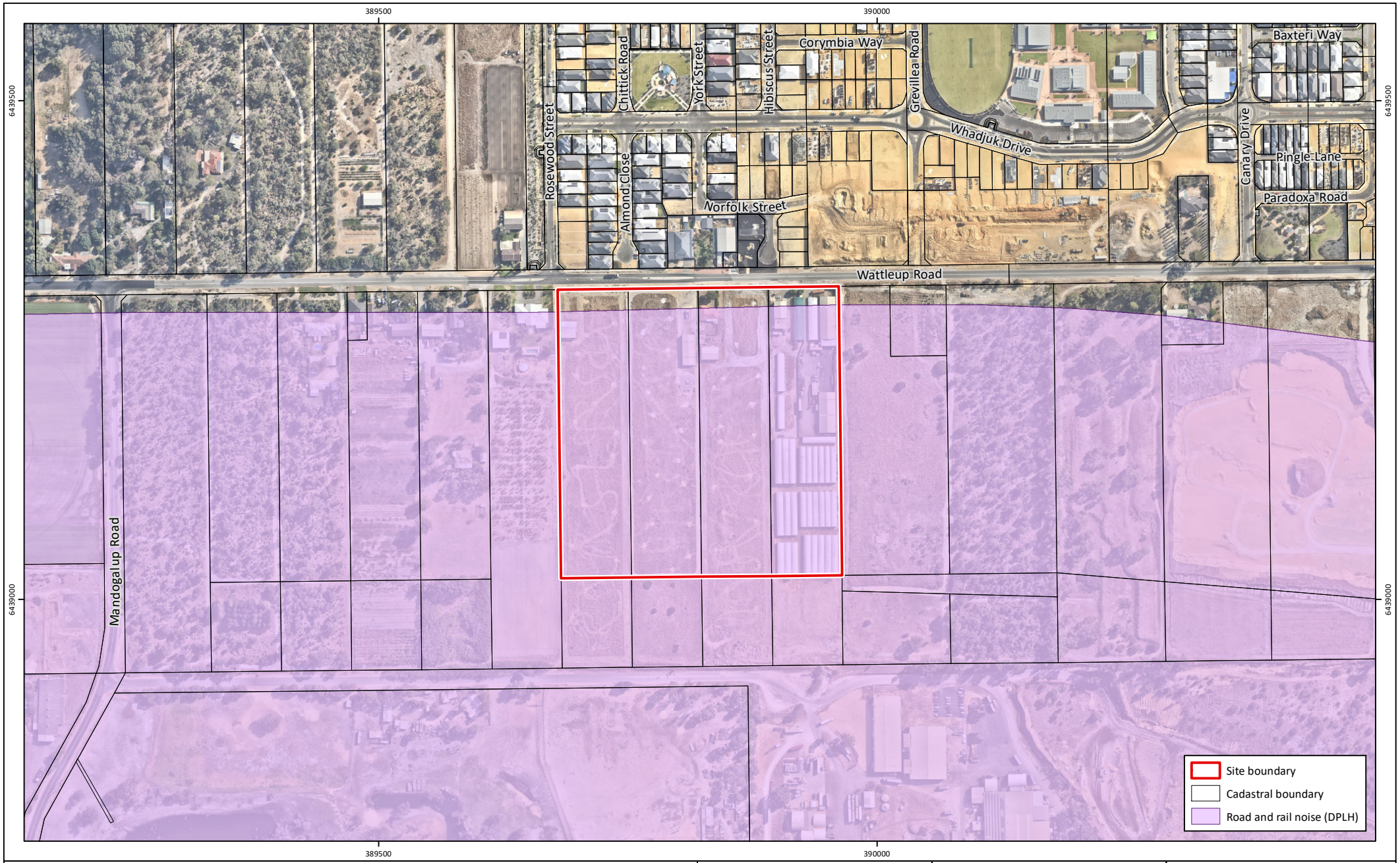

Figure 10: Road and Rail Noise

Project: Environmental Assessment and Management Strategy
Hammond Quarter West

Client: Qube Property Group

Plan Number:
EP24-053(01)--F10

Drawn:	AS
Date:	16/05/2024
Checked:	JDH
Approved:	JDH
Date:	08/07/2024

N

0 50 100 150
Metres

Scale: 1:5,000@A4

GDA2020 MGA Zone 50

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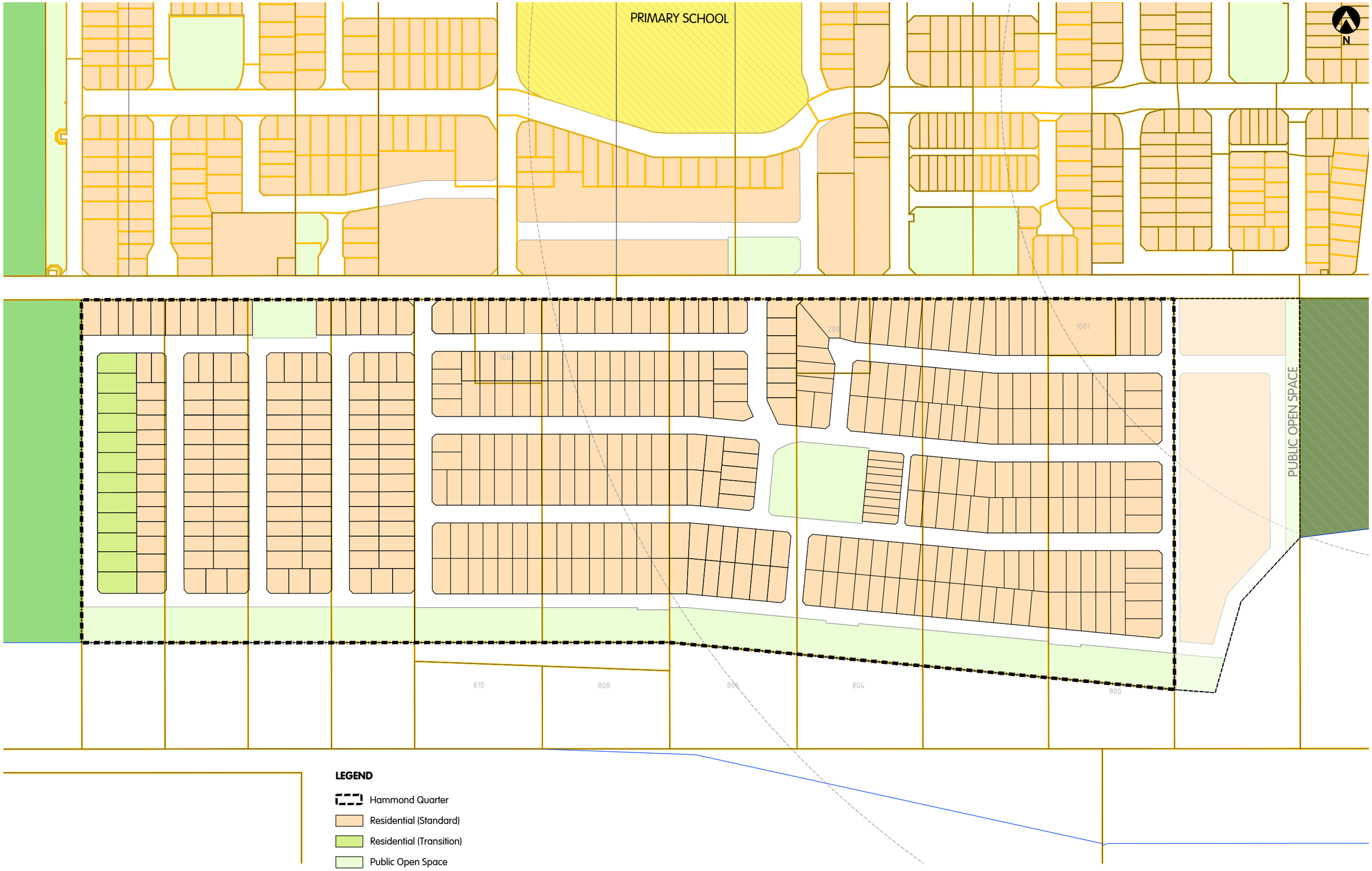
Appendix A

Hammond Quarter West Structure Plan Amendment (Hatch 2024)



QUBE

HATCH

CADASTRAL INFORMATION
SOURCE: LANDGATE SLIP
YYMMDD: 230619
DWG REF: LGATE-001
PROJECTION: PCG94

SIZE A3_ 1:2500

0 metres 20 40 60 80 100

REV	DESCRIPTION	YYMMDD	DRAWN	APPR'D
N	RELOCATE POS - TO SUIT DRAINAGE	240423	SB	TP
M	REMOVE TEMP ROAD NOTATION	240313	SB	TP
L	COLOUR TEMP CONNECTION AS RESI	240214	SB	TP

CONCEPT PLAN - WATTLEUP NEIGHBOURHOOD

Hammond Quarter Structure Plan

City of Cockburn

JOB CODE	DRAW NO.	REV.
QUB WAT	**RD1 010**	**N**

DISCLAIMER: ISSUED FOR DESIGN INTENT ONLY. ALL AREAS AND DIMENSIONS ARE SUBJECT TO DETAIL DESIGN AND SURVEY

LEGEND

- Area of Modification
- Residential (Standard)
- Residential (Transition)
- Public Open Space

YIELD TABLE

Existing Lots	4
Proposed Lots	
Residential (Standard)	125
Residential (Transition)	11
TOTAL	**136**
Public Open Space	2

Note: Totals include proposed lots used for temporary road access.

QUBE

HATCH

CADASTRAL INFORMATION
SOURCE: LANDGATE SLIP
YYMMDD: 230619
DWG REF: LGATE-001
PROJECTION: PCG94

SIZE A3_ 1:2000

0 metres 20 40 60 80 100

REV	DESCRIPTION	YYMMDD	DRAWN	APPR'D
N	RELOCATE POS - TO SUIT DRAINAGE	240423	SB	TP
M	REMOVE TEMP ROAD NOTATION	240313	SB	TP
L	COLOUR TEMP CONNECTION AS RESI	240214	SB	TP

CONCEPT PLAN - WATTLEUP NEIGHBOURHOOD
City of Cockburn

JOB CODE	DRAW NO.	REV.
QUB WAT	**RD1 010**	**N**

DISCLAIMER: ISSUED FOR DESIGN INTENT ONLY. ALL AREAS AND DIMENSIONS ARE SUBJECT TO DETAIL DESIGN AND SURVEY

Appendix B

Transport and Noise Assessment (Lloyd George Acoustics, 2024)

Lloyd George Acoustics
PO Box 717
Hillarys WA 6923
T: 9401 7770
www.lgacoustics.com.au

Transportation Noise Assessment

Lot 813, Lot 78, Lot 815 and Lot 80 Wattleup Rd, Hammond Park

Reference: 24058981-01

Prepared for:
Qube

Association of Australasian Acoustical Consultants

Reference: 24058981-01

Lloyd George Acoustics Pty Ltd
ABN: 79 125 812 544

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E:	rob@lgacoustics.com.au	daryl@lgacoustics.com.au	hao@lgacoustics.com.au	matt.nolan@lgacoustics.com.au
P:	0410 107 440	0420 364 650	0438 481 207	0448 912 604

This report has been prepared in accordance with the scope of services described in the contract or agreement between Lloyd George Acoustics Pty Ltd and the Client. The report relies upon data, surveys, measurements and results taken at or under the particular times and conditions specified herein. Any findings, conclusions or recommendations only apply to the aforementioned circumstances and no greater reliance should be assumed or drawn by the Client. Furthermore, the report has been prepared solely for use by the Client, and Lloyd George Acoustics Pty Ltd accepts no responsibility for its use by other parties.

Date	Rev	Description	Author	Verified
8-May-24	0	Issued to Client	Terry George	Matt Moyle

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1. INTRODUCTION

It is proposed to subdivide land at Lot 813, Lot 78, Lot 815 and Lot 80 Wattleup Rd, Hammond Park (refer *Figure 1-1*) with the proposed subdivision plan shown in *Figure 1-2*. To the south is the future extension of Rowley Road, which is considered a 'Strategic Freight/Major Traffic Route' as shown on PlanWA Maps (red dashed line), such that a noise assessment is required in accordance with *State Planning Policy No. 5.4 Road and Rail Noise*, being the subject of this report.

A previous assessment[1] was undertaken for a similar proposed subdivision (refer *Figure 1-1*), such that this current assessment uses similar methodology by updating the previous noise model with the subject site subdivision.

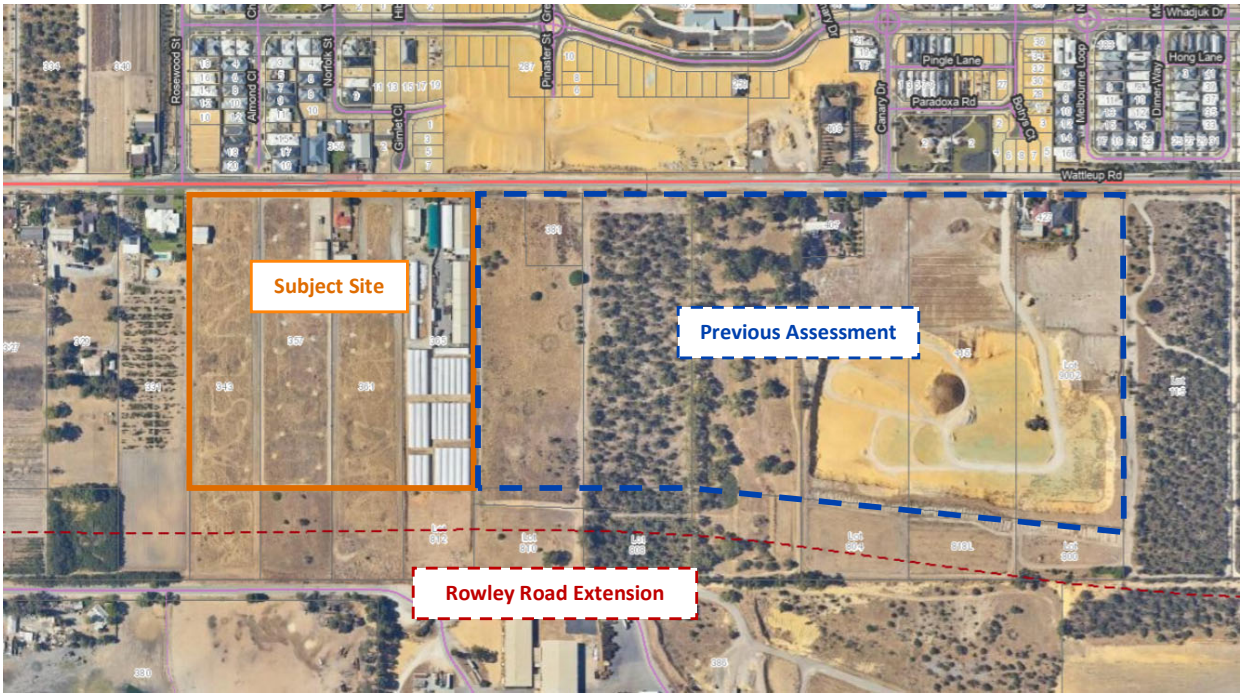


Figure 1-1: Subdivision Location (Source: DPLH PlanWA)

Appendix B contains a description of some of the terminology used throughout this report.

[1] *Transportation Noise Assessment, Lots 9003, 809, 805, 9001, 117 & 9002 Hammond Park*; Reference: 21026117-01e, 27 October 2023

Figure 1-2: Subdivision Layout

2. CRITERIA

The criteria relevant to this project is provided in *State Planning Policy No. 5.4 Road and Rail Noise* (hereafter referred to as SPP 5.4) produced by the Western Australian Planning Commission (WAPC). SPP 5.4 is supported by the *Road and Rail Noise Guidelines* (the Guidelines) and the Department of Planning, Lands and Heritage mapping. The objectives of SPP 5.4 are to:

- Protect the community from unreasonable levels of transport noise;
- Protect strategic and other significant freight transport corridors from incompatible urban encroachment;
- Ensure transport infrastructure and land-use can mutually exist within urban corridors;
- Ensure that noise impacts are addressed as early as possible in the planning process; and
- Encourage best practice noise mitigation design and construction standards.

Table 2-1 sets out noise targets that are to be achieved by proposals under which SPP 5.4 applies. Where the targets are exceeded, an assessment is required to determine the likely level of transport noise and management/mitigation required.

Table 2-1: Noise Targets for Noise Sensitive Land-Use

Scenario	Outdoor Noise Target		Indoor Noise Target	
Noise-sensitive land-use and/or development	55 dB $L_{Aeq(Day)}$	50 dB $L_{Aeq(Night)}$	40 dB $L_{Aeq(Day)}$ (Living and Work Areas)	35 dB $L_{Aeq(Night)}$ (Bedrooms)

Notes:

- Day period is from 6am to 10pm and night period from 10pm to 6am.
- The outdoor noise target is to be measured at 1-metre from the most exposed, habitable[2] facade of a noise sensitive building.
- For all noise-sensitive land-use and/or development, indoor noise targets for other room usages may be reasonably drawn from Table 1 of Australian Standard/New Zealand Standard AS/NZS 2107:2016 *Acoustics – Recommended Design Sound Levels and Reverberation Times for Building Interiors* (as amended) for each relevant time period.
- Outdoor targets are to be met at all outdoor areas as far as is reasonable and practicable to do so using the various noise mitigation measures outlined in the Guidelines.

The application of SPP 5.4 is to consider anticipated traffic volumes for the next 20 years from when the noise assessment has been undertaken.

[2] *A habitable room is defined in State Planning Policy 3.1 as a room used for normal domestic activities that includes a bedroom, living room, lounge room, music room, sitting room, television room, kitchen, dining room, sewing room, study, playroom, sunroom, gymnasium, fully enclosed swimming pool or patio.*

Table 2-2 sets out noise targets that are to be achieved by new or upgraded roads, under which SPP 5.4 applies.

Table 2-2: Noise Targets for Roads

Scenario	Outdoor Noise Target	
Road Upgrade	60 dB $L_{Aeq(Day)}$	55 dB $L_{Aeq(Night)}$

Notes:

- Day period is from 6am to 10pm and night period from 10pm to 6am.
- The outdoor noise target is to be measured at 1-metre from the most exposed, habitable[1] facade of a noise sensitive building.
- Outdoor targets are to be met at all outdoor areas as far as is reasonable and practicable to do so using the various noise mitigation measures outlined in the Guidelines. For example, it is likely unreasonable for a transport infrastructure provider to achieve the outdoor targets at more than 1 or 2 floors of an adjacent development with direct line of sight to the traffic.

In this case, Rowley Road extension will be a new road and therefore the 55 dB $L_{Aeq(Day)}$ and 50 dB $L_{Aeq(Night)}$ criteria of *Table 2-2* are applicable. If these criteria were achieved by the road builder, there would be no mitigation requirements to the subdivision, although such performance may not be practicable.

3. METHODOLOGY

Noise modelling has been undertaken in accordance with the requirements of SPP 5.4 and associated Guidelines. As this section of Rowley Road does not yet exist, noise monitoring has not been undertaken.

To predict the noise emissions, the computer program *SoundPLAN 8.2* was utilised incorporating the *Calculation of Road Traffic Noise* (CoRTN) algorithms, modified to reflect Australian conditions. The modifications included the following:

- Vehicles were separated into heavy (Austroads Class 3 upwards) and non-heavy (Austroads Class 1 and 2) with non-heavy vehicles having a source height of 0.5 metres above road level and heavy vehicles having two source heights at 1.5 metres and 3.6 metres above road level;
- A -0.8 dB correction has been applied to the lower level heavy vehicle noise source and -8.0 dB to the higher level noise source based on the *Transportation Noise Reference Book*; Paul Nelson (1987), so as to provide consistent results with the CoRTN algorithms;
- Adjustments of -0.8 dB and -1.7 dB have been applied to the predicted levels for the 'free-field' and 'at façade' cases respectively, based on the findings of *An Evaluation of the U.K. DoE Traffic Noise Prediction*; Australian Road Research Board, Report 122 ARRB – NAASRA Planning Group (March 1983).

Predictions are made at heights of 1.4 metres above ground floor level for single storey buildings and 4.2 metres above ground floor level for possible first floors of double storey buildings. The noise is predicted at 1-metre from an assumed building façade, resulting in a + 2.5 dB correction due to reflected noise.

Various input data are included in the modelling and these are discussed in *Section 3.1* to *Section 3.2*.

3.1. Ground Topography

The road design data was provided by Cossill & Webley dated 17 May 2022, as a 3D AutoCAD file and is understood to be the latest provided by Main Roads WA, however is subject to change noting there is no planned timeframe for the construction of this road. This was the same road design used for the future subdivision to the east of the subject site. Finished lot levels for the subject site subdivision were provided by Cossill & Webley, dated 1 May 2024, as a 3D AutoCAD file which has been merged with the existing topography in the area.

Indicative building outlines have been included as these can provide barrier attenuation when located between a source and a receiver, in much the same way as a hill or wall. All buildings are assumed to be single storey with heights of 3.5 metres. This means where modelling is undertaken to a possible upper floor, the noise is predicting above these building outlines.

3.2. Road Surface

The corrections applied for different road surface finishes are provided in *Table 3-1*.

Table 3-1: Noise Relationship Between Different Road Surfaces

Chip Seal				Asphalt			
14mm	10mm	5mm	Slurry	Dense Graded	Novachip	Stone Mastic	Open Graded
+3.5 dB	+2.5 dB	+1.5 dB	+1.0 dB	0.0 dB	-0.2 dB	-1.5 dB	-2.5 dB

Given the obligations for a new road to achieve the outdoor noise target, the assumed road surface is:

- Rowley Road – Dense Graded Asphalt.

3.3. Vehicle Speed

The posted speed is assumed to be:

- Rowley Road – 80 km/hr.

3.4. Traffic Volumes

Forecast 2041 traffic volumes were obtained from Main Roads WA to City of Cockburn (Lang Fong, Planning Information Manager, Email dated 24 January 2022). A 2046 plot was also more recently obtained from Main Roads WA (Scott Hazebroek, Traffic Modelling Analyst, Reference: #42809, dated 7 February 2024), showing volumes within a few hundred vehicles of those previously provided. *Table 3-2* provides the traffic volume input data in the model.

Table 3-2: Traffic Information Used in Noise Modelling

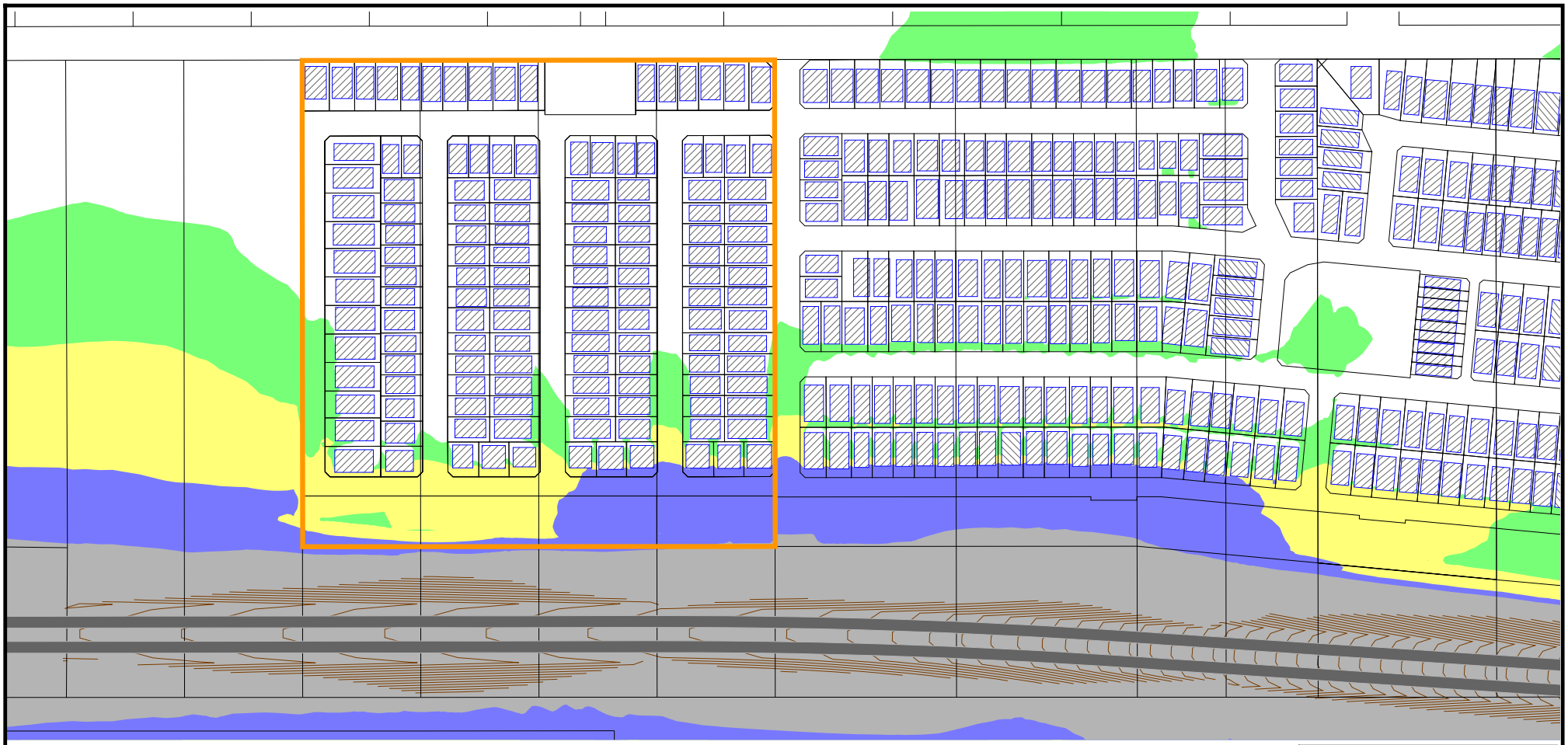
Road	Section	Direction	Traffic Volume	% Heavy Vehicles
Rowley Road	West of Hammond Road	Eastbound	19,200	19
		Westbound	14,900	19

3.5. Ground Absorption

The ground absorption has been assumed to be 0.0 (0%) for the roads and 0.5 (50%) through the subdivision, noting that 0.0 represents hard reflective surfaces such as water and 1.0 represents absorptive surfaces such as grass.

4. RESULTS

The noise modelling results are provided in *Figure 4-1* and *Figure 4-2* as $L_{Aeq(Day)}$ noise level contour plots, being for the future traffic conditions at ground floor height and first floor height level. It can be seen that the outdoor noise target will be exceeded assuming no mitigation.



Lots 813, 78, 815 & 80, Hammond Park -
Future 2046 $L_{Aeq(Day)}$ Noise Level Contours to Ground Floor

Assumed Road Surfaces are:
Rowley Road: Dense Graded Asphalt

SoundPLAN v8.2
CoRTN Algorithms

8 May 2024

Lloyd George Acoustics
PO Box 717
HILLARYS WA 6923
(08) 9401 7770

Length Scale 1:3500

0 20 40 80 120 160 m

Figure 4-1

Signs and symbols

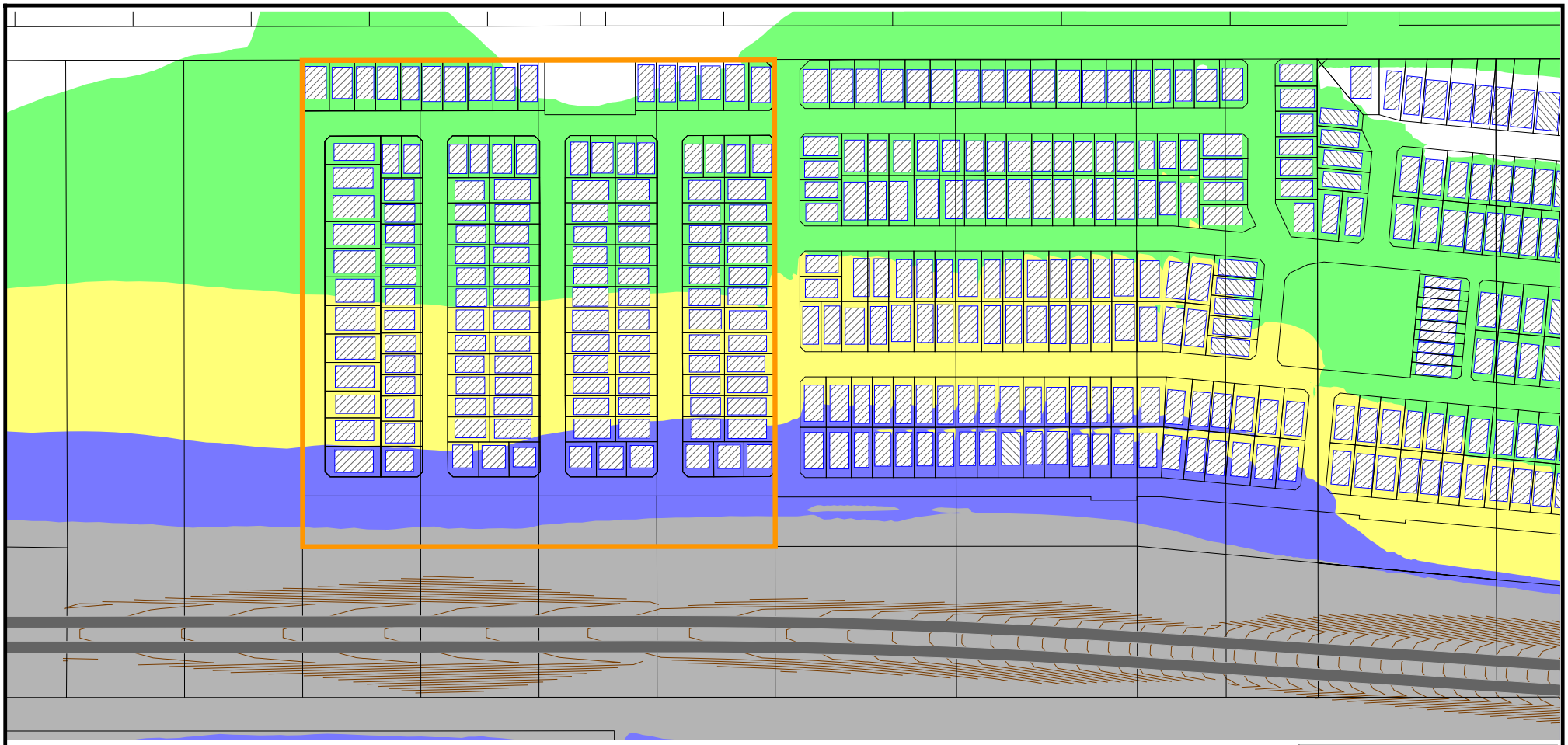
- Road
- Indicative Building
- Subject Site

N

Noise levels
$L_{Aeq(Day)}$ dB

<= 55	
<= 56	Exposure A
<= 57	
<= 58	
<= 59	Exposure B
<= 60	
<= 61	
<= 62	
<= 63	Exposure C
<= 64	
<= 65	
<= 66	
> 66	Exposure D

SPP 5.4 (Sep 2019)



Lots 813, 78, 815 & 80, Hammond Park -
Future 2046 $L_{Aeq(Day)}$ Noise Level Contours to Ground Floor

Assumed Road Surfaces are:
Rowley Road: Dense Graded Asphalt

SoundPLAN v8.2
CoRTN Algorithms

8 May 2024

Lloyd George Acoustics
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HILLARYS WA 6923
(08) 9401 7770

Length Scale 1:3500

0 20 40 80 120 160 m

Figure 4-2

Signs and symbols

- Road
- Indicative Building
- Subject Site

N

Noise levels
$L_{Aeq(Day)}$ dB

<= 55	
<= 56	Exposure A
<= 57	
<= 58	
<= 59	Exposure B
<= 60	
<= 61	
<= 62	
<= 63	Exposure C
<= 64	
<= 65	
<= 66	
> 66	Exposure D

SPP 5.4 (Sep 2019)

5. ASSESSMENT

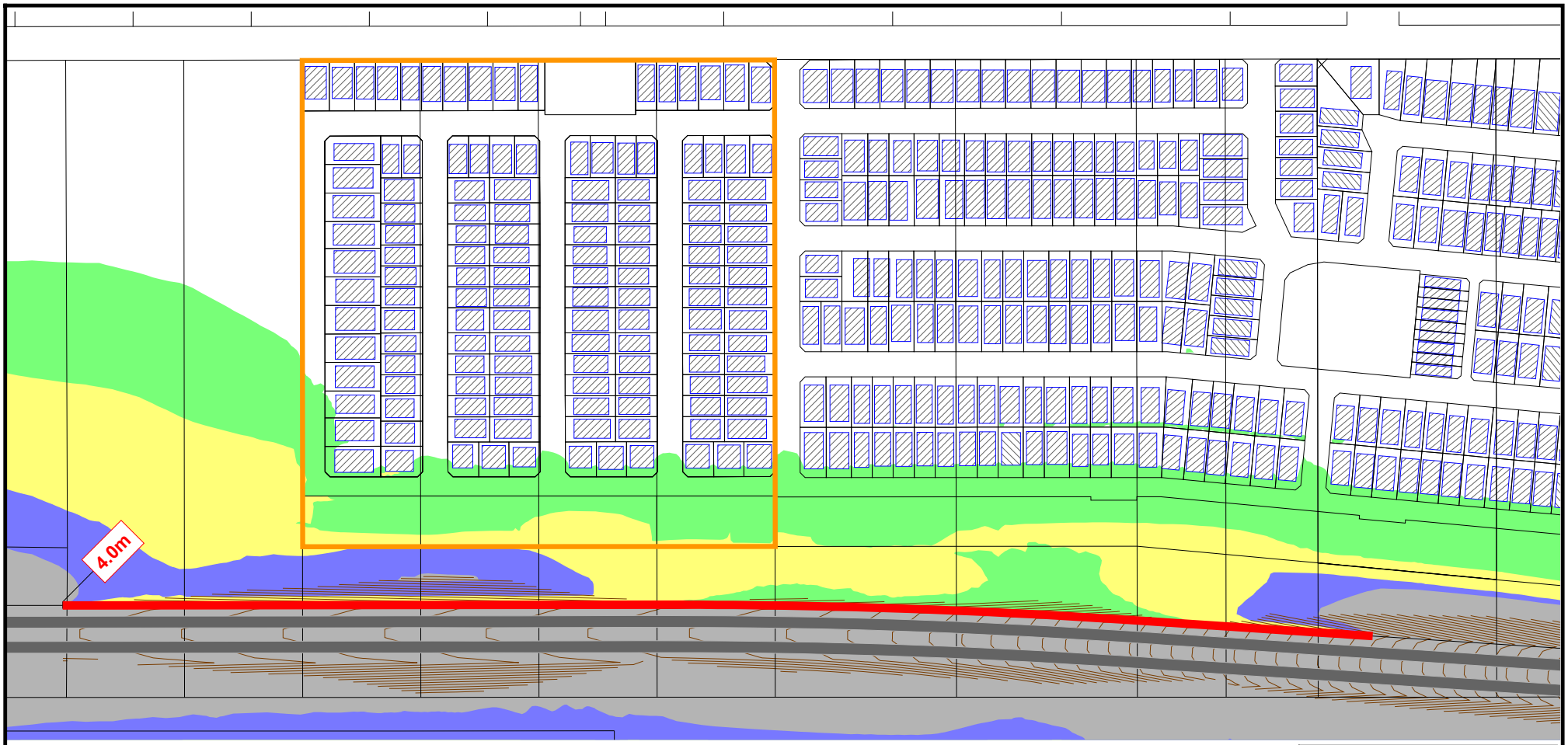
The objectives of SPP 5.4 are to achieve:

- Indoor noise levels specified in *Table 2-1* in noise-sensitive areas (e.g. bedrooms and living rooms of houses); and
- A reasonable degree of acoustic amenity for outdoor living areas on each residential lot.

Where the outdoor noise targets of *Table 2-1* are achieved, no further noise controls are necessary. With reference to *Section 4*, it is evident the outdoor noise target will be exceeded at some lots. Following discussions between stakeholders for the subdivision to the east, the preferred noise mitigation strategy is:

- Road builder to construct a 4-metre high wall alongside the road or mitigation to provide an equivalent result; and
- Developer is to incorporate Quiet House Packages to affected lots, including notifications on lot titles. *Appendix A* provides the Quiet House Packages, as taken from the SPP 5.4 Guidelines. Alternatives to the provided Packages can be accepted if supported by a report from a suitably qualified acoustical consultant (member firm of the Association of Australasian Acoustical Consultants (AAAC)) once the specific house plans for the lot are available.

The noise contours associated with the above are provided in *Figure 5-1* (ground floor) and *Figure 5-2* (first floor) with the noise mitigation shown on *Figure 5-3* (ground floor) and *Figure 5-4* (first floor).



Lots 813, 78, 815 & 80, Hammond Park -
Future 2046 $L_{Aeq(Day)}$ Noise Level Contours to Ground Floor
Includes 4.0m High Wall to Achieve Exposure A at Ground Floor

Assumed Road Surfaces are:
Rowley Road: Dense Graded Asphalt

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Length Scale 1:3500

0 20 40 80 120 160 m

Figure 5-1

Signs and symbols

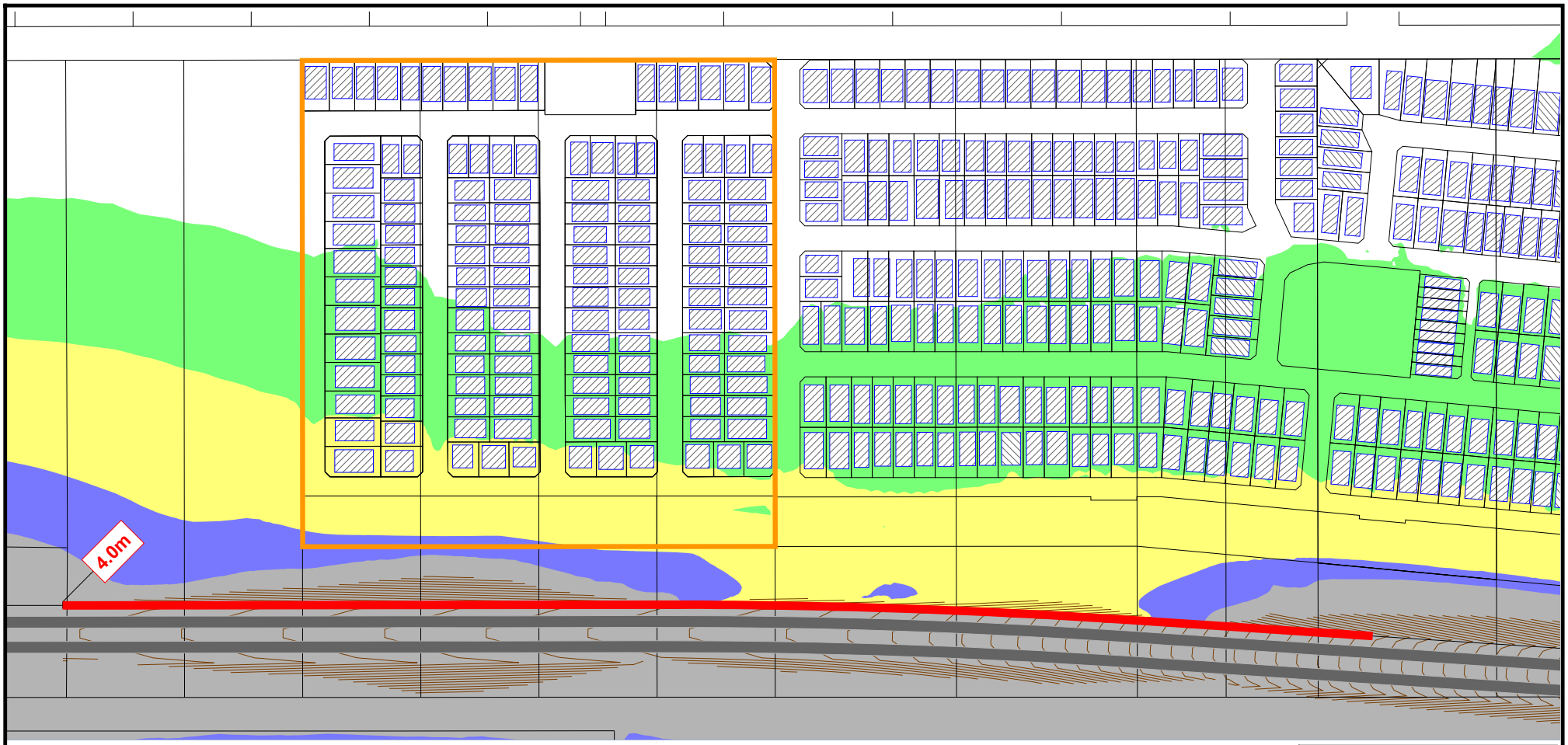
- Road
- Indicative Building
- Wall
- Subject Site

N

Noise levels
$L_{Aeq(Day)}$ dB

<= 55	
<= 56	Exposure A
<= 57	
<= 58	
<= 59	Exposure B
<= 60	
<= 61	
<= 62	
<= 63	Exposure C
<= 64	
<= 65	
<= 66	
> 66	Exposure D

SPP 5.4 (Sep 2019)



Lots 813, 78, 815 & 80, Hammond Park -
Future 2046 $L_{Aeq(Day)}$ Noise Level Contours to First Floor
Includes 4.0m High Wall to Achieve Exposure A at Ground Floor

Assumed Road Surfaces are:
Rowley Road: Dense Graded Asphalt

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CoRTN Algorithms

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Length Scale 1:3500

0 20 40 80 120 160 m

Figure 5-2

Signs and symbols

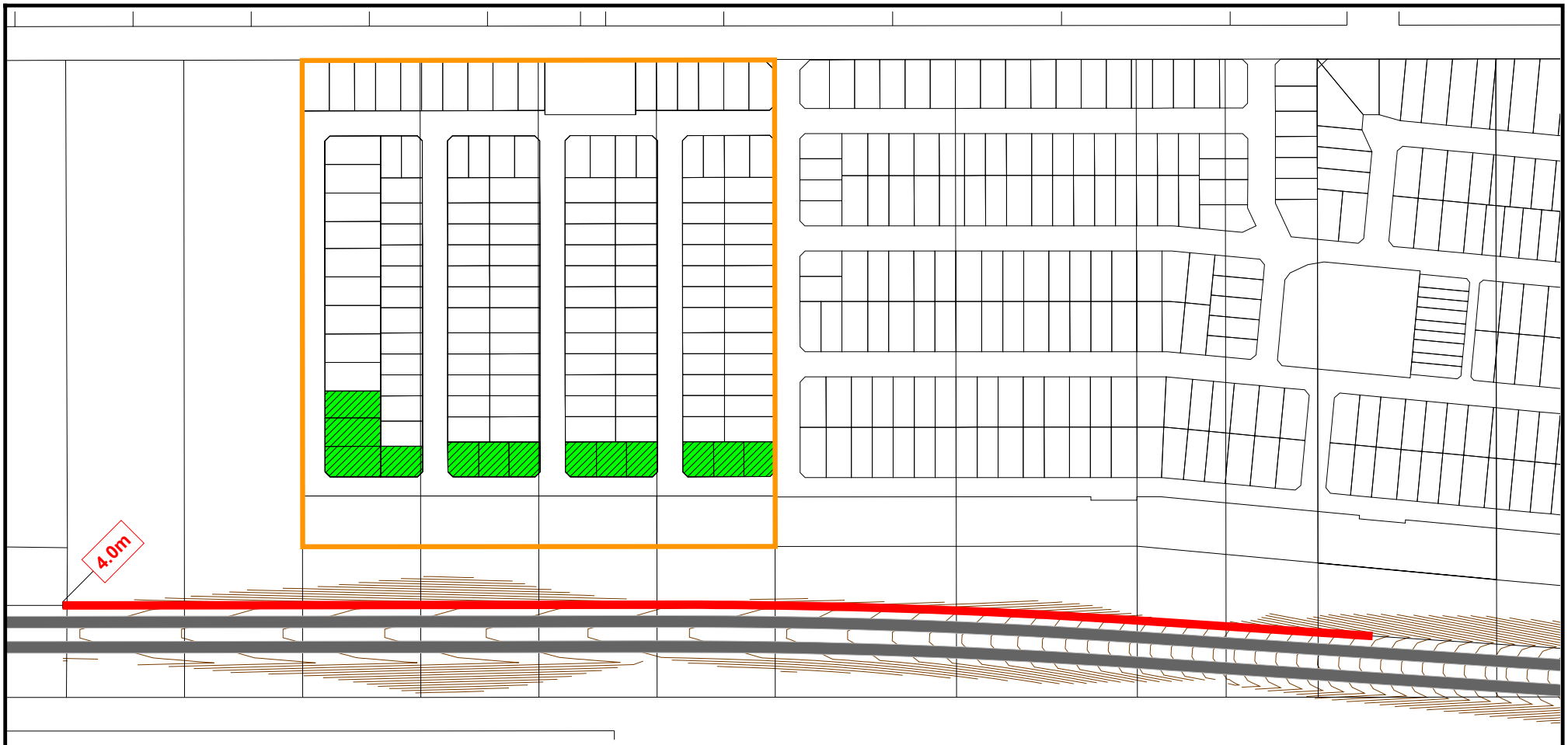
- Road
- Indicative Building
- Wall
- Subject Site

N

Noise levels
$L_{Aeq(Day)}$ dB

<= 55	
<= 56	Exposure A
<= 57	
<= 58	
<= 59	Exposure B
<= 60	
<= 61	
<= 62	
<= 63	Exposure C
<= 64	
<= 65	
<= 66	
> 66	Exposure D

SPP 5.4 (Sep 2019)



Lots 813, 78, 815 & 80, Hammond Park -
Noise Mitigation to Ground Floor
Includes 4.0m High Wall to Achieve Exposure A at Ground Floor

Assumed Road Surfaces are:
Rowley Road: Dense Graded Asphalt

SoundPLAN v8.2
CoRTN Algorithms

8 May 2024

Signs and symbols

- Road
- Wall
- Subject Site
- Package A
- Package B

N

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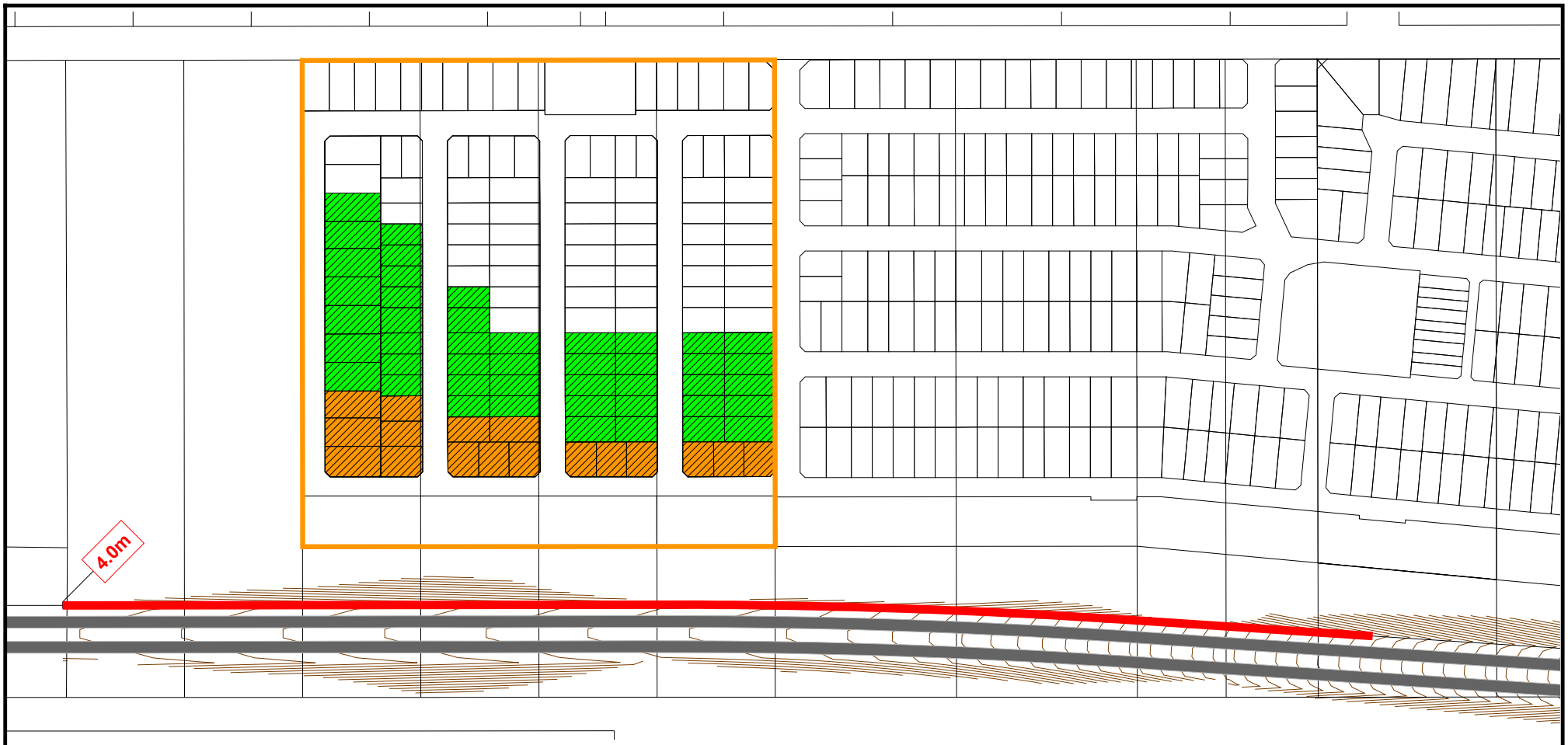
(08) 9401 7770

Length Scale 1:3500

0 20 40 80 120 160 m

Figure 5-3



Lots 813, 78, 815 & 80, Hammond Park -
Noise Mitigation to First Floor
Includes 4.0m High Wall to Achieve Exposure A at Ground Floor

Assumed Road Surfaces are:
Rowley Road: Dense Graded Asphalt

SoundPLAN v8.2
CoRTN Algorithms

8 May 2024

Signs and symbols

- Road
- Wall
- Subject Site
- Package A
- Package B

N

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Length Scale 1:3500

0 20 40 80 120 160 m

Figure 5-4

6. FURTHER DISCUSSION

When the subdivision to the east was assessed, the subject site proposed subdivision was not included. With the wall extension and additional houses, these change the noise impacts to the previous subdivision. *Figure 6-1* and *Figure 6-2* are the extracts from the previous report showing the recommended noise mitigation. *Figure 6-3* and *Figure 6-4* show the new recommendations taking into account the presence of the subject site subdivision, with some changes towards the western end.

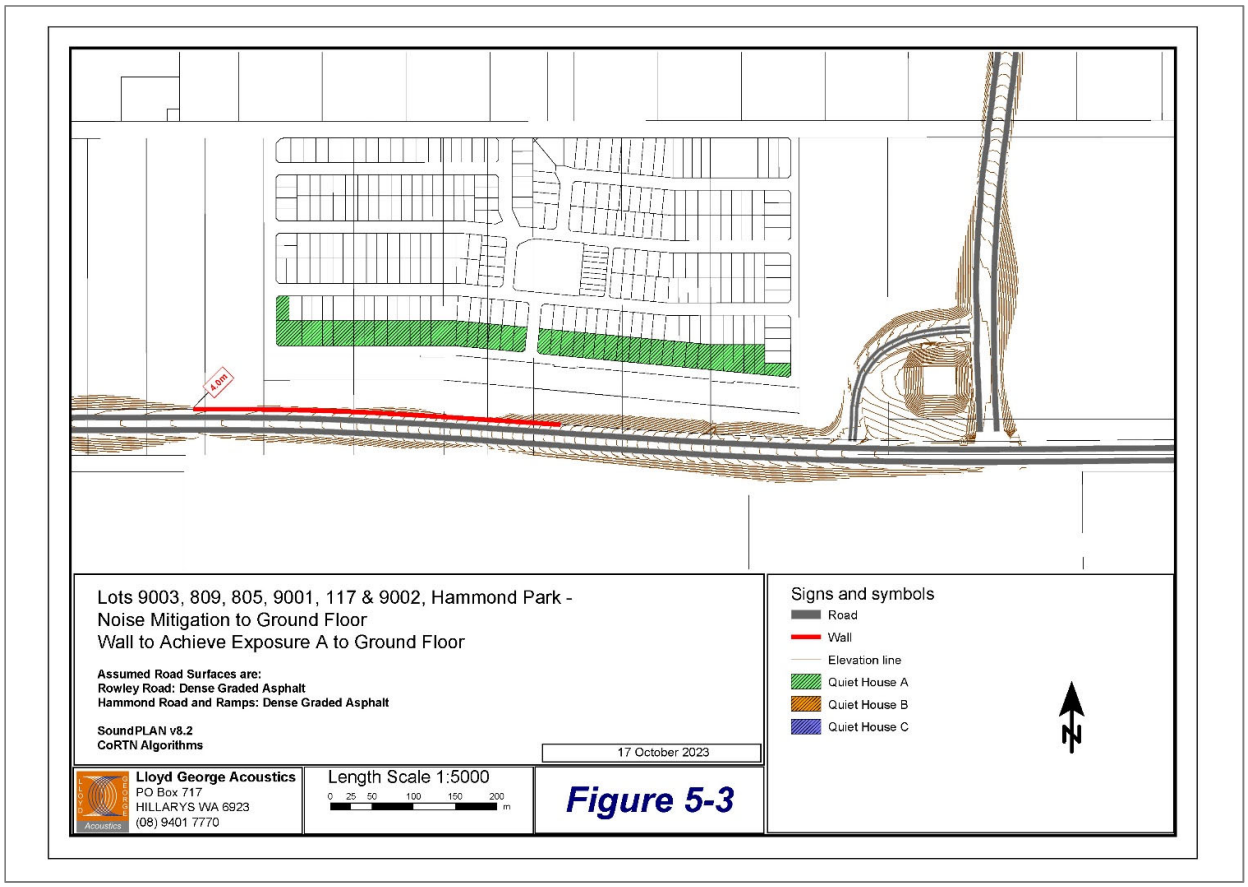

Figure 6-1: Eastern Subdivision Previous Noise Mitigation – Ground Floor Level

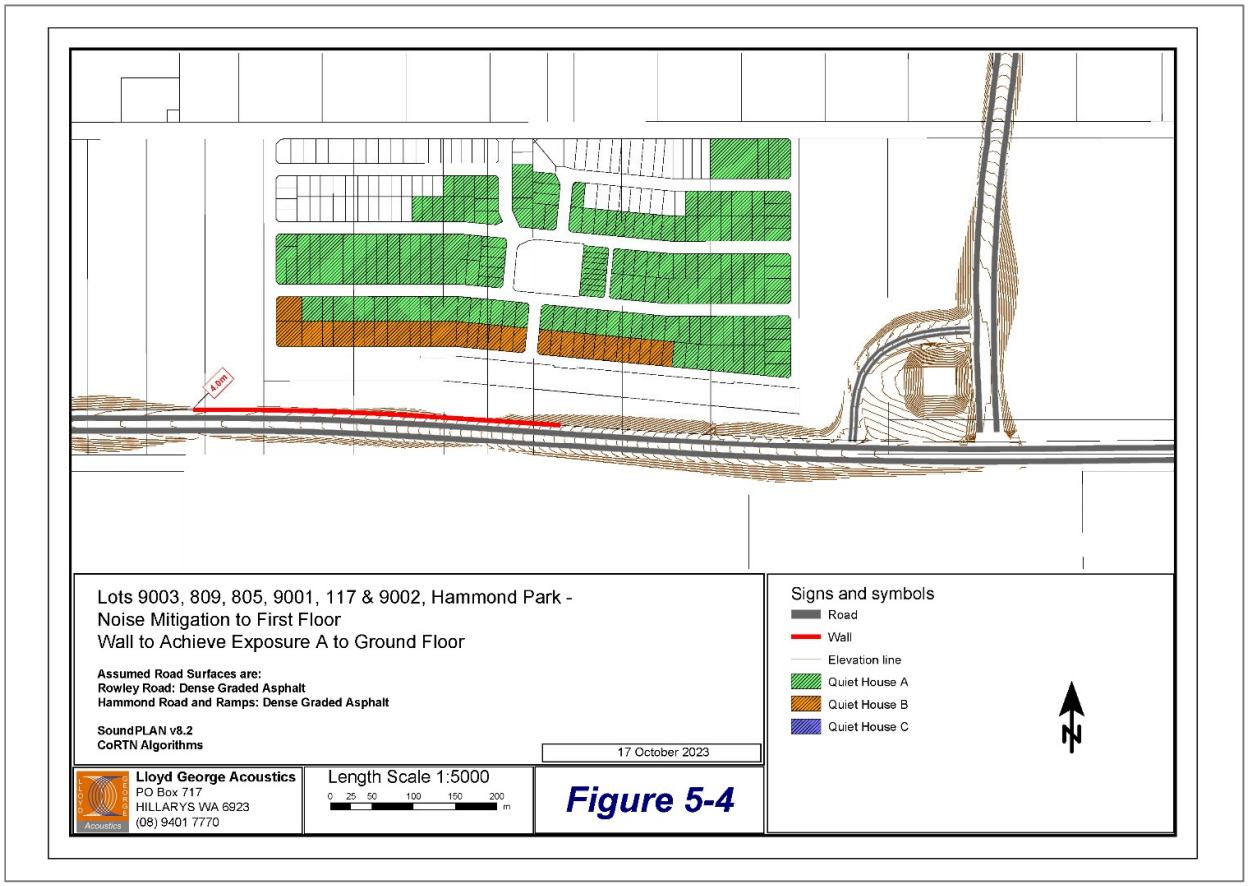

Figure 6-2: Eastern Subdivision Previous Noise Mitigation – First Floor Level

Lots 9003, 809, 805, 9001, 117 & 9002, Hammond Park -
Noise Mitigation to Ground Floor
Wall to Achieve Exposure A to Ground Floor

Assumed Road Surfaces are:
Rowley Road: Dense Graded Asphalt
Hammond Road and Ramps: Dense Graded Asphalt

SoundPLAN v8.2
CoRTN Algorithms

8 May 2024

Signs and symbols

- Road
- 4.0m Wall
- Elevation line
- Quiet House A
- Quiet House B
- Quiet House C

N

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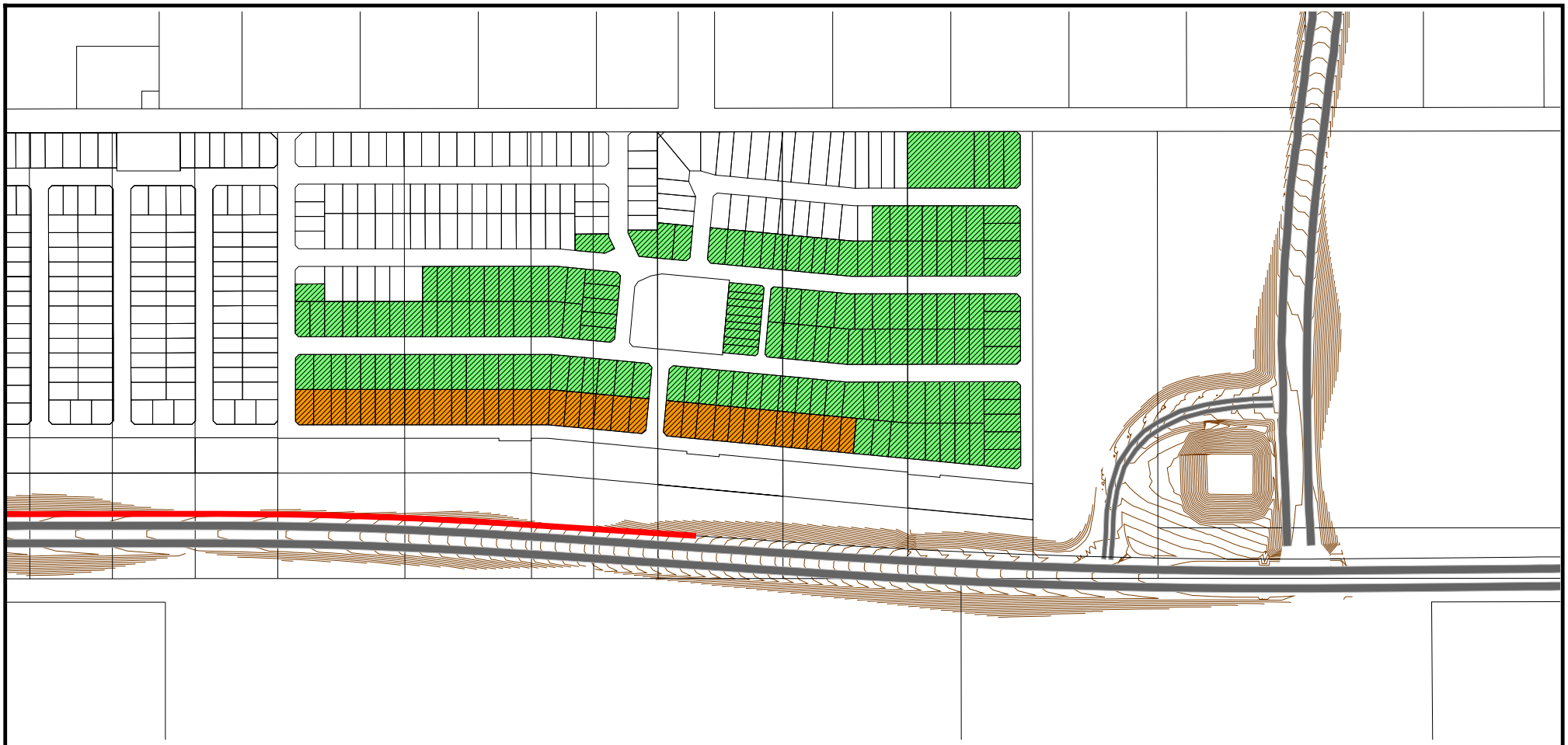
Length Scale 1:5000

0 25 50 100 150 200 m

Figure 6-3



Lots 9003, 809, 805, 9001, 117 & 9002, Hammond Park -
Noise Mitigation to First Floor
Wall to Achieve Exposure A to Ground Floor

Assumed Road Surfaces are:
Rowley Road: Dense Graded Asphalt
Hammond Road and Ramps: Dense Graded Asphalt

SoundPLAN v8.2
CoRTN Algorithms

8 May 2024

Signs and symbols

- Road
- 4.0m Wall
- Elevation line
- Quiet House A
- Quiet House B
- Quiet House C

N

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HILLARYS WA 6923
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Length Scale 1:5000

0 25 50 100 150 200 m

Figure 6-4

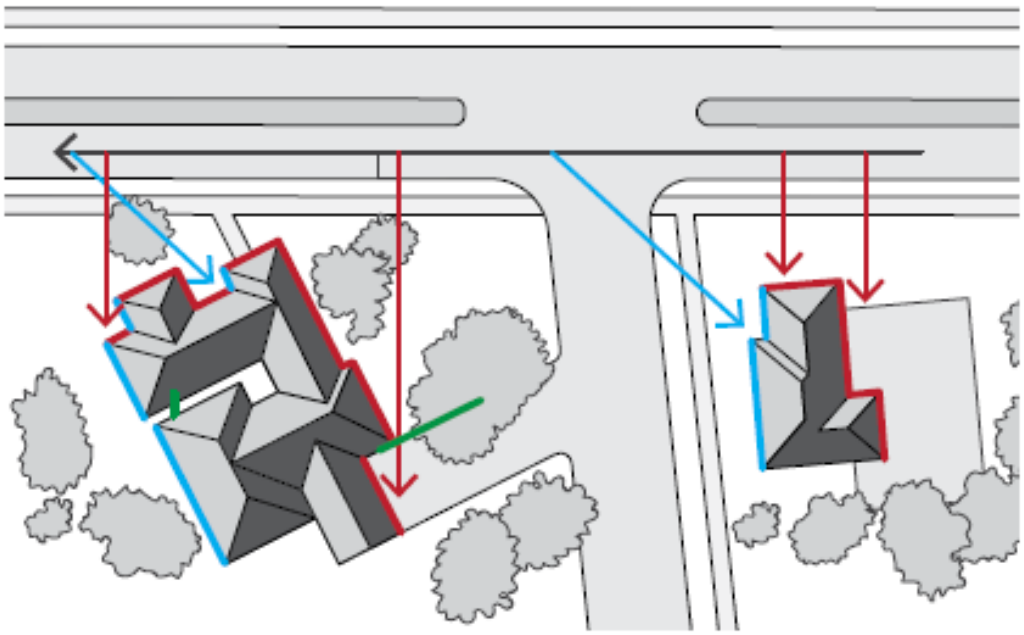
Appendix A – Quiet House Packages

The packages and information provided on the following pages are taken from *Road and Rail Noise Guidelines* (September 2019).

Where outdoor and indoor noise levels received by a noise-sensitive land-use and/or development exceed the policy's noise target, implementation of quiet house requirements is an acceptable solution.

With regards to the packages, the following definitions are provided:

- **Facing** the transport corridor (red): Any part of a building façade is 'facing' the transport corridor if any straight line drawn perpendicular (at a 90 degree angle) to its nearest road lane or railway line intersects that part of the façade without obstruction (ignoring any fence).
- **Side-on** to transport corridor (blue): Any part of a building façade that is not 'facing' is 'side-on' to the transport corridor if any straight line, at any angle, can be drawn from it to intersect the nearest road lane or railway line without obstruction (ignoring any fence).
- **Opposite** to transport corridor (green): Neither 'side on' nor 'facing', as defined above.



Quiet House Package A

56-58 dB $L_{Aeq(Day)}$ & 51-53 dB $L_{Aeq(Night)}$

Element	Orientation	Room	
		Bedroom	Indoor Living and Work Areas
External Glazing	Facing	• Up to 40% floor area ($R_w + C_{tr} \geq 28$): – Sliding or double hung with minimum 10mm single or 6mm-12mm-10mm double insulated glazing; – Sealed awning or casement windows with minimum 6mm glass. • Up to 60% floor area ($R_w + C_{tr} \geq 31$): – Sealed awning or casement windows with minimum 6mm glass.	• Up to 40% floor area ($R_w + C_{tr} \geq 25$): – Sliding or double hung with minimum 6mm single or 6mm-12mm-6mm double insulated glazing; • Up to 60% floor area ($R_w + C_{tr} \geq 28$); • Up to 80% floor area ($R_w + C_{tr} \geq 31$).
	Side On	As above, except $R_w + C_{tr}$ values may be 3 dB less or max % area increased by 20%.	
	Opposite	No specific requirements	
External Doors	Facing	• Fully glazed hinged door with certified $R_w + C_{tr} \geq 28$ rated door and frame including seals and 6mm glass.	• Doors to achieve $R_w + C_{tr} \geq 25$: – 35mm Solid timber core hinged door and frame system certified to R_w 28 including seals; – Glazed sliding door with 10mm glass and weather seals.
	Side On	As above, except $R_w + C_{tr}$ values may be 3 dB less.	
	Opposite	No specific requirements	
External Walls	All	• $R_w + C_{tr} \geq 45$: – Two leaves of 90mm thick clay brick masonry with minimum 20mm cavity; or – Single leaf of 150mm brick masonry with 13mm cement render on each face; or – One row of 92mm studs at 600mm centres with: ▪ Resilient steel channels fixed to the outside of the studs; and ▪ 9.5mm hardboard or fibre cement sheeting or 11mm fibre cement weatherboards fixed to the outside; ▪ 75mm thick mineral wool insulation with a density of at least 11kg/m^3; and ▪ 2 x 16mm fire-rated plasterboard to inside.	
Roofs and Ceilings	All	• $R_w + C_{tr} \geq 35$: • Concrete or terracotta tile or metal sheet roof with sarking and at least 10mm plasterboard.	

Quiet House Package B

59-62 dB $L_{Aeq(Day)}$ & 54-57 dB $L_{Aeq(Night)}$

Element	Orientation	Room	
		Bedroom	Indoor Living and Work Areas
External Glazing	Facing	• Up to 40% floor area ($R_w + C_{tr} \geq 31$): – Fixed sash, awning or casement with minimum 6mm glass or 6mm-12mm-6mm double insulated glazing. • Up to 60% floor area ($R_w + C_{tr} \geq 34$): – Fixed sash, awning or casement with minimum 10mm glass or 6mm-12mm-10mm double insulated glazing.	• Up to 40% floor area ($R_w + C_{tr} \geq 28$): – Sliding or double hung with 6mm-12mm-10mm double insulated glazing; – Sealed awning or casement windows with minimum 6mm glass. • Up to 60% floor area ($R_w + C_{tr} \geq 31$); • Up to 80% floor area ($R_w + C_{tr} \geq 34$).
	Side On	As above, except $R_w + C_{tr}$ values may be 3 dB less or max % area increased by 20%.	
	Opposite	As above, except $R_w + C_{tr}$ values may be 6 dB less or max % area increased by 20%.	
External Doors	Facing	• Fully glazed hinged door with certified $R_w + C_{tr} \geq 31$ rated door and frame including seals and 10mm glass.	• Doors to achieve $R_w + C_{tr} \geq 28$: – 40mm Solid timber core hinged door and frame system certified to R_w 32 including seals; – Fully glazed hinged door with certified $R_w + C_{tr} \geq 28$ rated door and frame including seals and 6mm glass.
	Side On	As above, except $R_w + C_{tr}$ values may be 3 dB less or max % area increased by 20%.	
	Opposite	As above, except $R_w + C_{tr}$ values may be 6 dB less or max % area increased by 20%.	
External Walls	All	• $R_w + C_{tr} \geq 50$: – Two leaves of 90mm thick clay brick masonry with minimum 50mm cavity between leaves and 25mm glasswool or polyester (24kg/m^3). Resilient ties used where required to connect leaves. – Two leaves of 110mm clay brick masonry with minimum 50mm cavity between leaves and 25mm glasswool or polyester insulation (24kg/m^3). – Single leaf of 220mm brick masonry with 13mm cement render on each face. – 150mm thick unlined concrete panel or 200mm thick concrete panel with one layer of 13mm plasterboard or 13mm cement render on each face. – Single leaf of 90mm clay brick masonry with: ▪ A row of 70mm x 35mm timber studs or 64mm steel studs at 600mm centres; ▪ A cavity of 25mm between leaves; ▪ 50mm glasswool or polyester insulation (11kg/m^3) between studs; and ▪ One layer of 10mm plasterboard fixed to the inside face.	
Roofs and Ceilings	All	• $R_w + C_{tr} \geq 35$: – Concrete or terracotta tile or metal sheet roof with sarking and at least 10mm plasterboard ceiling with R3.0+ fibrous insulation.	

Mechanical Ventilation requirements

In implementing the acceptable treatment packages, fresh air requirements of the National Construction Code must be satisfied on the basis of windows closed. Whilst not the only solution, the most common is mechanical ventilation / air-conditioning is installed with the following considerations:

- Acoustically rated openings and ductwork to provide a minimum sound reduction performance of R_w 40 dB into sensitive spaces;
- Evaporative systems require attenuated ceiling air vents to allow closed windows;
- Refrigerant based systems need to be designed to achieve National Construction Code fresh air ventilation requirements;
- Openings such as eaves, vents and air inlets must be acoustically treated, closed or relocated to building sides facing away from the corridor where practicable.

Notification

Notifications on title advise prospective purchasers of the potential for noise impacts from major transport corridors and help with managing expectations.

The Notification is to state as follows:

This lot is in the vicinity of a transport corridor and is affected, or may in the future be affected, by road and rail transport noise. Road and rail transport noise levels may rise or fall over time depending on the type and volume of traffic.

Appendix B – Terminology

The following is an explanation of the terminology used throughout this report:

- **Decibel (dB)**

The decibel is the unit that describes the sound pressure levels of a noise source. It is a logarithmic scale referenced to the threshold of hearing.

- **A-Weighting**

An A-weighted noise level has been filtered in such a way as to represent the way in which the human ear perceives sound. This weighting reflects the fact that the human ear is not as sensitive to lower frequencies as it is to higher frequencies. An A-weighted sound level is described as L_A, dB.

- **L_{eq}**

The L_{eq} level represents the average noise energy during a measurement period.

- **L_1**

The L_1 level represents the noise level exceeded for 1 percent of the measurement period and is considered to represent the average of the maximum noise levels measured.

- **L_{10}**

The L_{10} level represents the noise level exceeded for 10 percent of the measurement period and is considered to represent the "intrusive" noise level.

- **L_{90}**

The L_{90} level represents the noise level exceeded for 90 percent of the measurement period and is considered to represent the "background" noise level.

- **$L_{Aeq(Day)}$**

The $L_{Aeq(Day)}$ level is the logarithmic average of the L_{Aeq} levels from 6.00am to 10.00pm.

- **$L_{Aeq(Night)}$**

The $L_{Aeq(Night)}$ level is the logarithmic average of the L_{Aeq} levels from 10.00pm to 6.00am.

- **$L_{A10,18hour}$**

The $L_{A10,18hour}$ level is the arithmetic average of the hourly L_{A10} levels between 6.00am and midnight.

- **$L_{Aeq,24hour}$**

The $L_{Aeq,24hour}$ level is the logarithmic average of the L_{Aeq} levels from over an entire day.

- **Noise-sensitive land use and/or development**

Land-uses or development occupied or designed for occupation or use for residential purposes (including dwellings, residential buildings or short-stay accommodation), caravan park, camping ground, educational establishment, child care premises, hospital, nursing home, corrective institution or place of worship.

- **R_w**

This is the weighted sound reduction index. It is a single number rating determined by moving a grading curve in integral steps against the laboratory measured transmission loss until the sum of the deficiencies at each one-third-octave band, between 100 Hz and 3.15 kHz, does not exceed 32 dB. The higher the R_w value, the better the acoustic performance.

- **C_{tr}**

This is a spectrum adaptation term for airborne noise and provides a correction to the R_w value to suit source sounds with significant low frequency content such as road traffic or home theatre systems. A wall that provides a relatively high level of low frequency attenuation (i.e. masonry) may have a value in the order of – 4 dB, whilst a wall with relatively poor attenuation at low frequencies (i.e. stud wall) may have a value in the order of -12 dB.

- **About the Term 'Reasonable'**

An assessment of reasonableness should demonstrate that efforts have been made to resolve conflicts without comprising on the need to protect noise-sensitive land-use activities. For example, have reasonable efforts been made to design, relocate or vegetate a proposed noise barrier to address community concerns about the noise barrier height? Whether a noise mitigation measure is reasonable might include consideration of:

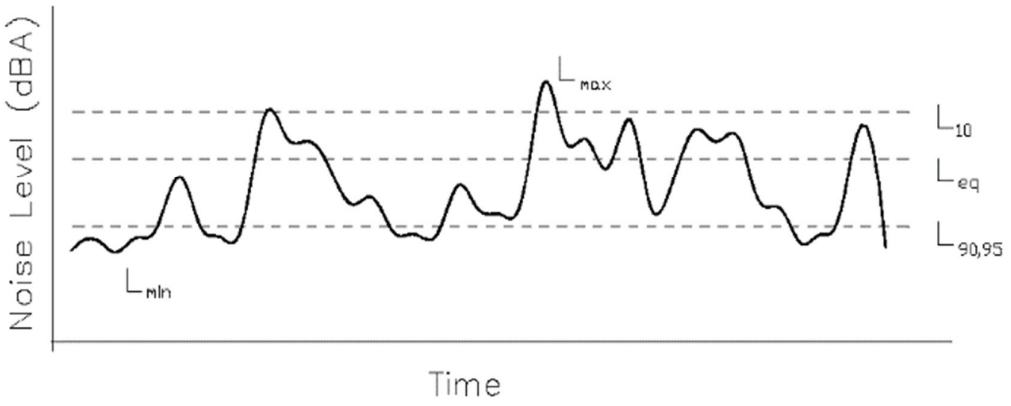
- The noise reduction benefit provided;
- The number of people protected;
- The relative cost vs benefit of mitigation;
- Road conditions (speed and road surface) significantly differ from noise forecast table assumptions;
- Existing and future noise levels, including changes in noise levels;
- Aesthetic amenity and visual impacts;
- Compatibility with other planning policies;
- Differences between metropolitan and regional situations and whether noise modelling requirements reflect the true nature of transport movements;
- Ability and cost for mobilisation and retrieval of noise monitoring equipment in regional areas;
- Differences between Greenfield and infill development;
- Differences between freight routes and public transport routes and urban corridors;
- The impact on the operational capacity of freight routes;
- The benefits arising from the proposed development;
- Existing or planned strategies to mitigate the noise at source.

- **About the Term 'Practicable'**

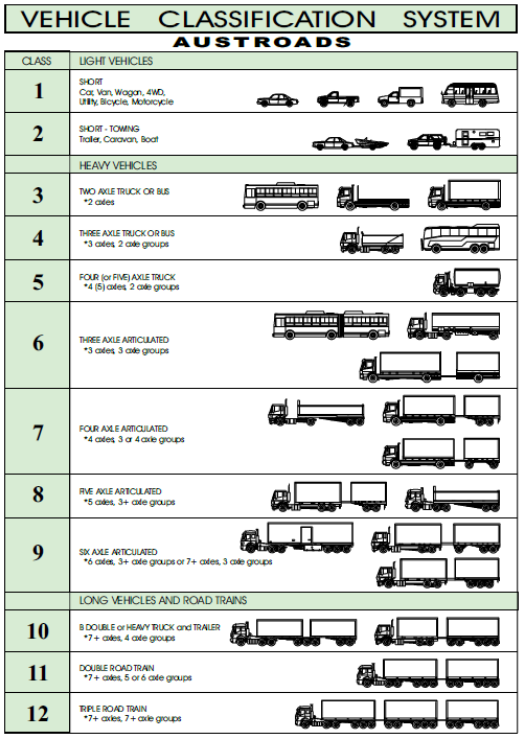
'Practicable' considerations for the purposes of the policy normally relate to the engineering aspects of the noise mitigation measures under evaluation. It is defined as "reasonably practicable having regard to, among other things, local conditions and circumstances (including costs) and to the current state of technical knowledge" (*Environmental Protection Act 1986*). These may include:

- Limitations of the different mitigation measures to reduce transport noise;
- Competing planning policies and strategies;
- Safety issues (such as impact on crash zones or restrictions on road vision);
- Topography and site constraints (such as space limitations);
- Engineering and drainage requirements;
- Access requirements (for driveways, pedestrian access and the like);
- Maintenance requirements;
- Bushfire resistance or BAL ratings;
- Suitability of the building for acoustic treatments.

- **Chart of Noise Level Descriptors**



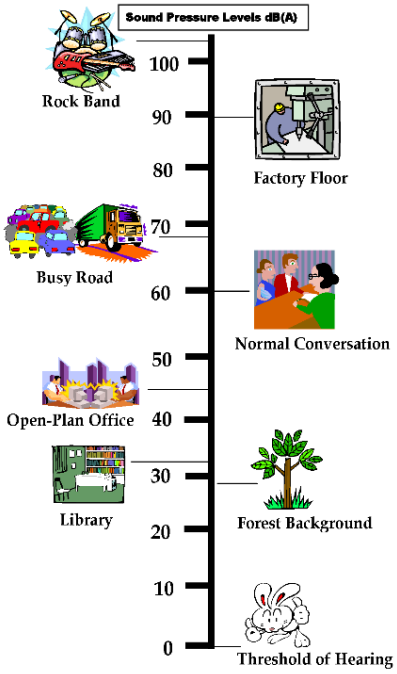
- **Austroads Vehicle Class**



VEHICLE CLASSIFICATION SYSTEM
AUSTROADS

CLASS	LIGHT VEHICLES
1	SHORT Car, Van, Wagon, 4WD, Utility, Bicycle, Motorcycle
2	SHORT - TOWING Trailer, Caravan, Boat
	HEAVY VEHICLES
3	TWO AXLE TRUCK OR BUS *2 axles
4	THREE AXLE TRUCK OR BUS *3 axles, 2 axle groups
5	FOUR (or FIVE) AXLE TRUCK *4 (5) axles, 2 axle groups
6	THREE AXLE ARTICULATED *3 axles, 3 axle groups
7	FOUR AXLE ARTICULATED *4 axles, 3 or 4 axle groups
8	FIVE AXLE ARTICULATED *5 axles, 3+ axle groups
9	SIX AXLE ARTICULATED *6 axles, 3+ axle groups or 7+ axles, 3 axle groups
	LONG VEHICLES AND ROAD TRAINS
10	B DOUBLE or HEAVY TRUCK and TRAILER *7+ axles, 4 axle groups
11	DOUBLE ROAD TRAIN *7+ axles, 5 or 6 axle groups
12	TRIPLE ROAD TRAIN *7+ axles, 7+ axle groups

- **Typical Noise Levels**



Appendix F

Transport Impact Assessment

PTG00109

Transport Impact Assessment
Hammond Quarter (West) Structure Plan

3rd October 2024 | Revision C

Prepared for Qube Hammond Corner Pty Ltd

www.ptgconsulting.com.au

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REPORT DETAILS

Unique Document Identification

	Information
Document Title	TIA
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1 INTRODUCTION

1.1 Background

PTG Consulting WA (PTG) has been commissioned by Qube Hammond Corner Pty Ltd to prepare a Traffic Impact Assessment (TIA) for the proposed amendment to the Hammond Quarter Structure Plan approved by the WAPC in February 2024 (referred henceforth as the "LSP").

This report has been prepared in accordance with the Western Australian Planning Commission (WAPC) Transport Assessment Guidelines for Developments: Volume 2 – Planning Schemes, Structure Plans and Activity Centre Plans (2016) and the Transport Impact Assessment (TIA) Checklist is included at Appendix A.

Specifically, this report aims to assess the operations of the proposed LSP development amendment internally and its connections to the adjacent road network, with a focus on traffic volumes, access and accessibility.

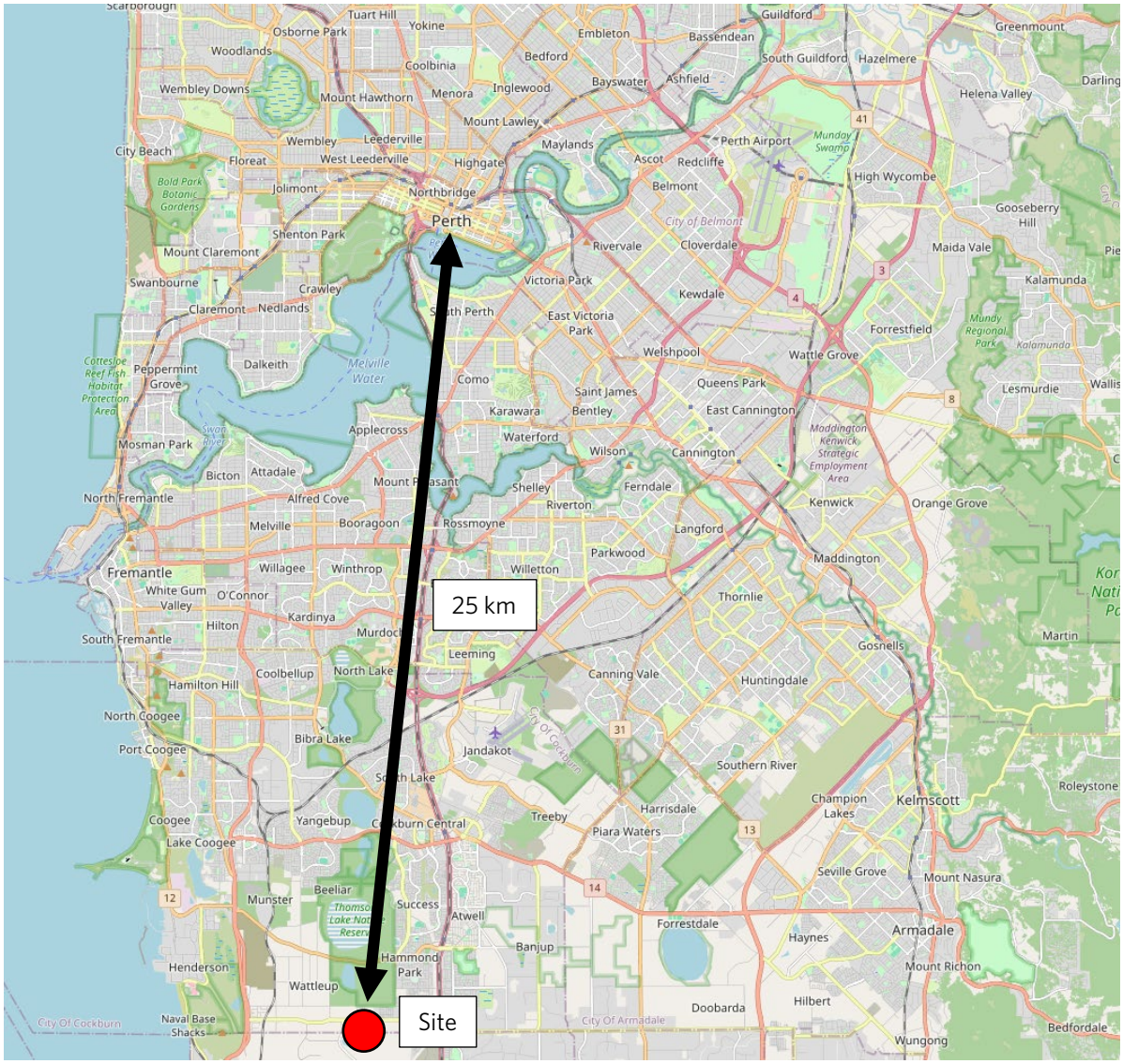
This report also outlines the requirements and opportunities associated with traffic and transport within the development, referencing relevant Council and WAPC policies and guidelines as well as best-practice planning within Western Australia.

2 STRUCTURE PLAN PROPOSAL

2.1 Regional Context

The structure plan area (LSP) is located approximately 25km from the Perth CBD in the suburb of Hammond Park as shown in **Figure 1**. The suburb is predominantly occupied by residential dwellings, with the immediate surrounding area still under development. The suburb and the LSP is well connected to the Perth CBD via Kwinana Freeway and the Mandurah rail line and to Fremantle/Kwinana industrial strip via Rockingham Road and Stock Road.

Figure 1 - Regional Location

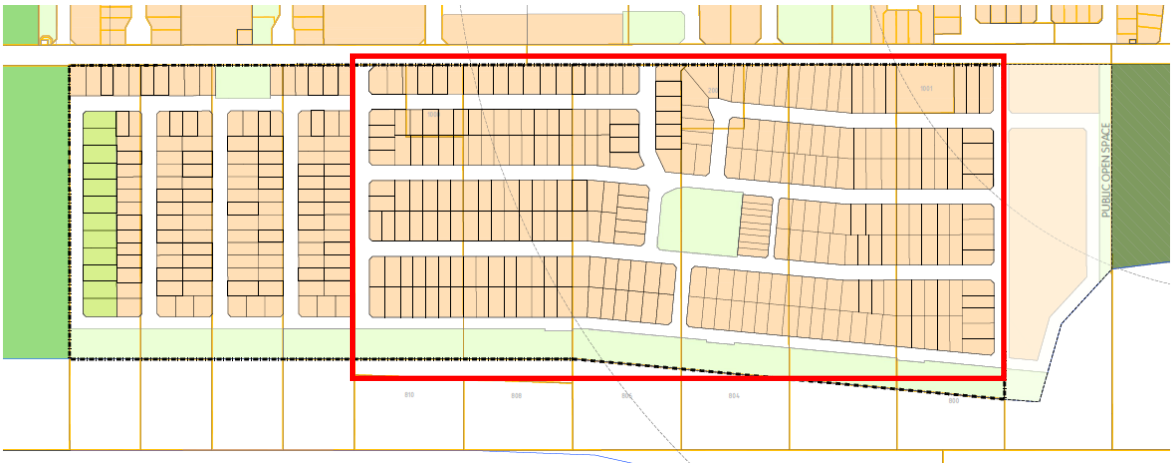


2.2 Proposed Land Uses

The overall structure plan is shown in **Figure 2** with the amendment area shown in **Source:** Qube

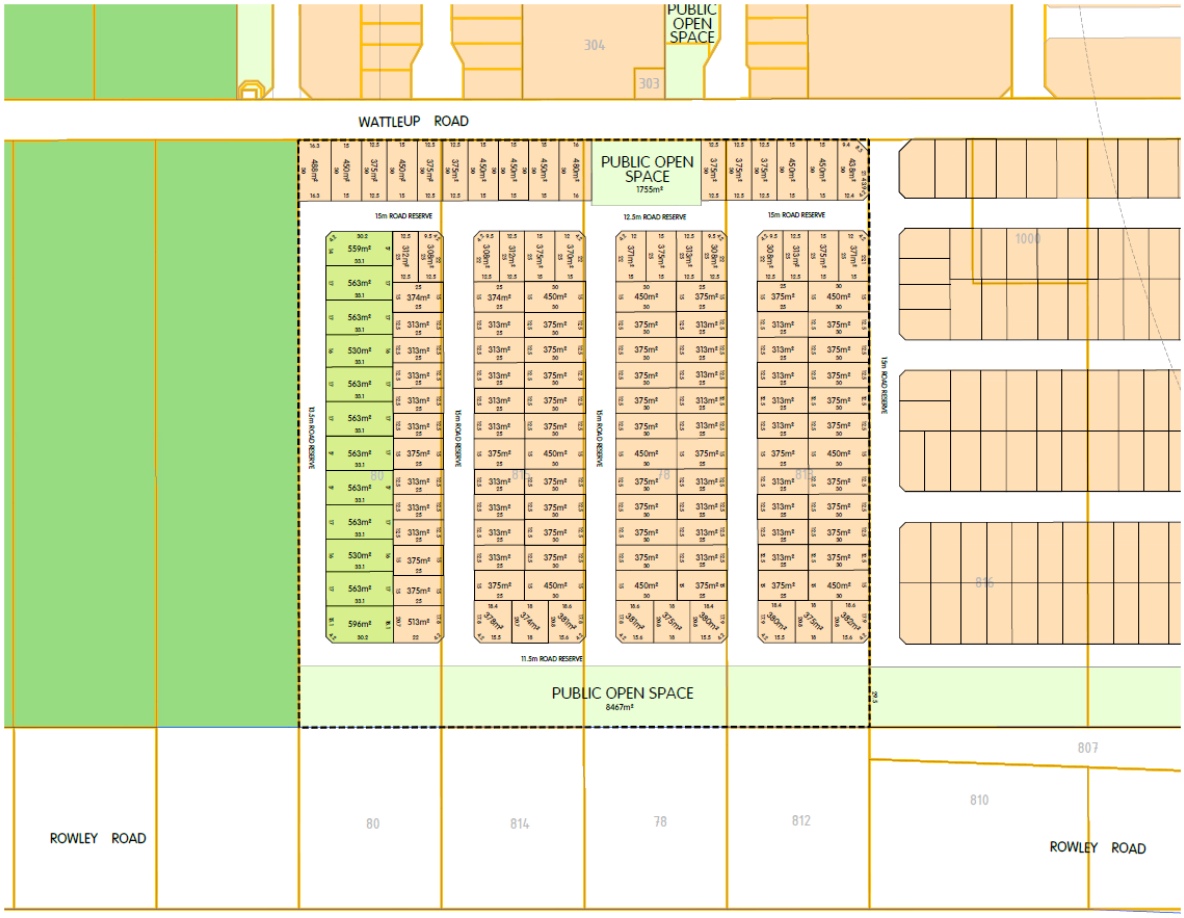
Figure 3 which will comprise of residential dwellings.

Figure 2 - Hammond Quarter Structure Plan



Source: Qube

Figure 3 - Structure Plan Amendment Area



Source: Qube

2.3 Table of Land Uses and Quantities

Table 1 provides a summary of the proposed land use yields within the amendment area.

Table 1 - Land Use Yields

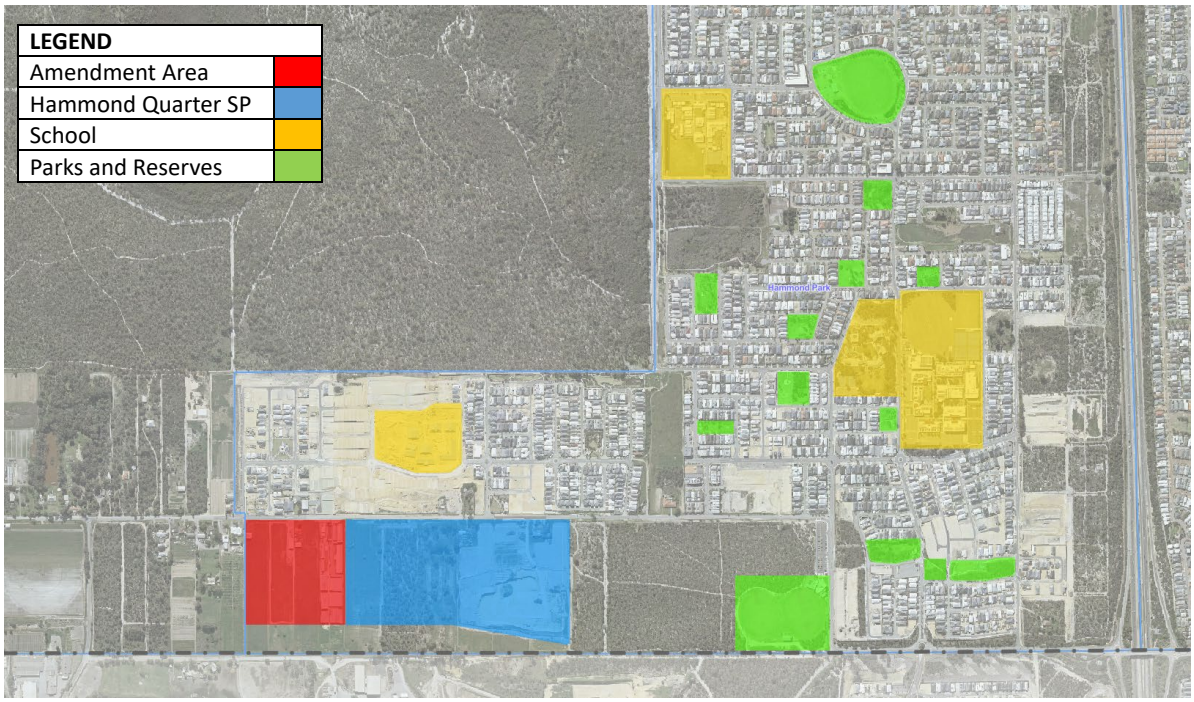
Land Uses	Yield
Residential (standard)	125 dwellings
Residential (transition)	11 dwellings
Total	136 dwellings

2.4 Major Attractors/Generators

Major attractors and generators within the surrounding area of the LSP is shown in **Figure 4** and listed below:

- Hammond Park Primary School
- Hammond Park Catholic Primary School
- Hammond Park Secondary School
- New Primary School (currently under construction)

Figure 4 - Major Attractors/Generators within the Surrounding Area



2.5 Specific Issues

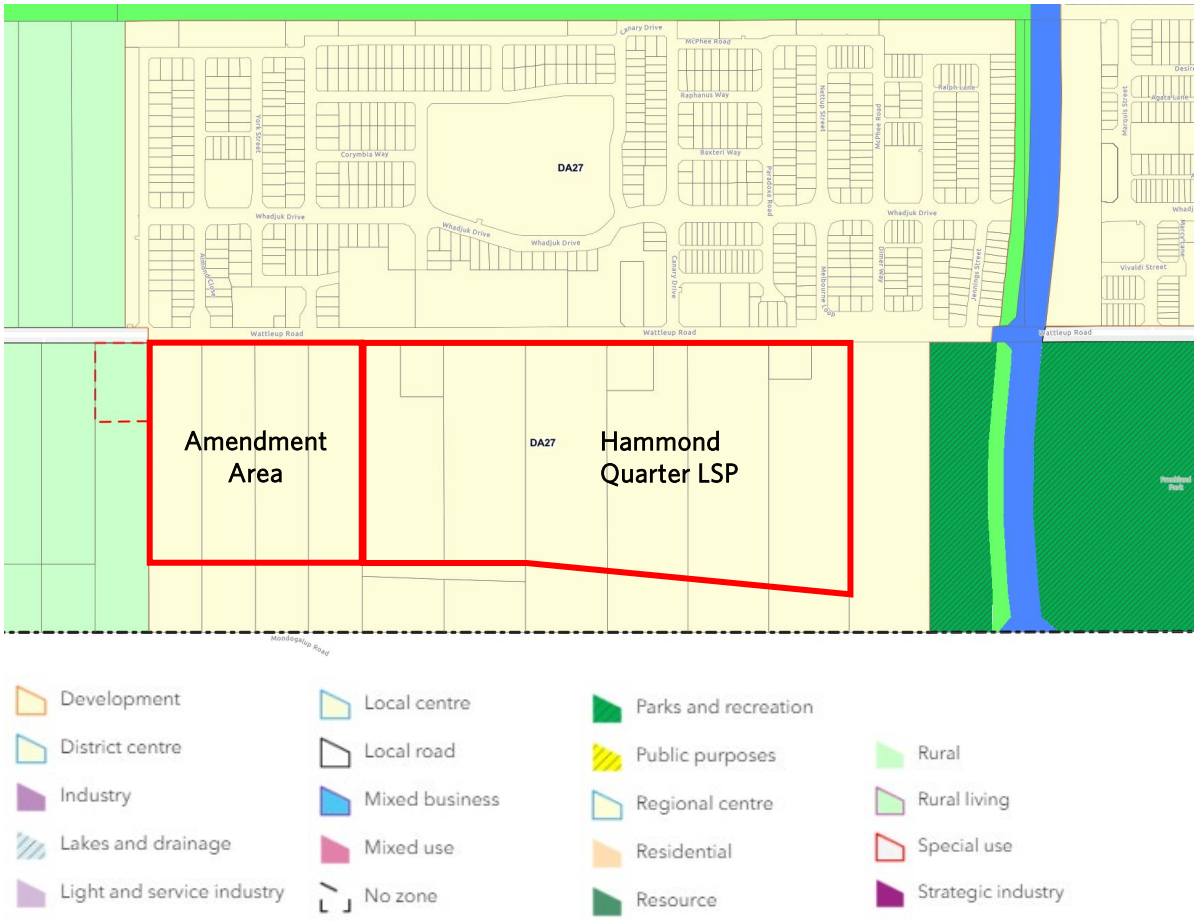
No specific issues are noted directly related to the LSP site.

3 EXISTING SITUATION

3.1 Existing Land Uses Within Structure Plan

The amendment area is zoned as "development" under the City of Cockburn's Town Planning Scheme No.3 as shown in **Figure 5**.

Figure 5 - Town Planning Scheme No.3 Zoning



Source: City of Cockburn

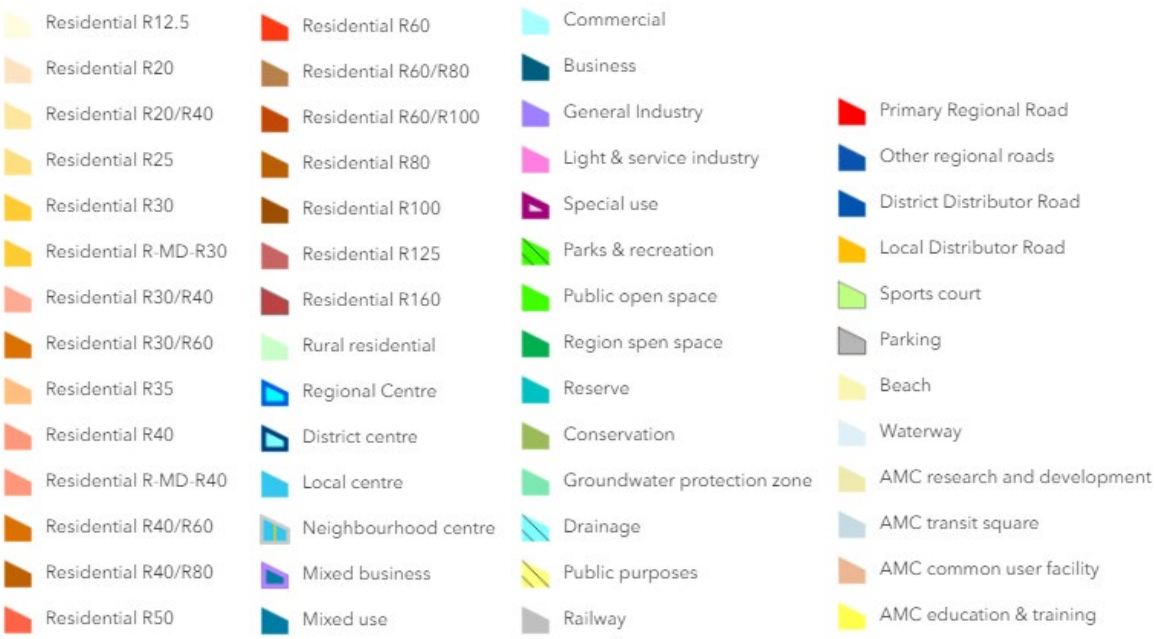
3.2 Existing Land Uses Within 800 Metres of Structure Plan Area

As shown in **Figure 5** above, the surrounding area is zoned "development" to the east and rural to the west under the Town Planning Scheme No.3.

Further details regarding the planned land uses are provided in the local structure plans for the surrounding areas as shown in **Figure 6**. The surrounding area of the site consists of a mix of residential densities, a primary school and several small park and reserve areas.

Figure 6 - Structure Plan Zoning

Source: City of Cockburn



3.3 Existing Road Network Within Structure Plan Area

The amendment area is currently vacant and does not contain an existing established road network.

3.4 Existing Pedestrian/Cycle Networks Within Structure Plan Area

The amendment area is currently vacant and does not contain an existing pedestrian/cycle networks.

3.5 Existing Public Transport Services Within Structure Plan Area

The amendment area is currently vacant and does not contain an existing public transport network.

3.6 Existing Road Network Within 2 (or 5) km of Structure Plan Area

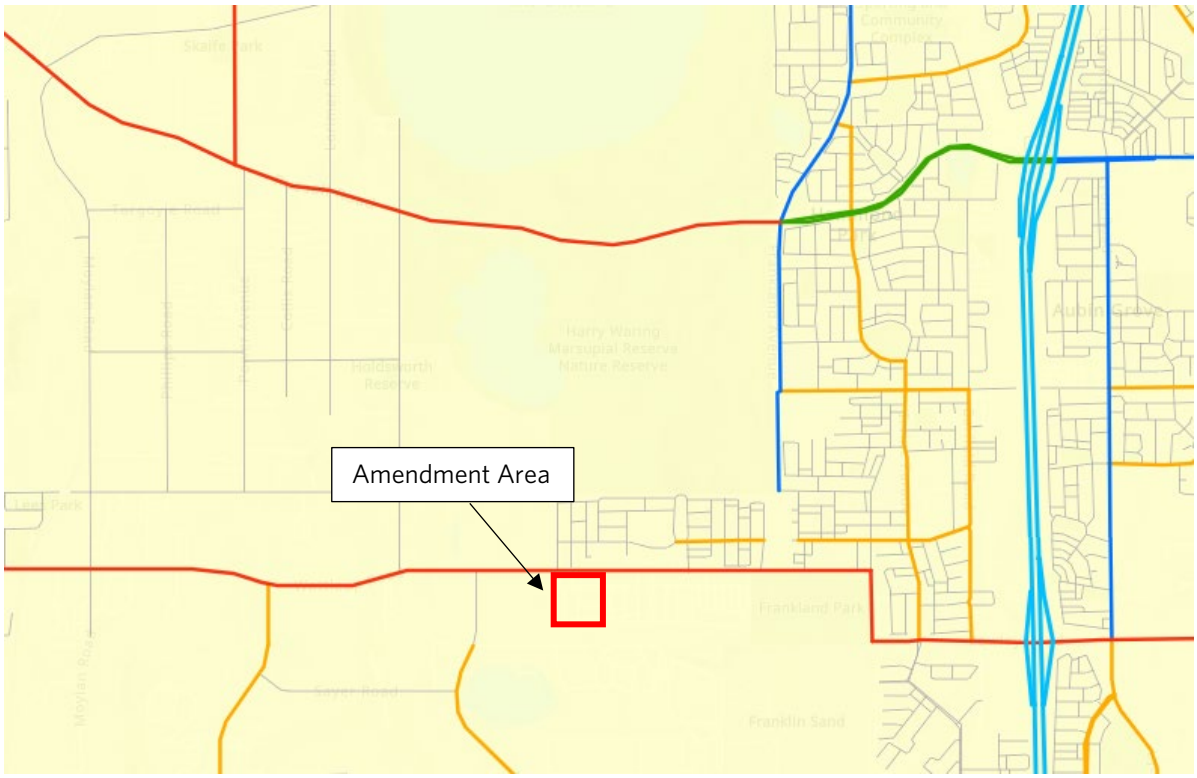
The road network within Western Australia is defined by Main Roads WA road hierarchy which describes the function, characteristic and management of each type of road. A description of each road type as per Main Roads WA Road Hierarchy criteria is summarised in **Table 2** below.

Table 2 - Road Hierarchy Description

Road Type	Description
Primary Distributors	Provide for major regional and inter-regional traffic movement and carry large volumes of generally fast moving traffic. Some are strategic freight routes, and all are State Roads. They are managed by Main Roads Western Australia.
District Distributor A	Carry traffic between industrial, commercial and residential areas and generally connect to Primary Distributors. These are likely to be truck routes and provide only limited access to adjoining property. They are managed by local government.
District Distributor B	Perform a similar function to type A District Distributors but with reduced capacity due to flow restrictions from access to and roadside parking alongside adjoining property. These are often older roads with a traffic demand in excess of that originally intended. District Distributor A and B roads run between land-use cells and generally not through them, forming a grid which would ideally space them around 1.5 kilometres apart. They are managed by local government.
Regional Distributor	Roads that are not Primary Distributors, but which link significant destinations and are designed for efficient movement of people and goods within and beyond regional areas. They are managed by local government.
Local Distributor (Urban)	Roads that carry traffic within a cell and link District Distributors or Regional Distributors at the boundary, to access roads. The route of Local Distributors should discourage through traffic so that the cell formed by the grid of District Distributors only carries traffic belonging to or serving the area. These roads should accommodate buses but discourage trucks. Urban Local Distributor roads are managed by local government.
Local Distributor (Rural)	Connect to other Rural Distributors and to Rural Access Roads. Not Regional Distributors, but which are designed for efficient movement of people and goods within regional areas. Rural Local Distributor roads are managed by local government.
Access Roads	Provide access to abutting properties with amenity, safety and aesthetic aspects having priority over the vehicle movement function. These roads are bicycle and pedestrian friendly. They are managed by local government.

Figure 7 shows the road hierarchy network and **Table 3** provides a summary of the road characteristics of the surrounding road network.

Figure 7 - Road Hierarchy



Source: Main Roads Road Information Mapping

Table 3 - Surrounding Network Road Hierarchy

Road Name	Road Hierarchy	Jurisdiction	No. of Lanes	No. of Foot paths	Road Pavement Width (m)	Posted Speed Limit
Wattleup Road	Regional Distributor	Local Government	2	0	~8.6m	60km/h
Frankland Avenue	Access Road (north of Wattleup Road) Regional Distributor (south of Wattleup Road)	DPLH/Local Government	2	1	~9.7m	50-60km/h
Hammond Road	Distributor B	Local Government	2	1	~9m	50km/h
Whadjuk Drive*	Local Distributor	Local Government	2	2	~11.8m	50km/h
Mandogalup Road	Local Distributor	Local Government	2	0	~7.4m	70km/h

* Whadjuk Drive is only partially constructed but the completed road section will be classified as a Local Distributor

3.7 Traffic Flows on Roads Within Structure Plan Area (AM and/or PM Peak Hours)

There are no traffic volumes associated with the amendment area as it is currently vacant and does not contain an established road network.

3.8 Traffic Flows on Roads Within 2 (or 5) km Of Structure Plan Area (AM and/or PM Peak Hours)

Existing traffic volumes were obtained from Main Roads WA Traffic Map and the City of Cockburn for the roads summarised in **Table 4.**

Table 4 Existing Traffic Volumes

Road Name	Year	Source	Weekday	AM Peak	PM Peak	HV%
Wattleup Road (East of Frankland Avenue)	2020	MRWA	5,755	469	527	20%
Wattleup Road (East of Mandogalup Road)	2019	City of Cockburn	4,969	480	488	17.2%
Wattleup Road (West of Frankland Avenue)	2019	City of Cockburn	5,227	499	487	15.2%
Frankland Avenue (North of Wattleup Road)	2020	MRWA	1,841	241	204	4%
Frankland Avenue (South of Wattleup Road)	2020	MRWA	6,508	580	627	18%
Hammond Road (South of Gaebler Road)	2021	City of Cockburn	3,208	425	391	5.9%

3.9 Existing Pedestrian/Cycle Networks Within 800m of Structure Plan Area

There are very few pedestrian and cycling paths within the surrounding area as the surrounding area is still mostly undeveloped. The developing area to the north of the site has a developing footpath network as shown in **Figure 8**.

Figure 8 - Surrounding Pedestrian/Cycle Network

3.10 Existing Public Transport Services Within 800m of Structure Plan Area

There are currently no existing public transport facilities within the vicinity of the LSP. The nearest bus service is the 535 and 536 bus service shown in **Figure 9**. These services currently terminate at the nearby schools of Hammond Park Primary School (route 535) and Hammond Park Secondary College (route 536). **Table 5** provides a summary of the service frequency.

Table 5 - Bus Route Description and Frequency

Bus Route	Route Description	Weekday Peak Frequency	Saturday Frequency	Sunday and Public Holiday Frequency
535	Aubin Grove Stn - Hammond Park West via Macquarie Bvd	20 mins	60 mins	60 mins
536	Aubin Grove Stn - Hammond Park via Barfield Rd	20 mins	60 mins	60 mins

Figure 9 - Public Transport within the Surrounding Area

Source: Transperth

4 PROPOSED INTERNAL TRANSPORT NETWORKS

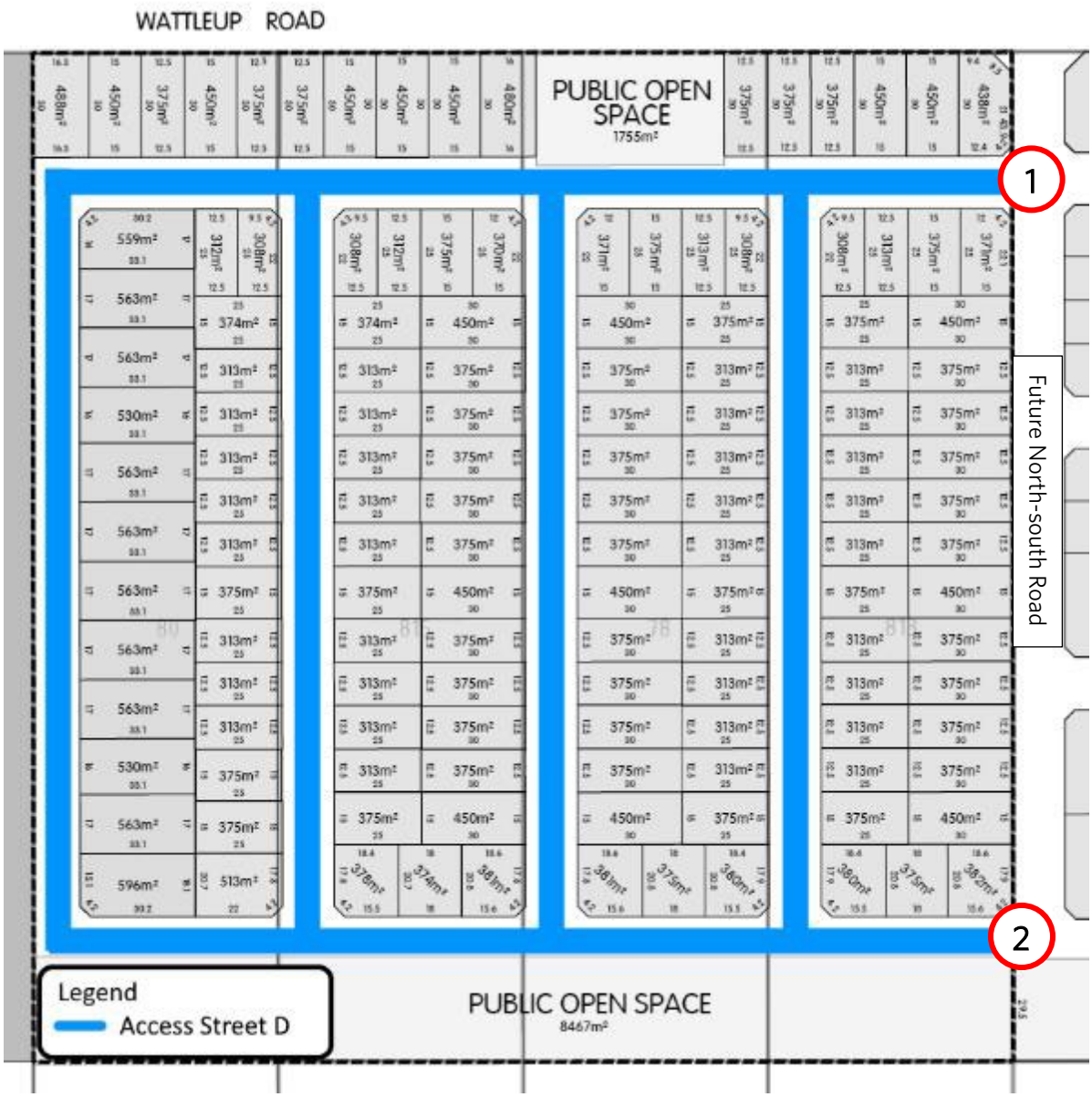
4.1 Changes/Additions to Existing Road Network or Proposed New Road Network

All roads within the amendment area will be newly constructure and classified as Access Streets as shown in **Figure 10**. The proposed access points to the LSP are via the future north-south road aligning the eastern boundary of the LSP which will be constructed as part of the development of the adjacent structure plan. The 2 access points are as follows:

- Access Road 1 – Full movement access at future north-south road
- Access Road 2 – Full movement access at future north-south road

Access to the main arterial road (Wattleup Road) is via the northern end of the future north-south road as shown in **Figure 10**.

Figure 10 - Structure Plan Road Hierarchy



4.2 Road Reservation Widths

The road reserve widths of the internal access roads will be finalised during the subdivision stage in order to accommodate final road and intersection geometry. Typically, the anticipated road reserve widths within the structure plans are summarised below:

- Access Road – 13.5m – 15m
- Access Road adjacent to public open space – 11.5m – 12.5m

4.3 Road Cross-Sections & Speed Limits

The indicative cross sections for access streets are shown in **Figure 11** through to **Figure 13**. Embayed on-street parking can be accommodated within the verge strips with some modifications.

As the roads within the amendment area are all planned to be access streets, the speed limit will likely be 50km/h which is the default speed limit for built-up areas within Western Australia.

Figure 11 - Concept Sketch of Access Street (15m)

Figure 12 - Concept Sketch of Access Street (13.5m)

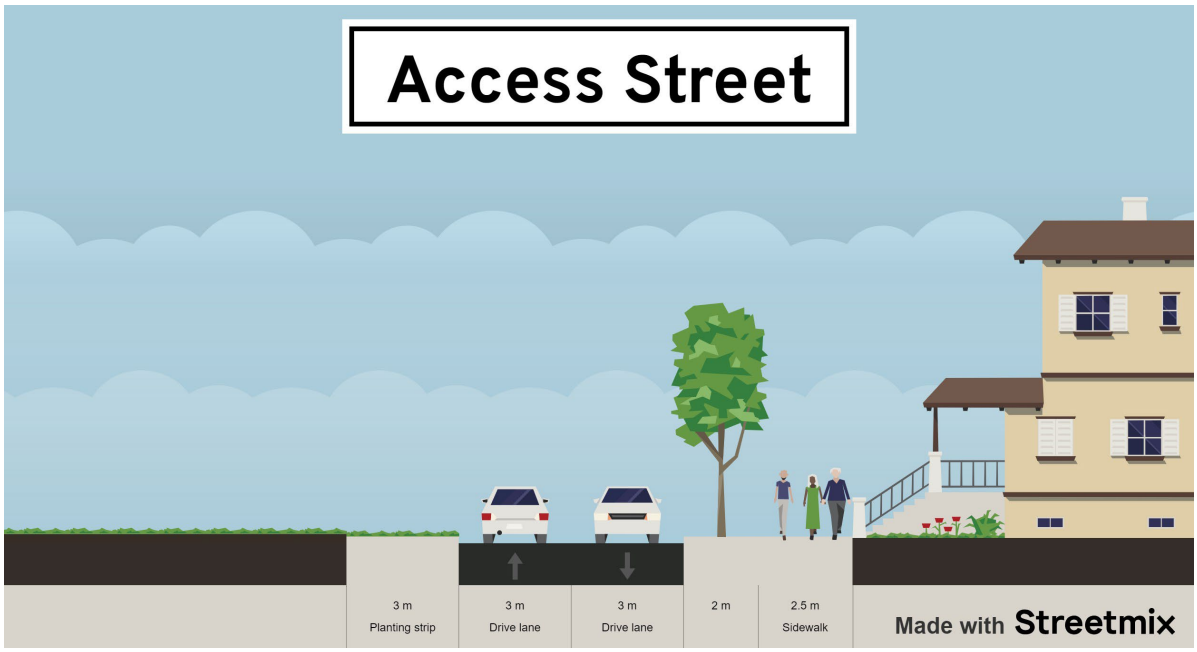
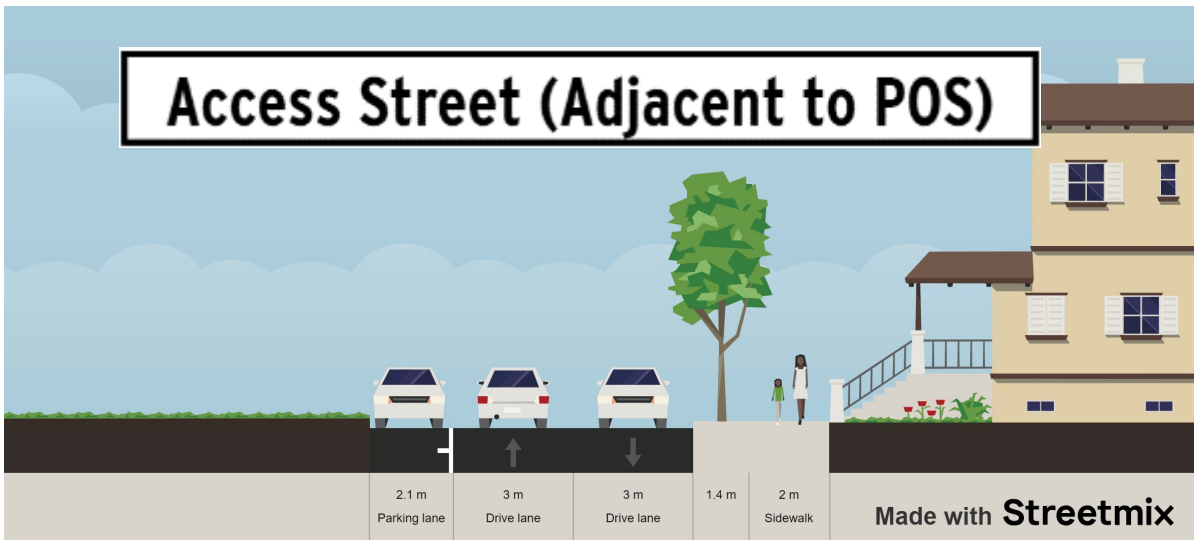


Figure 13 - Concept Sketch of Access Street Cross Section Fronting Public Open Space (11.5m)



4.4 Intersection Controls

All intersections internal to the amendment area have been arranged as T-intersections and as such, standard intersection give-way rules will apply. Due to the length of east-west roads withing the area, traffic calming measures will be provided along all east-west roads. The type of measure will be determined later during detailed design or subdivision stage, however they could be in the form of blister islands, chicanes, lane narrowing, speed humps etc.

4.5 Pedestrian/Cycle Networks and Crossing Facilities

The pedestrian network within the amendment area will connect seamlessly with the adjacent Hammond Quarter Structure Plan area by virtue of the local street footpath network (with the TIA setting out that every local road will have a footpath on at least one side) in addition to the pathways provided within the areas of POS.

In terms of north-south pedestrian connections, a pedestrian refuge island is to be constructed within Wattleup Road as part of the upcoming road upgrades. It is expected that this location will be the key route for pedestrian traffic over Wattleup Road and could also be upgraded to a guarded school crossing once school age population within the southern land requires it. As such, its positioning will consider the ideal route to the Jilbup Primary School.

4.6 Public Transport Routes

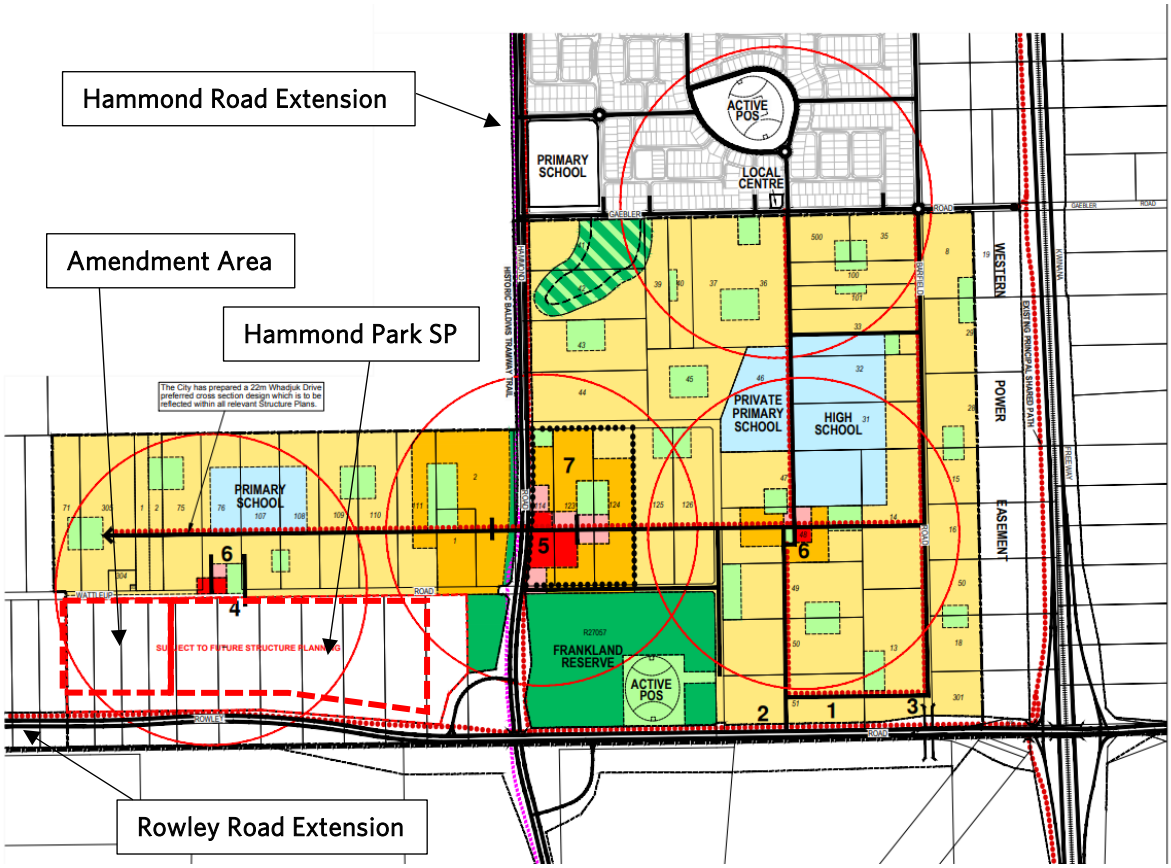
There are no public transport routes planned within the amendment area or the adjacent LSP. Further details on future public transport changes can be found in section 5.

5 CHANGES TO EXTERNAL TRANSPORT NETWORKS

5.1 Road Network

Figure 14 shows the proposed road alignments as detailed in the Southern Suburbs District Structure Plan (SSDSP) 2012. The Plan also details the proposed land uses and pedestrian/cycling network. The following sections will discuss future road upgrades/extension within the SSDSP.

Figure 14 - Road Network in SSDSP



Source: Southern Suburbs District Structure Plan (SSDSP) (2012)

5.1.1 Rowley Road

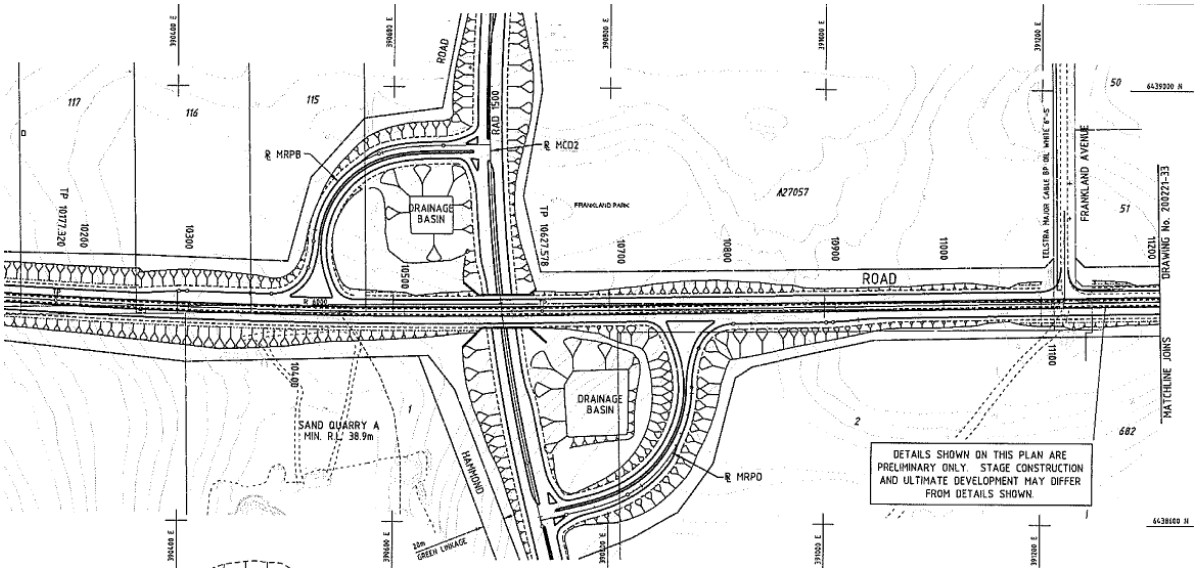
The Department of Planning, Lands and Heritage (DPLH) has identified the need to upgrade and extend Rowley Road westwards as a dual carriageway, which would potentially provide the main link from the Kwinana Freeway to the Latitude 32 industrial area and the proposed future outer harbour. The extension will run parallel to Wattleup Road and will reduce the freight traffic demand along Wattleup Road.

5.1.2 Hammond Road

Hammond Road (currently named Frankland Avenue south of Russell Road) is planned to be extended southwards from Gaebler Road to Rowley Road and continue further south.

In the interim, the intersection of Hammond Road and Rowley Road is proposed to be upgraded to either a roundabout or signal controlled. The long term plans for this intersection, as mentioned in the SSDSP, is to fully grade separate this intersection. Main Roads WA has developed preliminary concepts of the proposed upgrades which are shown in **Figure 15**.

Figure 15 - Rowley Road/Hammond Road Proposed Ultimate Layout



Source: Main Roads (2015)

5.1.3 Wattleup Road

Wattleup Road will continue to be a significant freight route until the construction of the Rowley Road extension. Following this upgrade to the transport network, Wattleup Road will be downgraded with its function shifting towards accommodating local traffic movement.

5.1.3.1 Speed Limit

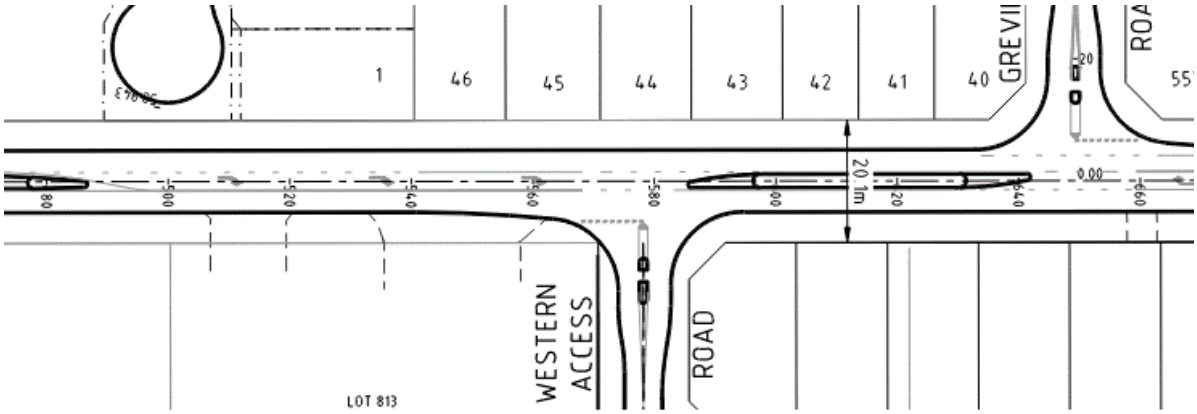
In the long term, when Rowley Road is extended, Wattleup Road will no longer function as a primary regional route and heavy vehicle traffic would shift onto Rowley Road. At this point, Wattleup Road should be downgraded to a local road with a 50km/h speed limit.

5.1.3.2 Road Upgrades

Wattleup Road is proposed to be upgraded to an urban standard to support the residential buildout on both the northern and southern sides of the road. The upgrades will include road pavement widening which will allow the installation of right turn lanes at selected residential access roads. The traffic lanes will be 3.5m wide, while the turn lanes will be 3m wide.

Figure 16 shows the proposed concept design for the future north-south road/Wattleup Road intersection which provides access to the amended LSP area as well as the Hammond Quarter Structure Plan area to the east. The intersection includes a dedicated right turn pocket to facilitate right turn movements into the local road without disrupting through traffic.

Figure 16 - Wattleup Road/Access Road 1 Intersection Concept



Source: Hammond Quarter Structure Plan Transport Impact Assessment (2022)

5.2 Pedestrian/Cycle Networks and Crossing Facilities

5.2.1 SSDSP

As detailed in the SSDSP, an interconnecting network of shared paths is proposed within the District Structure Plan area with the main connections being identified as Hammond Road, Rowley Road, Wattleup Road, Aubin Grove Station and the Kwinana Freeway. Also, as detailed in the SSDSP, a major shared path will be provided on Whadjuk Drive.

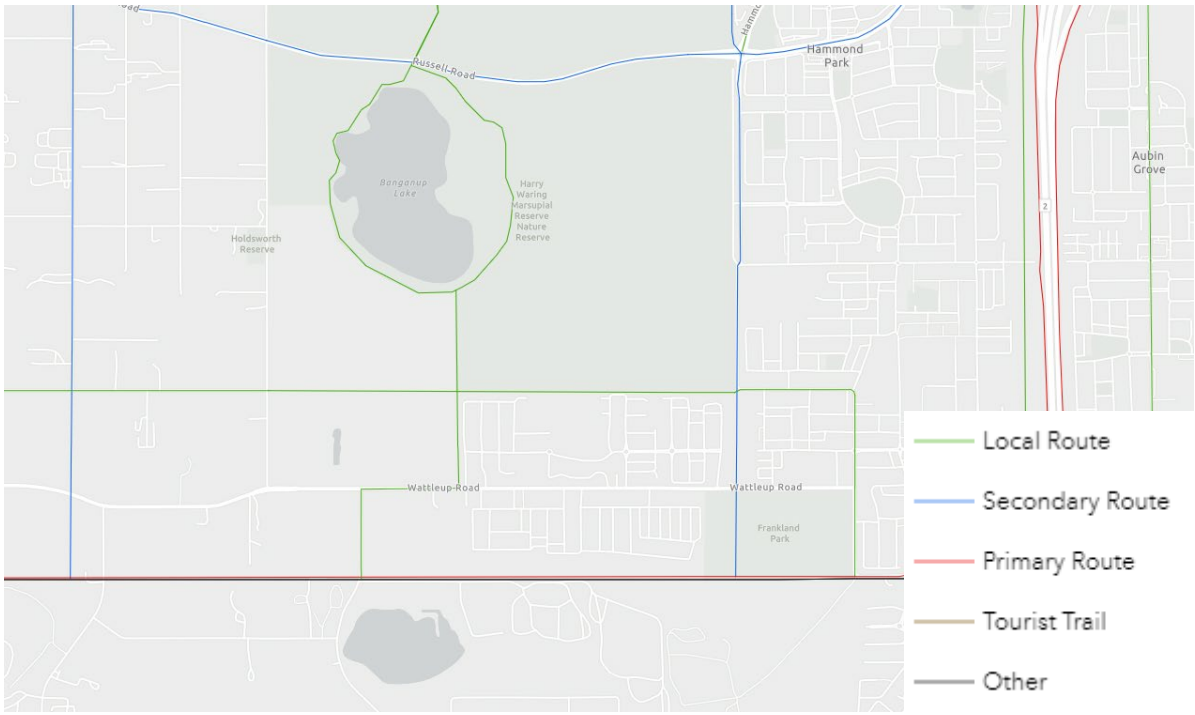
Pedestrian and cycling facilities will be provided within the LSP consistent with the appropriate road hierarchy as per Liveable Neighbourhood guidelines with at least a standard footpath along all roads within the LSP.

5.2.2 Long-Term Cycle Plan (LTCN)

Figure 17 shows the Department of Transport's aspirational future cycling network within the Perth metro region. The map shows the proposed cycle route hierarchy for the roads surrounding the LSP which is summarised below.

- Rowley Road – Primary Route
- Wattleup Road – Local Route
- Frankland Avenue – Local Route
- Hammond Road – Secondary Route
- Southern Boundary of Harry Waring Marsupial Reserve – Local Route

Figure 17 - Long Term Cycle Network



Source: Department of Transport

5.3 Public Transport Services

The Public Transport Authority (PTA) were contacted and advised that, in light of the LSP development to the south, Route 535 is likely to be shifted from Whadjuk Drive and extended along Wattleup Road so that the route is more central to the residential catchment.

This potential extension is subject to resources (buses & service KM), patronage, development patterns, community consultation and lastly availability of a terminus/bus turnaround facility.

6 INTERGRATION WITH SURROUNDING AREA

6.1 Trip Attractors/Generators Within 800 Metres

Hammond Park Primary School is located approximately 1.4km to the northeast, while Hammond Park Catholic Primary School and Hammond Park Secondary School is located approximately 1.5km east of the LSP boundary. Additionally, a future primary school is currently under construction within the residential area to the north of Wattleup Road. These schools are likely to be a major trip attractor from the LSP.

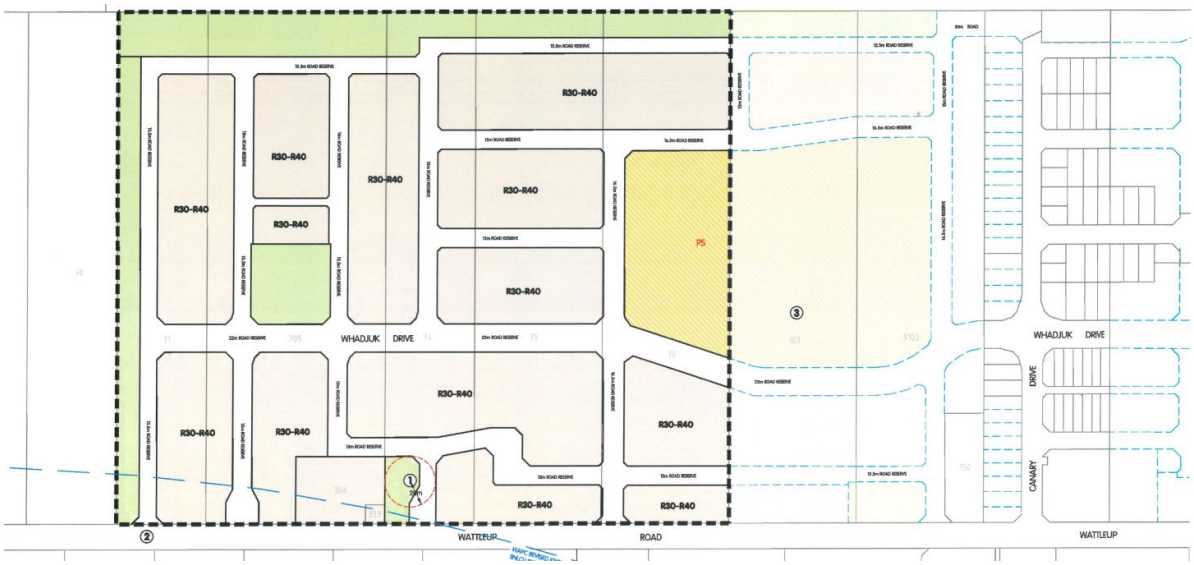
Other sites that would attract trips from the LSP includes a "Neighbourhood Centre" adjacent to the future intersection of Whadjuk Drive and Hammond Road, as well as the Aubin Grove Train Station.

6.2 Proposed Changes to Land Uses Within 800 Metres

6.2.1 Hammond Park West Structure Plan (North of Wattleup Road)

The area to the north of Wattleup Road is currently being developed into residential area and a primary school. **Figure 19** below shows the approved Structure Plan layout and **Figure 20** shows the current development progress.

Figure 18 – Hammond Park West Structure Plan



Source: City of Cockburn

Figure 19 - Current Development Progress of Hammond Park West Structure Plan

6.3 Travel Desire Lines from Structure Plan to These Attractors/Generators

Under the current road network arrangement, access to key generator and attractors will be via Wattleup Road. Once the surrounding road network is built up and more route options are available, drivers are more likely to use local roads (such as Whadjuk Drive) to travel to and from the local schools within the surrounding area. Wattleup Road will still be the main route choice for travel to external attractors/generators such as the Aubin Grove Train Station.

6.4 Adequacy and Deficiencies of the External Transport Networks

Much of the surrounding transport network is incomplete and will continue to improve as the surrounding area continues to be developed.

7 ANALYSIS OF INTERNAL TRANSPORT NETWORKS

7.1 Assessment Year(s) and Time Period(s)

The assessment years are assumed as follows:

- Year 2034 – Future year with LSP completed in its entirety, including amendment.

As per WAPC Transport Impact Assessment Guidelines for Structure Plans, the assessment will be undertaken only for the full build-out of the development. Peak times selected are 7:45am – 8:45am and 4:00pm – 5:00pm, which are the peak times of Frankland Avenue and Wattleup Road intersection based on the traffic count data provided in Main Roads WA Traffic Map.

7.2 Structure Plan Generated Traffic

The trip generation rates for the LSP were obtained from the following sources:

- Roads and Maritime Services (RMS) Guide to Traffic Generating Developments – Updates Traffic Surveys (trip generation rates)
- Institute of Transportation Engineers (ITE) Trip Generation Manual 11th Edition (trip distribution percentages)

Table 6 shows the trip generation rates for the proposed land uses, **Table 7** shows the directional distribution and **Table 8** shows the total traffic generated be the LSP.

Table 6 - Trip Generation Rates

Land Use	Source	Yield	AM Peak	PM Peak
Residential	RTA	136	0.95 trips per dwelling	0.99 trips per dwelling

Table 7 - Trip Distribution

Land Use	AM Peak		PM Peak	
	IN	OUT	IN	OUT
Residential	26%	74%	64%	36%

Table 8 - Total Trip Generation

Land Use	AM Peak		PM Peak	
	IN	OUT	IN	OUT
Residential	34	96	87	49
Total	130		136	

The proposed LSP represents an increase in traffic of approximately 130 vehicle trips in the AM peak period and 136 vehicle trips in the PM peak period.

7.3 Extraneous (Through) Traffic

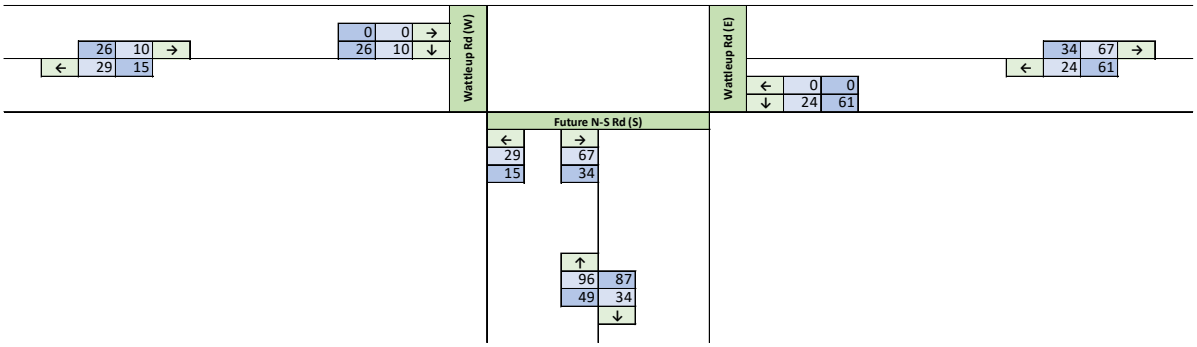
Not applicable as the proposed LSP does not contain any existing roads or traffic.

7.4 Design Traffic Flows (That is, Total Traffic)

As mentioned in the previous section, there is not extraneous traffic traveling through the LSP. As such, the design traffic flows will comprise of the traffic generated by the structure plan exclusively. **Figure 21** shows the total traffic follows generated by the LSP throughout the network that is being assessed. The distribution of the LSP traffic volumes along Wattleup Road are as follows:

- 30% to/from the west of Wattleup Road
- 70% to/from the east of Wattleup Road

Figure 20 - LSP Traffic Volumes



7.5 Road Cross-Sections

The indicative internal road cross sections are provided in **Section 4.3** and are consistent with Liveable Neighbourhoods' guidelines.

7.6 Access Strategy

For the purposes of a robust assessment, it is assumed that all traffic generated by the LSP will travel along the future north-south road and through to Wattleup Road. While it is possible for development traffic to access the LSP via the local roads connected to the adjacent structure plan area, the volume of these movement patterns will likely be low.

7.7 Pedestrian/Cycle Networks

As mentioned in **Section 4.5**, the pedestrian and cycle network will be determined later in the detail design or subdivision stage. The proposed pedestrian and cycle network should be consistent with the local character with sensible path connections both internally and externally.

7.8 Safe Routes to Schools

Not applicable as the proposed structure plan consists of only residential dwellings.

7.9 Pedestrian Permeability & Efficiency

The road network within the LSP is relatively standard and setup in a grid layout which provides a simple but legible arrangement where a footpath network can be established.

7.10 Access To Public Transport

Not applicable as there are no public transport links or facilities within the proposed LSP.

8 ANALYSIS OF EXTERNAL TRANSPORT NETWORKS

8.1 Extent of Analysis

To determine the traffic impacts of the proposed development on the surrounding network, a SIDRA assessment was conducted for the following intersection(s):

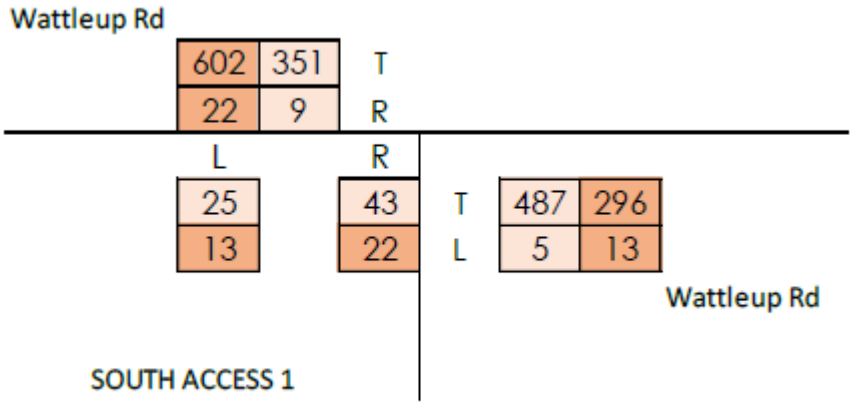
- Wattleup Road/Future North-South Road intersection

8.2 Base Flows for Assessment Year(s)

The base traffic volumes for the assessed intersection were obtained from the Hammond Quarter Structure Plan Transport Impact Assessment as shown summarised in **Figure 22**. These volumes include the following components:

- Background growth along Wattleup Road (1% growth per year)
- Traffic generated by the surrounding structure plans
- Increase in traffic volumes as a result of the Hammond Road extension

Figure 21 - Based Traffic Volumes for Assessment

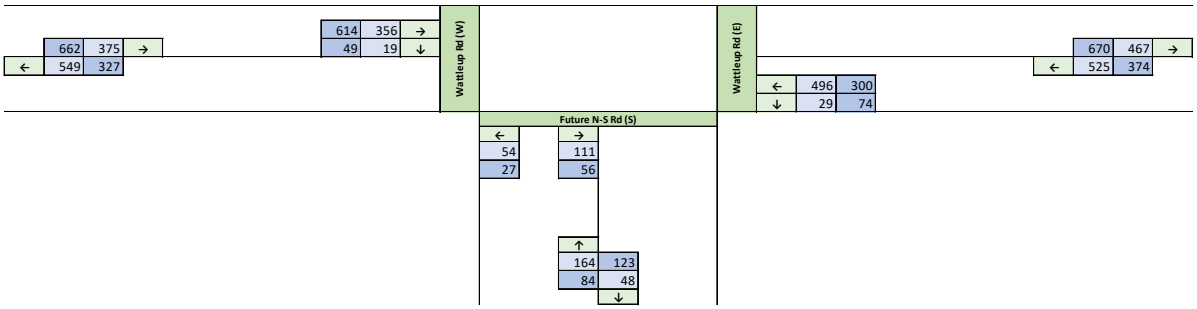


Source: Hammond Quarter Structure Plan Transport Impact Assessment (Rev E)

8.3 Total Traffic Flows

The combined base and development traffic volumes is summarised in **Figure 23** for the future assessment scenario.

Figure 22 - Total Traffic Volumes



8.4 Key Intersections Analysis

A description of the SIDRA outputs are as follows:

- **Degree of Saturation** is defined as the ratio of arrival flow to capacity. Degrees of Saturation above 1.0 represent oversaturated conditions (demand flow exceeds capacity) and degrees of saturation below 1.0 represent undersaturated conditions (demand flow is below capacity).
- **Delay** is the additional (excess) travel time experienced by a vehicle or pedestrian relative to a base travel time. The delay estimated in SIDRA is average for all vehicles, queued and unqueued.
- **Level of Service** as defined in the HCM is a quality measure describing operational conditions within a traffic stream, and in the case of SIDRA, a function of the average delay thresholds. A description of the level of service thresholds are as follows.
    - LOS A represents completely unconstrained free flow conditions.
    - LOS B represents free flow conditions.
    - LOS C represents reduced free flow conditions.
    - LOS D represent restricted traffic flow conditions.
    - LOS E represents operations at or near capacity.
    - LOS F represents forced breakdown or breakdown of traffic flow.
- **95th percentile queue** is the value below which 95% of all observed cycle queue lengths fall or 5% of all observed queue lengths exceed.

The SIDRA layout for Wattleup Road/Future North-South Road intersection is shown in **Figure 24** with the results of the assessment summarised in **Table 9**.

Figure 23 - SIDRA Layout for Wattleup Road/Future North-South Access Intersection

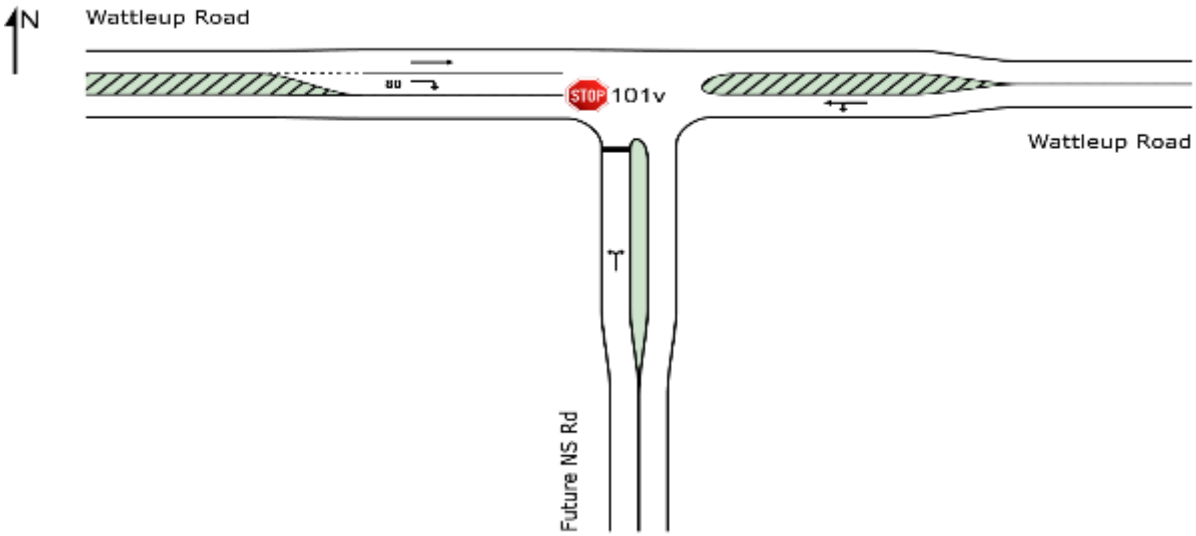


Table 9 - SIDRA Results for Wattleup Road/Future North-South Access Intersection

Intersection Approach		AM Peak				PM Peak			
	Turn	DOS	Delay	LOS	95% Queue (m)	DOS	Delay	LOS	95% Queue (m)
Future NS Rd (S)	L	0.700	22.3	C	28.9	0.348	11.4	B	10.4
	R	0.700	40.9	E	28.9	0.348	31.1	D	10.4
Wattleup Road (E)	L	0.360	6.5	A	0	0.226	6.5	A	0
	T	0.360	0.1	A	0	0.226	0.1	A	0

Wattleup Road (W)	T	0.281	0.1	A	0	0.351	0.1	A	0
	R	0.022	8.9	A	0.1	0.044	7.8	A	0.5
Total		0.700	5.8	A	28.9	0.351	2.7	A	10.4

The SIDRA results show that the Wattleup Road/Future North-south Road Access intersection will operate at an acceptable level of service for the future 2034 assessment scenario.

8.5 Road Cross-Sections

The indicative external road cross sections are consistent with Liveable Neighbourhoods' guidelines.

8.6 Intersection Layouts & Controls

The intersection within the structure plan to the east comprise mostly of T-intersections which will be give-way. Due to the length of east-west roads withing the LSP, traffic calming measures will be provided along all east-west roads. The type of measure will be determined later in the detailed design or subdivision stage, however they could be in the form of blister islands, chicanes, lane narrowing, etc.

8.7 Pedestrian/Cycle Networks

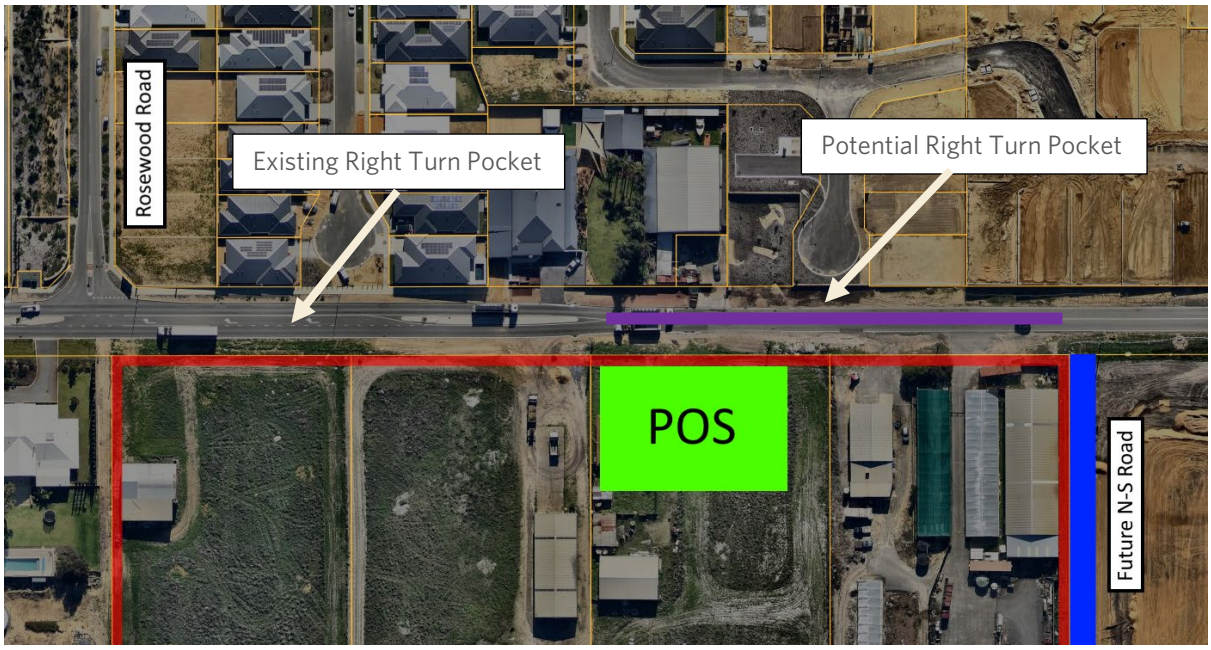
Wattleup Road, in its current form, presents a significant barrier for both pedestrian and cyclists due to the lack of crossing facility which allow users to travel to/from the north. This will also affect parents and students that reside in the areas south of Wattleup Road heading towards the primary school located to the north. As the surrounding area and road network continues to develop (and as the function of Wattleup Road changes), consideration should be given to providing appropriate crossing facilities connecting the Hammond Quarter Structure plan areas to the south with the Hammond Park West Structure plan areas to the north.

9 SITE SPECIFIC ISSUES

The City of Cockburn has raised questions with regard to only providing a single access point to the LSP amendment area and whether there is a need for an additional western access to the structure plan area to distribute traffic. The justification for the proposed access arrangement is summarised below:

- As demonstrated in the SIDRA results within **Section 8.4**, the operation of the Wattleup Road/future north-south road is considered to be acceptable with the worse performing movement being the right turn out of the future N-S road (LOS E and D for the AM and PM peaks respectively). Longest queues occur in the AM peak along this road approach extending up to 29m and does not extend through to the 4 way intersection. Constraints around the extremities of the LSP prohibit the possibility of additional external traffic inflow, meaning that there is not likely to be any significant future growth in traffic that would result in an increase in queue length.
- In order for an additional western access to provide any operational benefit, it would need to allow right turn movements out onto Wattleup Road (all other movements operate at or near free flow conditions). **Figure 24** below shows the current layout of Wattleup Road along with key elements within the structure plan. A summary of the additional assess feasibility are as follows:
    - An access to the west of the POS cannot be feasibly provided as it would conflict with the existing right turn pocket into Rosewood Street.
    - An access could potentially be provided east of the POS, though would provide almost no additional benefit due to its proximity to the future N-S road and limited internal catchment it would service.
    - If a right turn pocket is provided at the Wattleup Road/future N-S road intersection, it is likely to include a connected median that links up with the Wattleup Road/Rosewood Road right turn pocket. This would essentially leave no feasible locations for an additional full movement access along the site frontage.

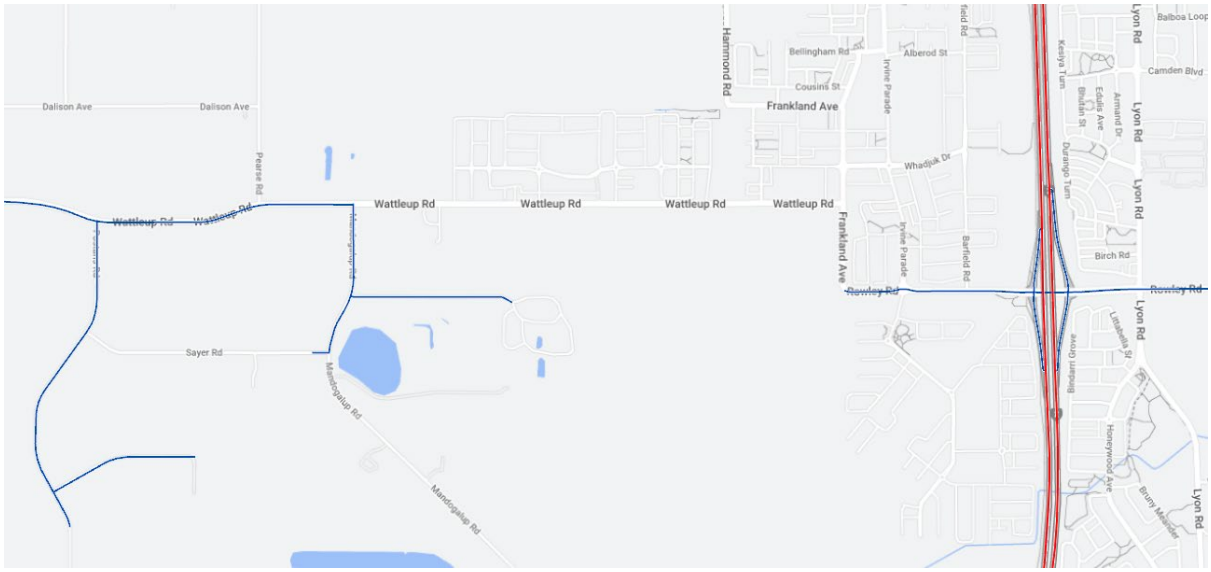
Figure 24 – Existing Road Layout



- Recently, Main Roads WA have approved the removal of RAV vehicle access on Wattleup Road along the section east of Mandogalup Road as shown in **Figure 25**. While RAV vehicles only account for around 1-1.5% of traffic along Wattleup Road, the removal of these vehicles is intended to be the first step towards downgrading Wattleup Road to be more suitable for future local traffic.
- While the assessment assumes traffic growth on Wattleup Road for the purposes of a robust analysis, it is more likely the volumes may decrease over time. The future Rowley Road extension is intended to be the main east-west link from Kwinana Freeway through to the Latitude 32 industrial zone and Rockingham Road. The construction of this extension will likely lead to a decrease in heavy vehicle and through traffic

leaving mostly local traffic along Wattleup Road. The reduction of through traffic will result in reducing delays and for turning traffic along Wattleup Road.

Figure 25 – RAV Vehicle Network



Source: Main Roads WA HVS Network

10 SUMMARY AND CONCLUSIONS

This report has been prepared in accordance with the Western Australian Planning Commission (WAPC) Transport Assessment Guidelines for Developments: Volume 2 – Planning Schemes, Structure Plans and Activity Centre Plans (2016); the checklist is included at Appendix A.

The following conclusions can be drawn from this TIA:

- The LSP comprises of 136 residential dwellings.
- The LSP is estimated to generate 130 vehicle trips in the AM peak period and 136 vehicle trips in the PM peak period.
- Public transportation is currently considered to be poor as there is a lack of services located within a reasonable distance to the LSP. While there are currently no plans to improve public transport within the surrounding area, there will likely be a stronger incentive to improve/extend bus services to the LSP and the surrounding area as it continues to develop, and the population increases. Such considerations are at the discretion of the PTA and whether there is sufficient demand to justify upgrades to the public transport network.
- The existing pedestrian/bike network is also considered to be poor within the surrounding area as most of the surrounds is currently undeveloped and lacks proper cycling paths or connections. Proper pedestrian and cycling infrastructure will be provided as the LSP and surrounding areas continue to develop in the future.
- The SIDRA assessment shows that the Wattleup Road/Future North-south Road Access intersection will operate at an acceptable level of service for the future 2034 assessment scenario.

Appendix A

WAPC CHECKLIST FOR INDIVIDUAL DEVELOPMENT - TRANSPORT IMPACT STATEMENT

APPENDIX A – WAPC CHECKLIST

Item	Status	Comments/Proposal
Summary	Section 9	
Introduction/Background	Section 1	
Structure Plan Proposal		
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Proposed Land Uses	Section 2	
Table Of Land Uses and Quantities	Section 2	
Major Attractors/Generators	Section 2	
Specific Issues	Section 2	
Existing Situation		
Existing Land Uses Within Structure Plan	Section 3	
Existing Land Uses Within 800 Metres of Structure Plan Area	Section 3	
Existing Road Network Within Structure Plan Area	Section 3	
Existing Pedestrian/Cycle Networks Within Structure Plan Area	Section 3	
Existing Public Transport Services Within Structure Plan Area	Section 3	
Existing Road Network Within 2 (Or 5) km of Structure Plan Area	Section 3	
Traffic Flows on Roads Within Structure Plan Area (PM and/or AM Peak Hours)	Section 3	
Traffic Flows on Roads Within 2 (Or 5) km of Structure Plan Area (AM and/or PM Peak Hours)	Section 3	
Existing Pedestrian/Cycle Networks Within 800m of Structure Plan Area	Section 3	
Existing Public Transport Services Within 800m of Structure Plan Area	Section 3	
Proposed Internal Transport Networks		
Changes/Additions to Existing Road Network or Proposed New Road Network	Section 4	
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Road Cross-Sections & Speed Limits	Section 4	
Intersection Controls	Section 4	
Pedestrian/Cycle Networks and Crossing Facilities	Section 4	
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Changes to External Transport Networks		
Road Network	Section 5	
Intersection Controls	Section 5	
Pedestrian/Cycle Networks and Crossing Facilities	Section 5	
Public Transport Services	Section 5	

Integration With Surrounding Area		
Trip Attractors/Generators Within 800 Metres	Section 6	
Proposed Changes to Land Uses Within 800 Metres	Section 6	
Travel Desire Lines from Structure Plan to These Attractors/Generators	Section 6	
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Deficiencies in External Transport Networks	Section 6	
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Structure Plan Generated Traffic	Section 7	
Extraneous (Through) Traffic	Section 7	
Design Traffic Flows (That is, Total Traffic)	Section 7	
Road Cross-Sections	Section 7	
Intersection Controls	Section 7	
Access Strategy	Section 7	
Pedestrian/Cycle Networks	Section 7	
Safe Routes to Schools	Section 7	
Pedestrian Permeability & Efficiency	Section 7	
Access to Public Transport	Section 7	
Analysis of External Transport Networks		
Extent of Analysis	Section 8	
Base Flows for Assessment Year(s)	Section 8	
Total Traffic Flows	Section 8	
Road Cross-Sections	Section 8	
Intersection Layouts & Controls	Section 8	
Pedestrian/Cycle Networks	Section 8	
Conclusions	Section 9	

APPENDIX B – CONCEPT LOCAL STRUCTURE PLAN

LEGEND

- Area of Modification
- Residential (Standard)
- Residential (Transition)
- Public Open Space

YIELD TABLE

Existing Lots	4
Proposed Lots	
Residential (Standard)	125
Residential (Transition)	11
TOTAL	**136**
Public Open Space	2

Note: Totals include proposed lots used for temporary road access.

QUBE

HATCH

CADASTRAL INFORMATION
SOURCE: LANDGATE SLIP
YYMMDD: 230619
DWG REF: LGATE-001
PROJECTION: PCG94

SIZE A3_ 1:2000

0 metres 20 40 60 80 100

REV	DESCRIPTION	YYMMDD	DRAWN	APPR'D
N	RELOCATE POS - TO SUIT DRAINAGE	240423	SB	TP
M	REMOVE TEMP ROAD NOTATION	240313	SB	TP
L	COLOUR TEMP CONNECTION AS RESI	240214	SB	TP

CONCEPT PLAN - WATTLEUP NEIGHBOURHOOD
City of Cockburn

JOB CODE	DRAW NO.	REV.
QUB WAT	**RD1 010**	**N**

DISCLAIMER: ISSUED FOR DESIGN INTENT ONLY. ALL AREAS AND DIMENSIONS ARE SUBJECT TO DETAIL DESIGN AND SURVEY

ptg consulting

www.ptgconsulting.com.au

Transport Impact Assessment

Hammond Quarter Structure Plan

CW1200533 / 304900893

Prepared for
Qube Property

29 January 2024

Stantec

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Approved By:

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Business Leader – Traffic & Transport

Date Approved 29/01/2024

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B	18/11/2022	Minor Text Revision	RR	SJL
C	17/11/2023	Turning Warrant Updates	BS	SJL
D	28/11/2023	Trip Distribution	BS	SJL
E	29/01/2024	Eastern Access updates	BS	SJL

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Our report is based on information made available by the client. The validity and comprehensiveness of supplied information has not been independently verified and, for the purposes of this report, it is assumed that the information provided to Stantec is both complete and accurate. Whilst, to the best of our knowledge, the information contained in this report is accurate at the date of issue, changes may occur to the site conditions, the site context or the applicable planning framework. This report should not be used after any such changes without consulting the provider of the report or a suitably qualified person.

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1 Introduction

1.1 Background

Stantec has been commissioned by Qube Property to prepare a Transport Impact Assessment (TIA) for the proposed Structure Plan (the Site) located in Hammond Park, City of Cockburn. The Structure Plan consists of lots 117, 200, 805, 809, 1000, 1001, 9001, 9002, 9003 Wattleup Road.

Previously, a TIA covering the future developments north and south of Wattleup Road was prepared by Stantec in April 2021 (document reference: CW1143500-TR-RP-002). After lodgement, City of Cockburn has requested a TIA report to cover the LSP which is to include an additional SIDRA analysis scenario for a future Hammond Road/Wattleup Road 3-way roundabout.

1.2 Site Location

The LSP is located within the suburb of Hammond Park, City of Cockburn. The Site is currently majority vacant as shown in **Figure 1-1**.

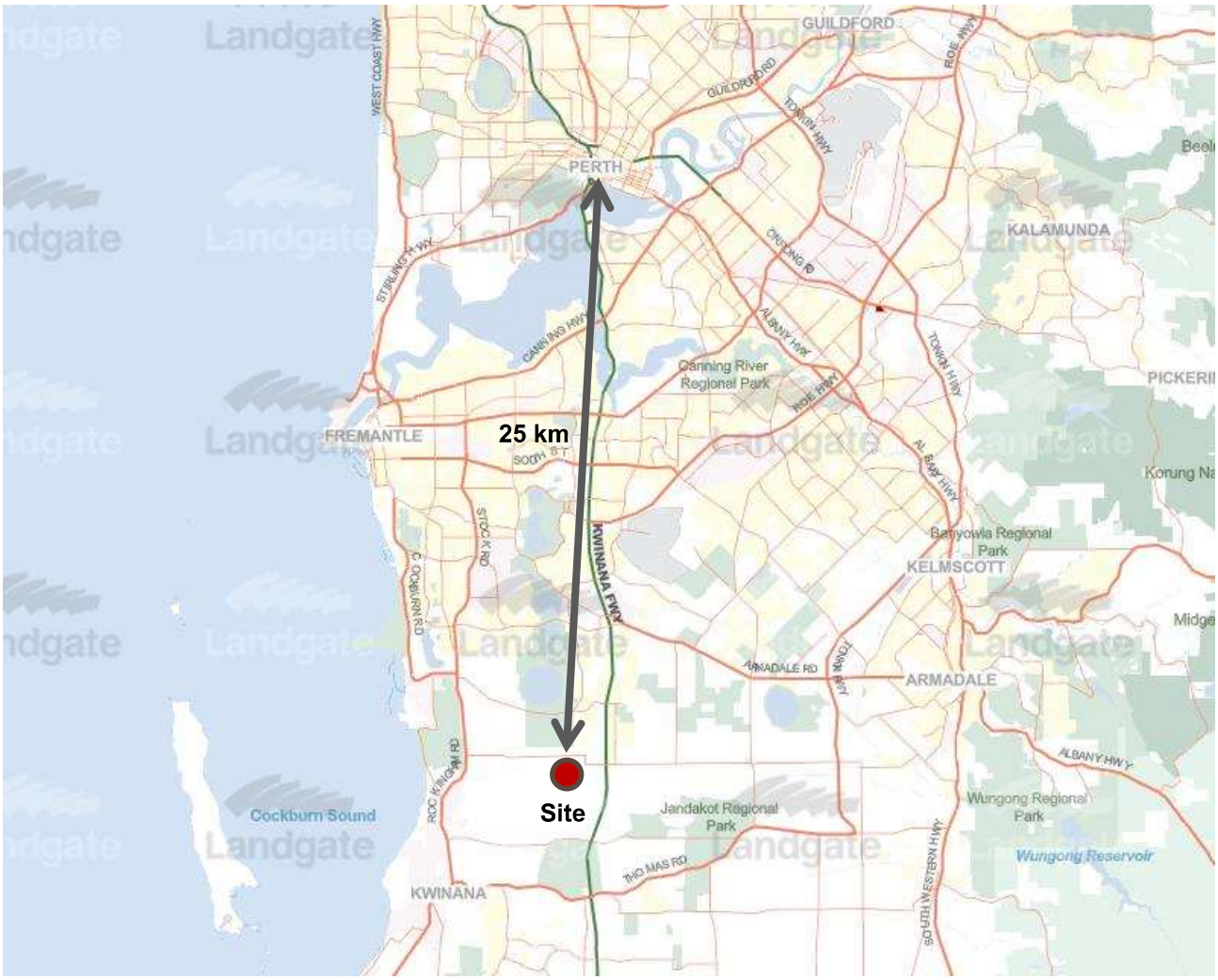
Figure 1-1 Site Location

2 Structure Plan Proposal

2.1 Regional Context

The LSP is located approximately 33km from the Perth CBD in the suburb of Hammond Park as shown in **Figure 2-1.** The suburb is predominantly occupied by residential dwellings, with the southern portion of the suburb (where the LSP is located) still under development. The suburb and the LSP is well connected to the Perth CBD via Kwinana Freeway and the Mandurah rail line and to Fremantle / Kwinana industrial strip via Rockingham Road and Stock Road.

Figure 2-1 Regional Location



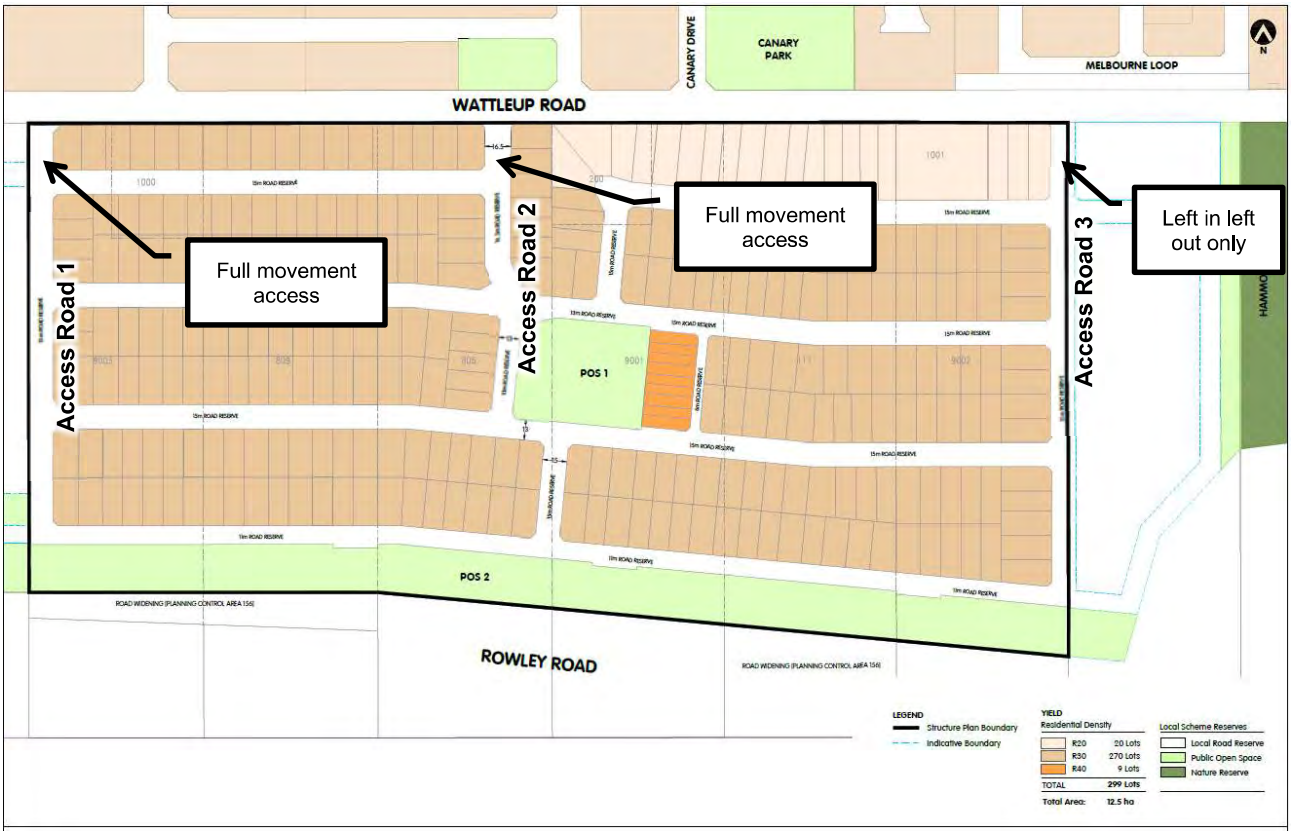
2.2 Proposed Land Use

The LSP is proposed to be developed into a residential subdivision with yields shown in **Table 2-1**. The LSP layout is shown **Figure 2-2**.

Table 2-1 LSP Indicative Land Use Yield

Land use	Indicative Yield
Residential Dwelling	294 dwellings

Figure 2-2 Proposed LSP Layout



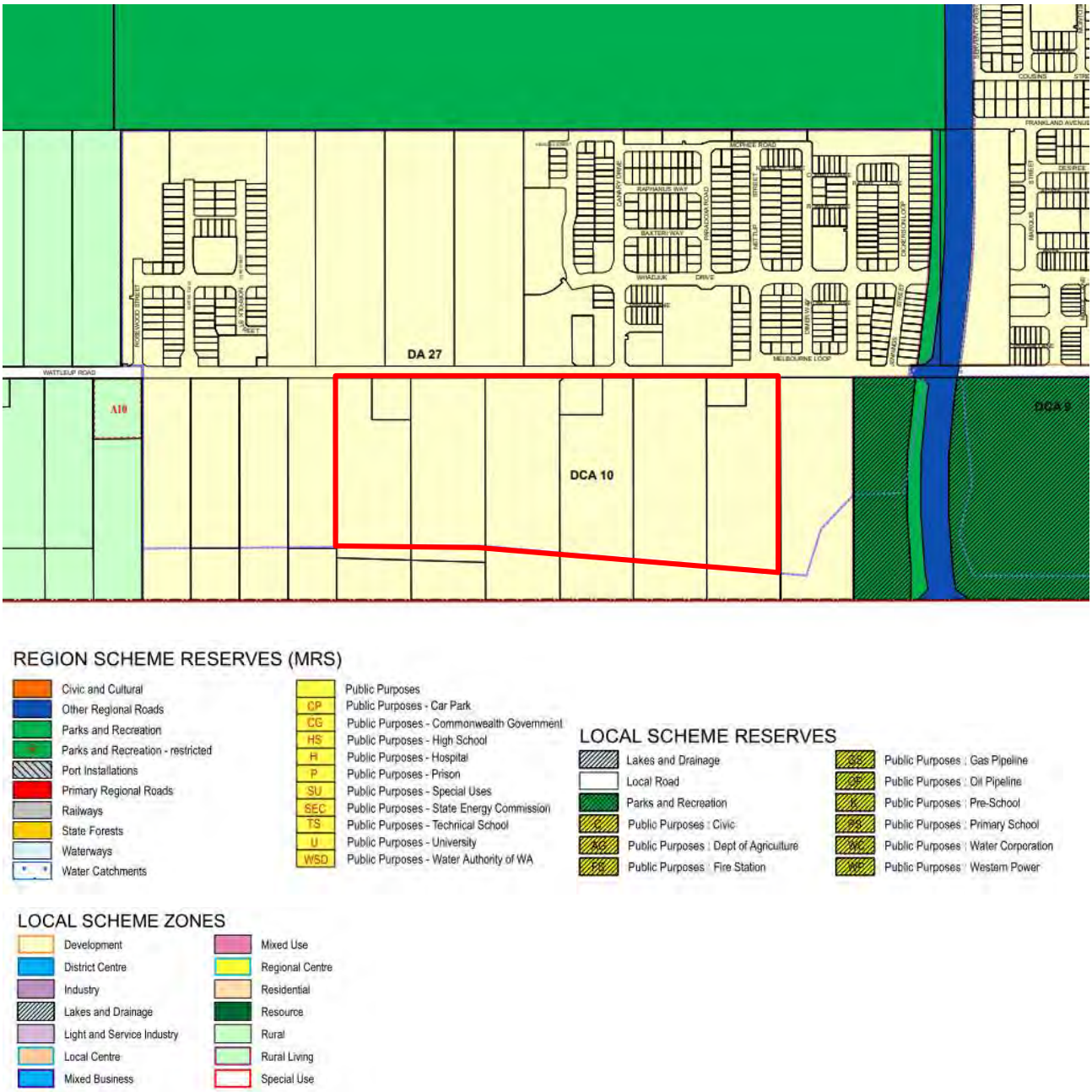
Source: Hatch Roberts Day 2022

3 Existing Situation

3.1 Existing Land Use

As shown in **Figure 3-1** below, the City of Cockburn *Town Planning Scheme No.3,* has zoned the LSP as "Development". The area north, west, and east of the LSP is also zoned as "Development", with the area north of Wattleup Road being progressively developed into residential lots / dwellings.

Figure 3-1 Existing Zoning



The LSP is located within the City of Cockburn's *Southern Suburbs District Structure Plan Stage 3* (SSDSP3) covering the suburbs of Hammond Park and Wattleup as shown in **Figure 3-2**. SSDSP3 provides the framework for land uses that integrates with the broader area. Under SSDSP3 the Site is marked as 'Subject to Future Structure Planning'.

Figure 3-2 Southern Suburbs District Structure Plan – Stage 3

3.2 Existing Road Network

The existing road network hierarchy within and surrounding the LSP is shown in **Figure 3-3.** The road classifications are defined in the Main Roads Functional Hierarchy as shown below in **Table 3-1.**

Table 3-1 Main Roads WA Road Hierarchy

Road Hierarchy	Description
Primary Distributor	Form the regional and inter-regional grid of MRWA traffic routes and carry large volumes of fast-moving traffic. Some are strategic freight routes, and all are National or State roads. They are managed by Main Roads.
Regional Distributors	Roads that are not Primary Distributors, but which link significant destinations and are designed for efficient movement of people and goods within and beyond regional areas. They are managed by Local Government.
District Distributor A	These carry traffic between industrial, commercial, and residential areas and connect to Primary Distributors. These are likely to be truck routes and provide only limited access to adjoining property. They are managed by Local Government.
District Distributor B	Perform a similar function to “District Distributor A” but with reduced capacity due to flow restrictions from access to and roadside parking alongside adjoining property. These are often older roads with traffic demand in excess of that originally intended. District Distributor A and B roads run between land-use cells and not through them, forming a grid that would ideally be around 1.5 kilometres apart. They are managed by Local Government.
Local Distributor	Carry traffic within a cell and link District Distributors at the boundary to access roads. The route of the Local Distributor discourages through traffic so that the cell formed by the grid of District Distributors only carries traffic belonging to or serving the area. These roads should accommodate buses but discourage trucks. They are managed by Local government.
Access Road	Provide access to abutting properties with amenity, safety and aesthetic aspects having priority over the vehicle movement function. These roads are bicycle and pedestrian friendly. They are managed by Local government.

Figure 3-3 Existing Road Network

Table 3-2 below summarises the characteristics of key roads within and surrounding the LSP.

Table 3-2 Key Roads Within and Surrounding the LSP

Road Name	Hierarchy	Jurisdiction	Configuration	Speed Limit (km/h)
Wattleup Road	Regional Distributor	City of Cockburn	▪ two-lane, two-way undivided carriageway ▪ connects to Rockingham Road to the west and Kwinana Freeway to the east (via Frankland Avenue and Rowley Road). ▪ No footpath on the majority of the road section	70 km/h from Frankland Avenue to 200m west of Canary Drive and increased to 80km/h towards the west.
Frankland Avenue	▪ Access Road north of Wattleup Road ▪ Regional Distributor south of Wattleup Road	City of Cockburn	▪ two-lane, two-way undivided carriageway ▪ Frankland Avenue connects to Rowley Road to the south. ▪ Paths are discontinuous and generally only available along built-up area	50 (speed limit is 70 km/h south of Wattleup Road)
Hammond Road	Distributor B	Department of Planning, Land and Heritage (Maintenance is the responsibility of Local Government)	▪ Two-lane, two-way undivided carriageway. ▪ Path on the east side, which terminates at Gaebler Road	50
Whadjuk Drive	Local Distributor	City of Cockburn	▪ Two-lane, two-way divided carriageway. ▪ The road has not yet been fully built as the area is still developing ▪ Path on both sides of the road, however it is currently discontinuous as the road is not yet fully constructed	50
Mandogalup Road	Local Distributor	City of Kwinana	▪ two-lane undivided carriageway ▪ Mandogalup Road connects to Wattleup Road to the north and Anketell Road to the south. ▪ No pedestrian or cycling facility are available along the road	70

3.3 Existing Road Network Volumes

Existing traffic volumes were obtained from Main Roads WA traffic data and tube count data from the City of Cockburn. The data is shown in **Table 3-3** below.

Table 3-3 Existing Mid-Block Traffic Volumes (two-way)

Road Name	Date	Average Two-way Daily Traffic Volume	Vehicles per AM Peak Hour	Vehicles per PM Peak Hour	Heavy Vehicle %	Source
Wattleup Road (East of Frankland Avenue)	2020	5,755	469	527	20%	MRWA Traffic Map Intersection Count
Wattleup Road (800m East of Mandogalup Road)	2019	4,966	481	492	17.9%	City of Cockburn
Frankland Avenue (North of Wattleup Road)	2020	1,841	241	204	4%	MRWA Traffic Map Intersection Count
Frankland Avenue (South of Wattleup Road)	2020	6,508	580	627	18%	MRWA Traffic Map Intersection Count
Hammond Road (310m South of Gaebler Road	2021	2838	425	391	5.9%	City of Cockburn

3.4 Existing Pedestrian/Cycle Networks

There are currently no complete pedestrian or cycle networks within the proposed LSP area.

3.5 Existing Public Transport Facilities

There are currently no existing public transport facilities within the vicinity of the LSP. The nearest bus service is the 535 and 536 bus service shown below. These services currently terminate at the nearby schools of Hammond Park Primary School (route 535) and Hammond Park Secondary College (route 536).

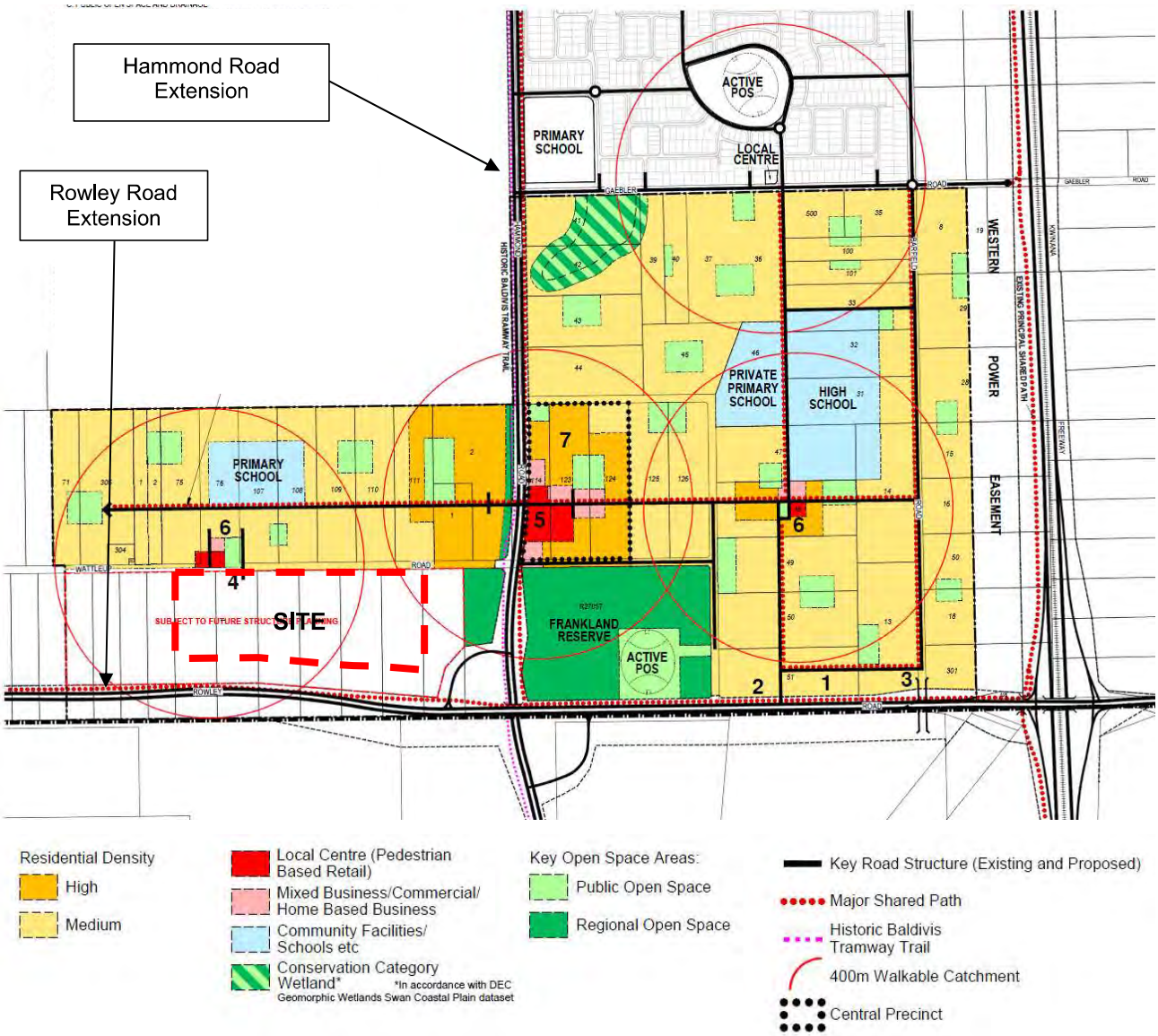
Figure 3-4 Existing Public Transport

4 Proposed Changes to Transport Networks

4.1 Planned Road Network Upgrades

Figure 4-1 shows the proposed road alignments as detailed in the Southern Suburbs District Structure Plan (SSDSP) 2012. The Plan also details the proposed land uses and pedestrian/cycling network. The following sections will discuss future road upgrades/extension within the SSDSP.

Figure 4-1 Road Network in SSDSP



Source: Southern Suburbs District Structure Plan (SSDSP) (2012)

4.1.2 Rowley Road

The Department of Planning, Lands and Heritage (DPLH) has identified the need to upgrade and extend Rowley Road westwards as a dual carriageway, which would potentially provide the main link from the Kwinana Freeway to the Latitude 32 industrial area and the proposed future outer harbour. The extension will run parallel to Wattleup Road and will reduce the freight traffic demand along Wattleup Road.

This extension has been detailed in the SSDSP, Section 5.3.1.

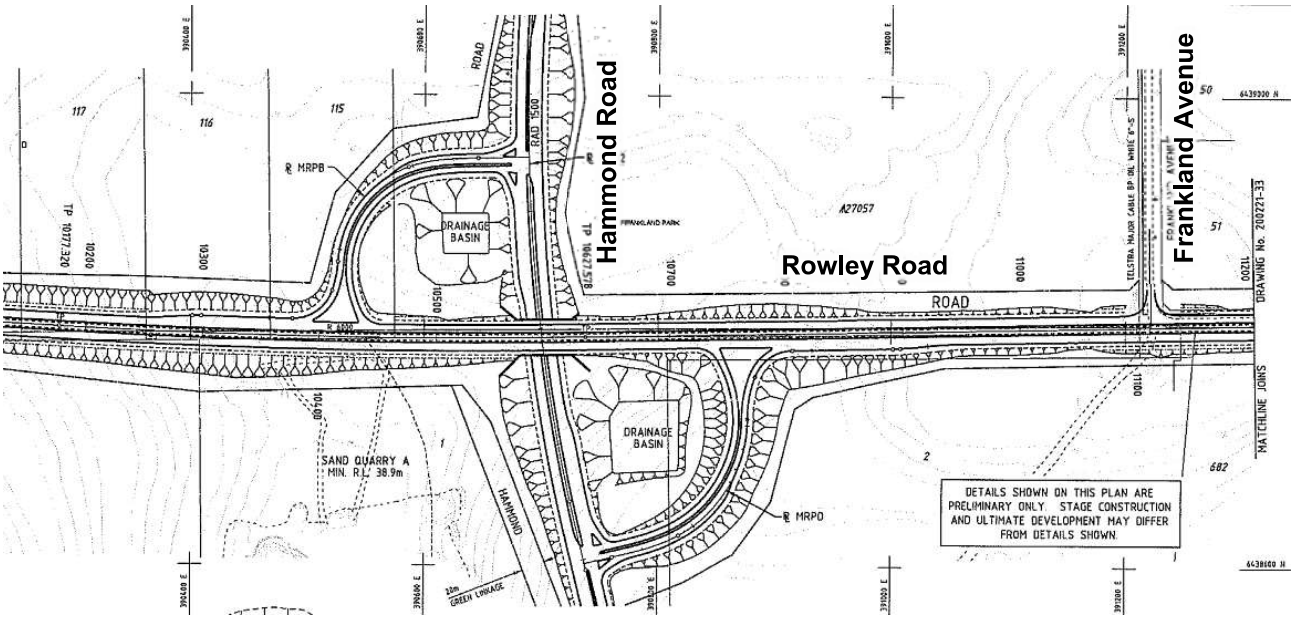
4.1.3 Hammond Road

Hammond Road (currently named Frankland Avenue south of Russell Road) is planned to be extended southwards from Gaebler Road to Rowley Road and continue further south.

The SSDSP defines the long-term intentions for the intersection of Hammond and Rowley Roads as a grade-separated interchange as shown in the preliminary concept proposed by Main Roads WA in **Figure 4-2**. Prior to grade separation, it is proposed that the intersection be signalised or roundabout controlled.

As part of this TIA, the City of Cockburn is considering an interim scenario where Hammond Road is only extended to Wattleup Road. In this scenario, Hammond Road and Wattleup Road form a 3-way roundabout. Refer to **Section 6.7.2** for detail of the SIDRA analysis of this roundabout.

Figure 4-2 Rowley Road/Hammond Road Proposed Ultimate Layout



Source: Main Roads (2015)

4.1.4 Wattleup Road

Wattleup Road will continue to be a significant freight route until the construction of the Rowley Road extension. Following this upgrade to the transport network, the function of Wattleup Road will shift more towards local traffic uses.

4.1.4.1 Speed Limit

Speed limit on Wattleup Road has recently been reduced to 70km/h from Frankland Avenue to 200m west of Canary Drive. The speed limit change excludes half of the LSP study area, however Main Roads WA has stated that section west of Canary Drive will be reviewed in the future when further changes are made along Wattleup Road.

In the medium term following the opening of the LSP, Wattleup Road speed limit is proposed to be reduced to 60km/h along the section that is abutting developed urban residential areas (between Frankland Avenue and Mandogalup Road). This would provide a safer road environment more suitable to an urban area and

would help reduce road safety risk along Wattleup Road related to its undulating vertical alignment that results in potential sight line limitations at some future intersecting roads.

In the long term, when Rowley Road is extended, Wattleup Road will no longer be the primary regional route and heavy vehicles traffic would use Rowley Road instead. At this point, Wattleup Road should be downgraded into a local road with a 50km/h speed limit.

4.1.4.2 Road Upgrades

Wattleup Road is proposed to be upgraded to support the additional residential area on both the north and south side of the road. The upgrades will include road pavement widening which will allow the installation of right turn lanes at residential access road. The traffic lanes will be 3.5m wide, while the turn lanes will be 3m wide.

Figure 4-3, Figure 4-4, and Figure 4-5 below shows the proposed design for Access Road 1 (western access road), Access Road 2 (central access road), and Access Road 3 (eastern access road) respectively. These designs were updated from the preliminary designs previously discussed with the City of Cockburn in March 2021 with inputs from Stantec. Right turn lanes are provided for Access Road 1 and 2, while Access Road 3 is left in and left out only with a left turn pocket. A traffic lane separator will be provided along Wattleup Road to prevent right turns into and out of Access Road 3.

Figure 4-3 Wattleup Road / Access Road 1 Intersection Concept

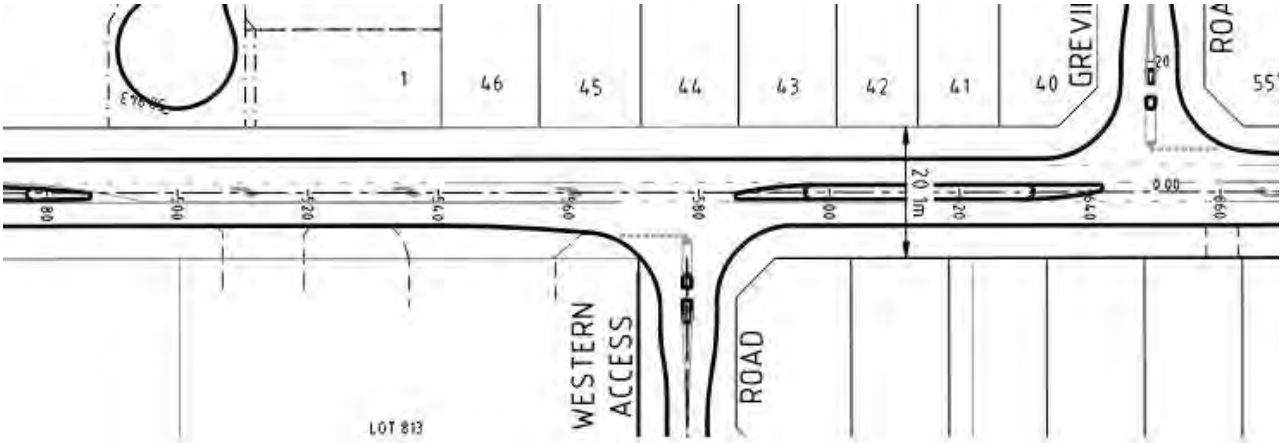


Figure 4-4 Wattleup Road / Access Road 2 Intersection Concept

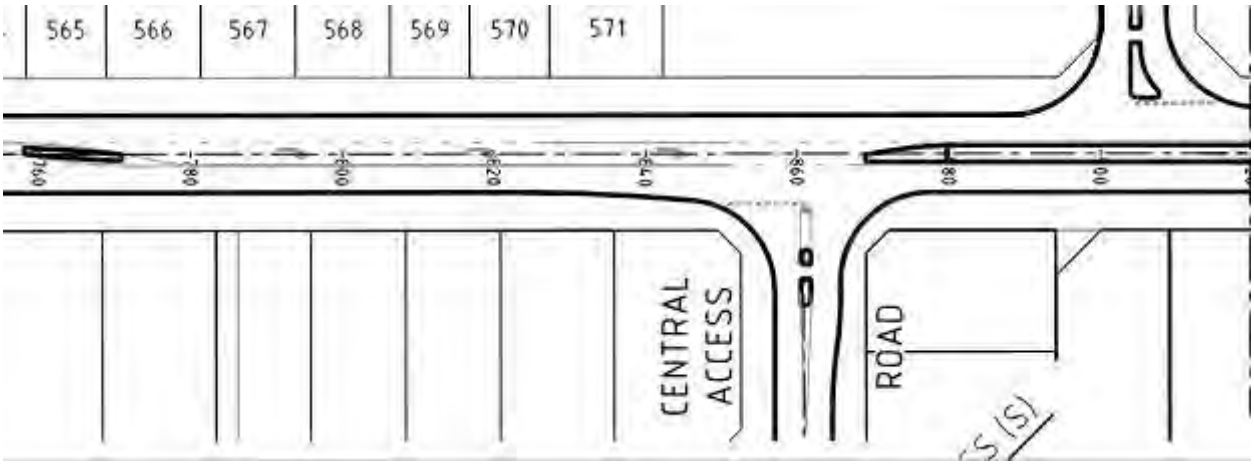
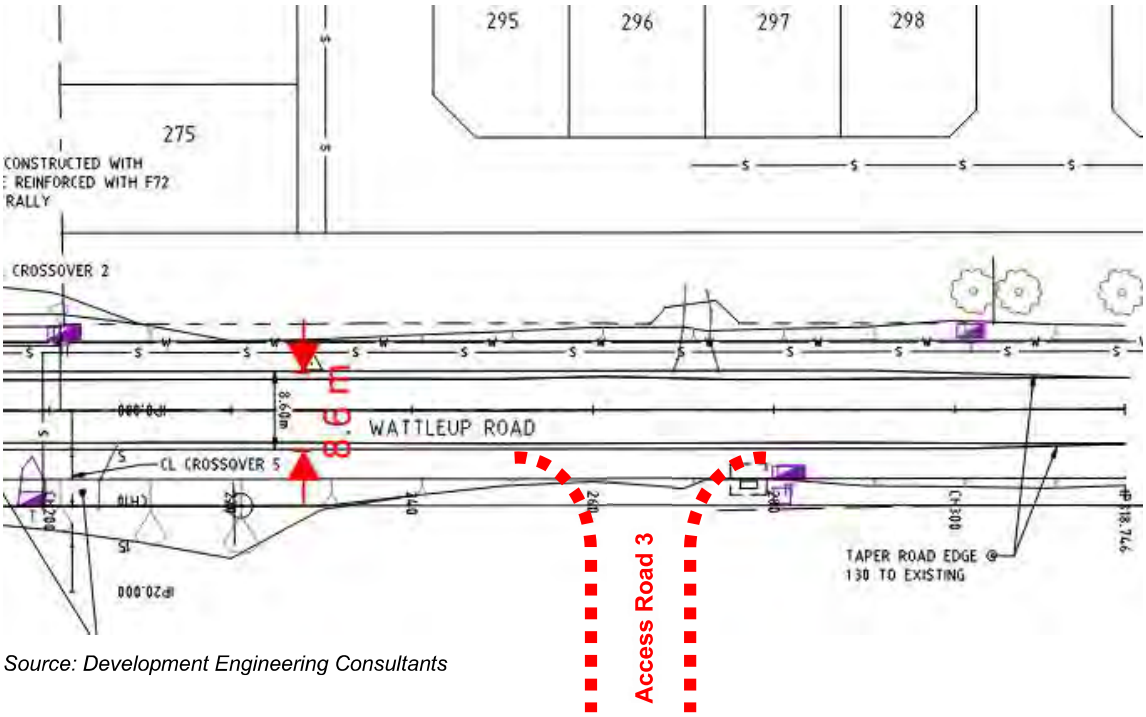


Figure 4-5 Wattleup Road / Access Road 3 Intersection Concept

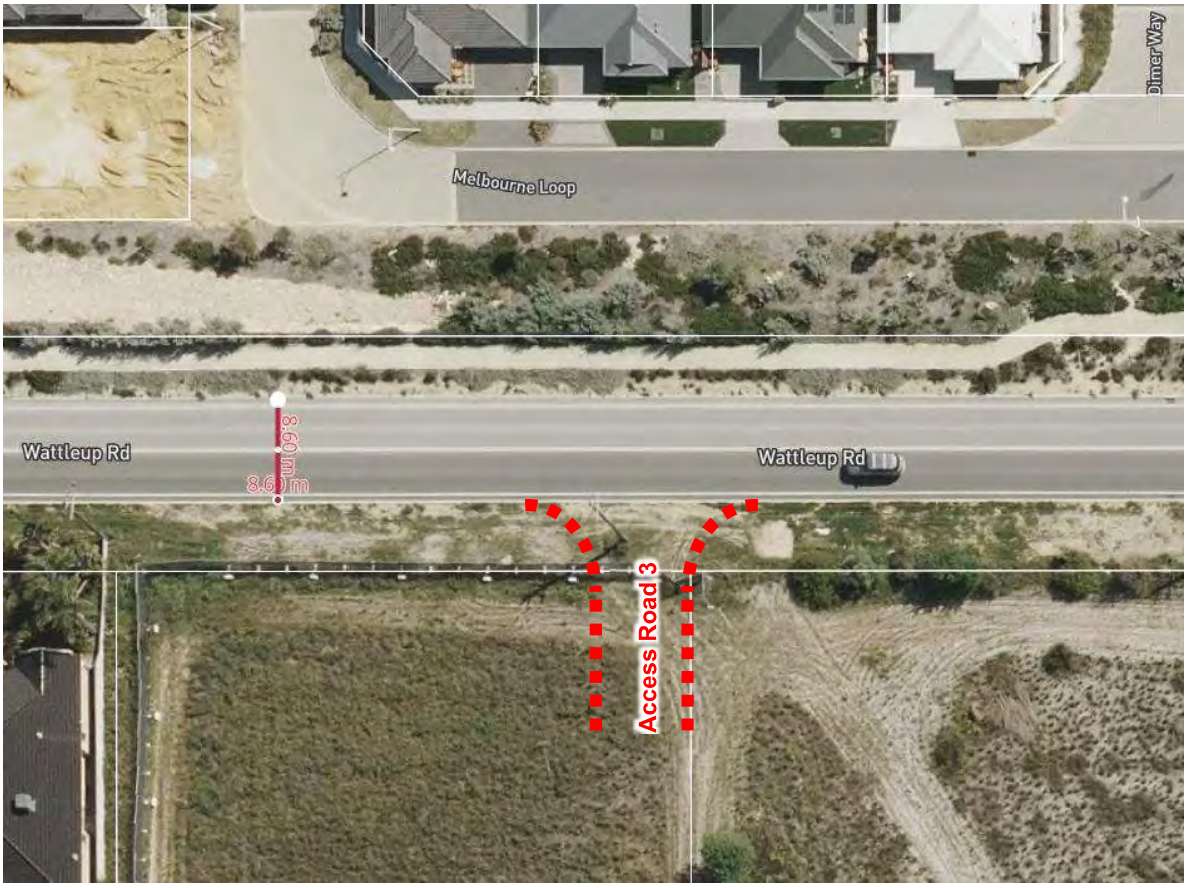
Note that Wattleup Road at Access Road 3 has previously been widened to 8.6m by others as part of previous development works. No further widening to Wattleup Road is proposed as part of Access Road 3 works. See **Figure 4-6** for the design drawing excerpt of Wattleup Road widening at Access Road 3 and **Figure 4-7** for the latest aerial image of the same location.

Figure 4-6 Wattleup Road Widening Design at Access Road 3



Source: Development Engineering Consultants

Figure 4-7 Wattleup Road at Access Road 3 – Current Situation



Source: MetroMap

4.1.4.3 Ultimate Intersection Form with Hammond Road

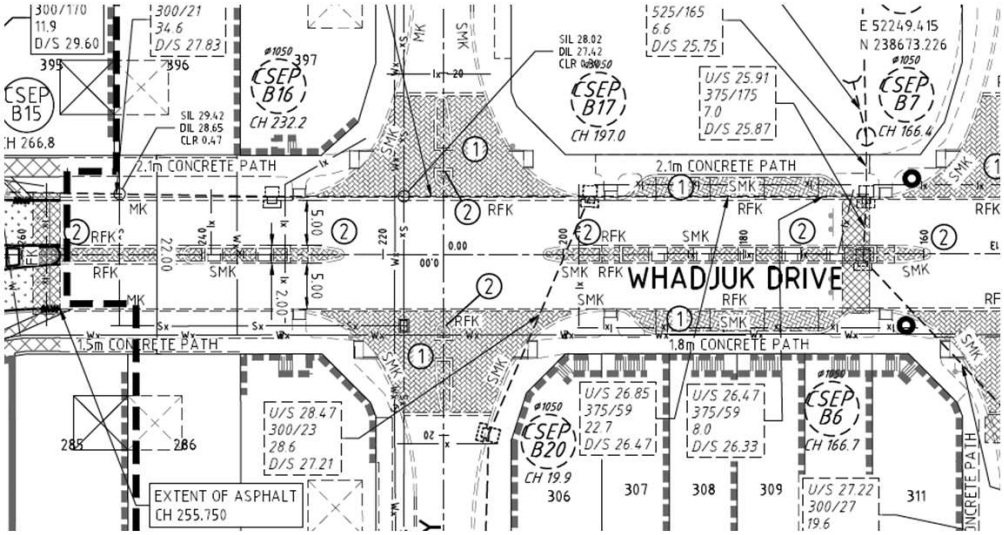
When Hammond Road is extended to Rowley Road, Wattleup Road is expected to be downgraded to an access road. The future intersection at Hammond Road in the ultimate scenario is not expected to be a full movement intersection but it is expected to be left-in left out only.

4.1.5 Whadjuk Drive (Neighbourhood Connector)

Whadjuk Drive is a Neighbourhood Connector that will form the main east-west connection for the residential area north of Wattleup Road. The proposed cross section alignment of Whadjuk Drive is required to be constructed based on the specifications set up by the City of Cockburn as shown in **Figure 4-8** within a road reserve width of 22m. **Figure 4-9** shows a conceptual sketch of Whadjuk Drive and **Figure 4-10** shows a section of Whadjuk Drive that has been constructed at another location east of the LSP.

Speed limits are likely to be 50km/h as is typical of built-up residential areas. Further restrictions will apply to the primary school frontage roads which would be designated “School Zones” with a 40km/h speed limit during peak school pickup and drop-off times.

Figure 4-8 Plan view of Whadjuk Drive



Source: City of Cockburn (2019)

Figure 4-9 Concept Sketch of Whadjuk Drive Cross Section (22m)

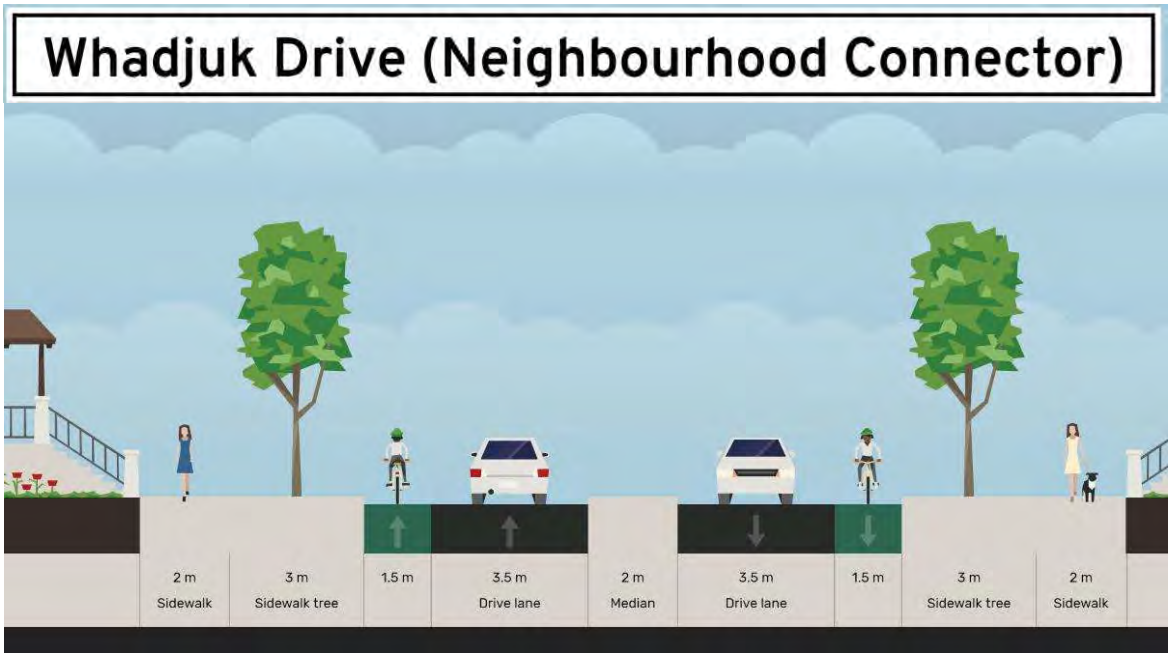


Figure 4-10 A Section of Completed Whadjuk Drive

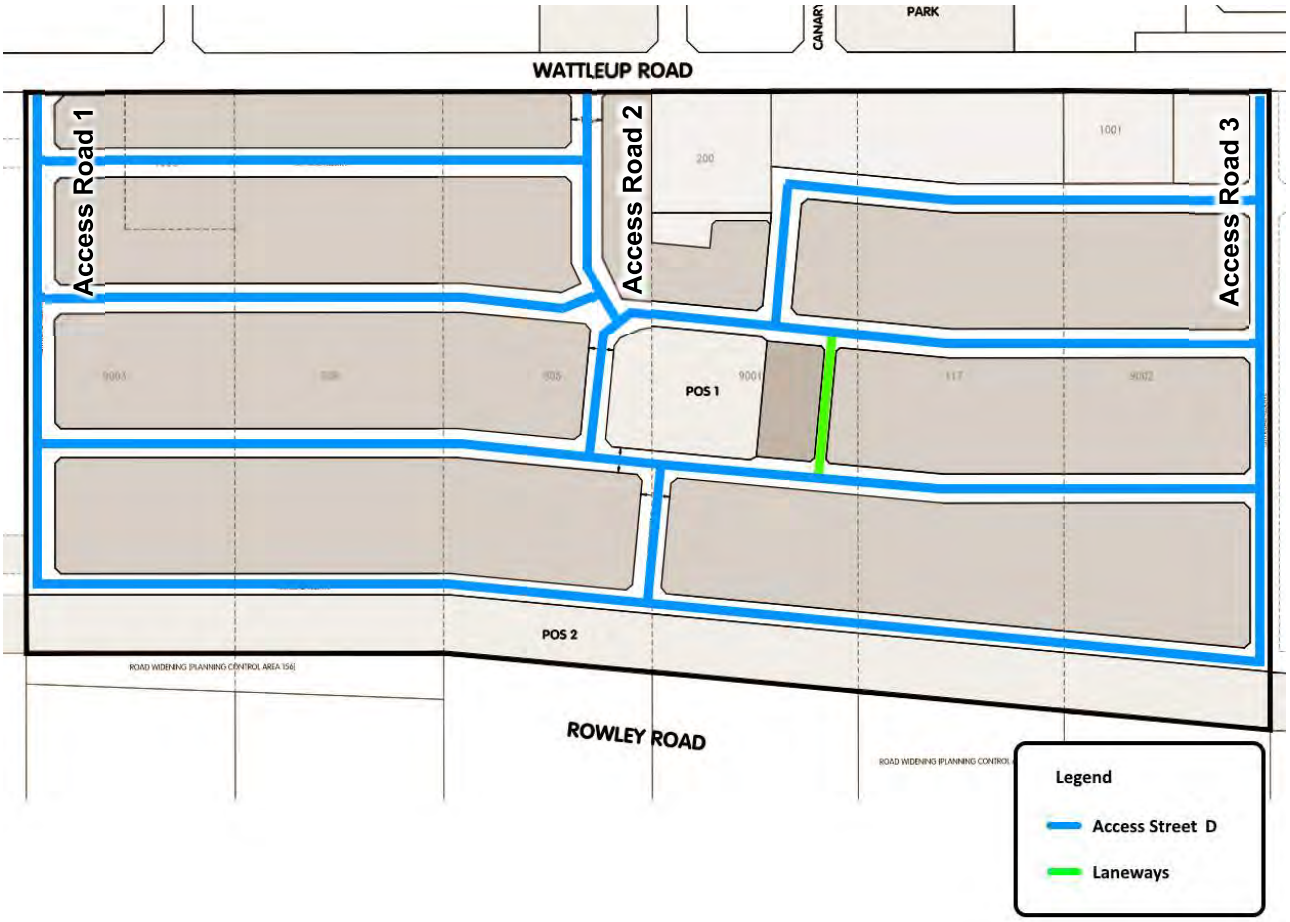
4.2 Road Hierarchy

4.2.1 Internal Road Hierarchy

Roads within the LSP will be classified as Access Streets as shown in **Figure 4-11.** There are 3 access points from the LSP to Wattleup Road:

- Access Road 1 – Full movement access at Wattleup Road
- Access Road 2 – Full movement access at Wattleup Road
- Access Road 3 – left-in left out access at Wattleup Road

Figure 4-11 LSP Road Hierarchy

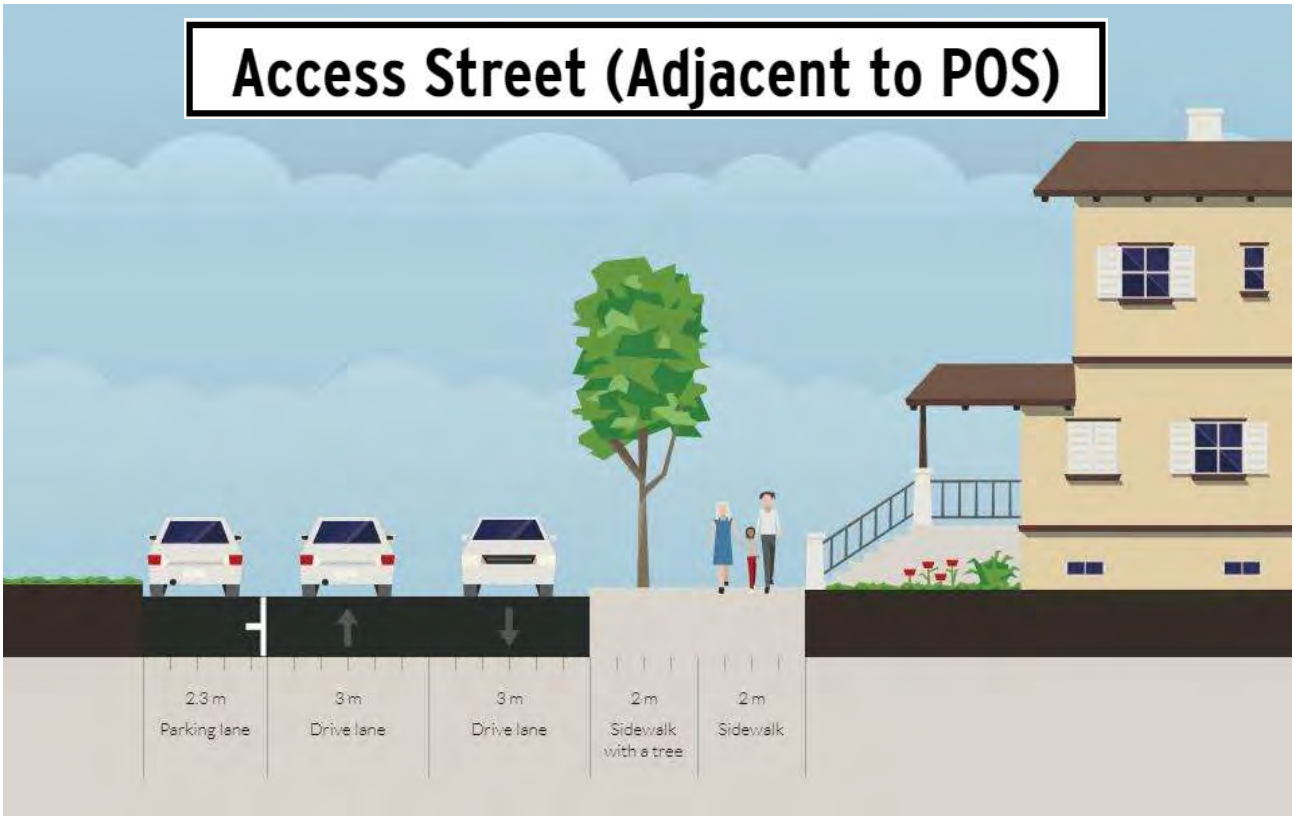


The road reserve widths of the internal access roads will be finalised during subdivision stage in order to accommodate final road and intersection geometry, however they would generally be 15m to 16.5m wide. Access roads adjacent to Public Open Space may be reduced to a 11 – 13m wide road reserve.

Indicative cross sections for access streets are shown in **Figure 4-12** through to **Figure 4-13.** Embayed on-street parking can be accommodated within the verge strips with some modifications. Additionally, if a 7.2 – 7.4m carriageway is adopted, informal on street parking can be provided.

Figure 4-12 Concept Sketch of Access Street Cross Section (15m)

Figure 4-13 Concept Sketch of Access Street Cross Section Fronting Public Open Space (13m)



4.2.2 External Road Hierarchy

The road hierarchy within the immediate surrounding area of the LSP is shown in **Figure 4-14**, using the road hierarchy definitions from Draft Liveable Neighbourhoods update (2015). This shows the 'interim' road hierarchy, in which major road upgrades/extension e.g., Hammond Road and Rowley Road, have not been constructed.

Wattleup Road is expected to be downgraded following the completion of Rowley Road, at which point regional and heavy vehicle traffic would divert to Rowley Road. **Figure 4-15** shows the indicative ultimate road hierarchy when Rowley Road is extended, where Wattleup Road would be downgraded to a lower order road (Access Street).

Figure 4-14 Indicative Road Hierarchy – Interim

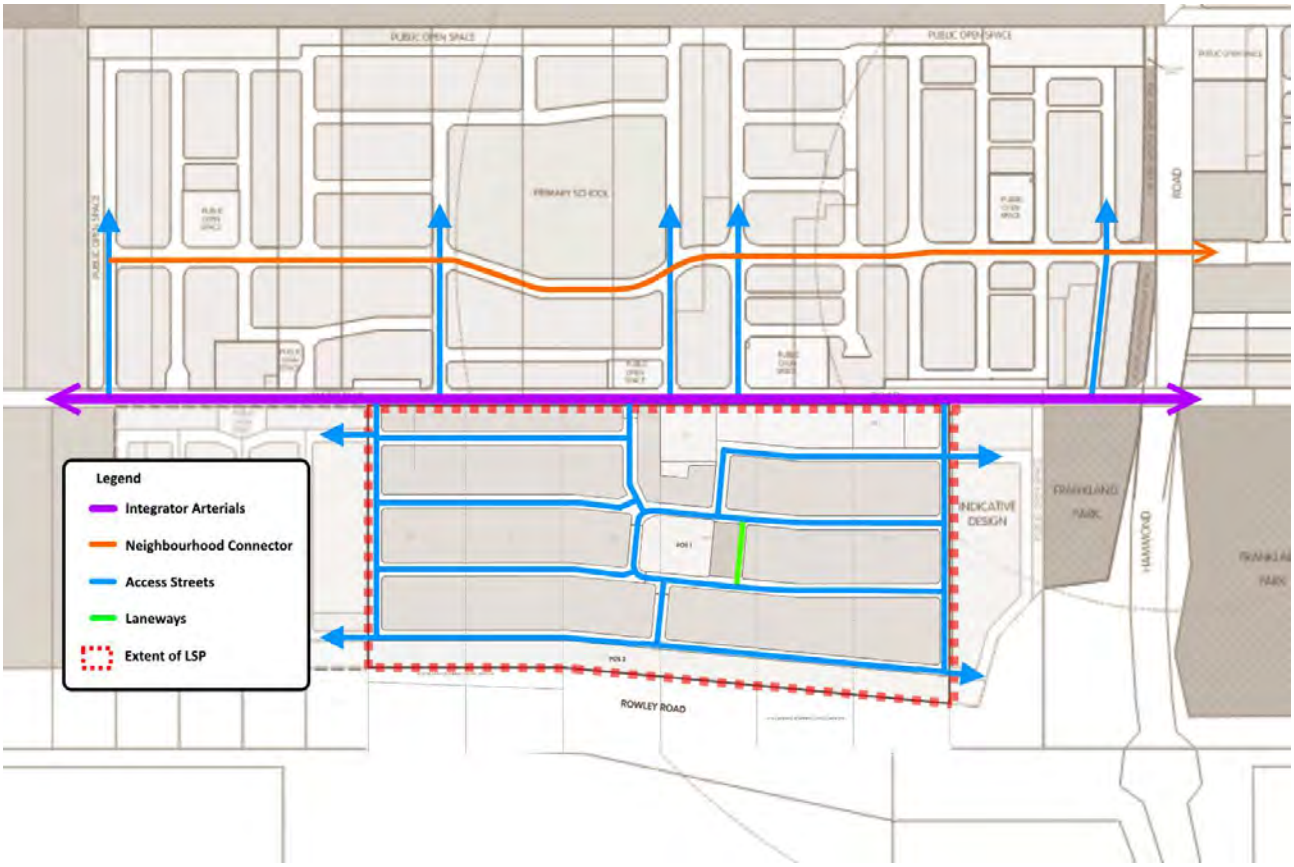
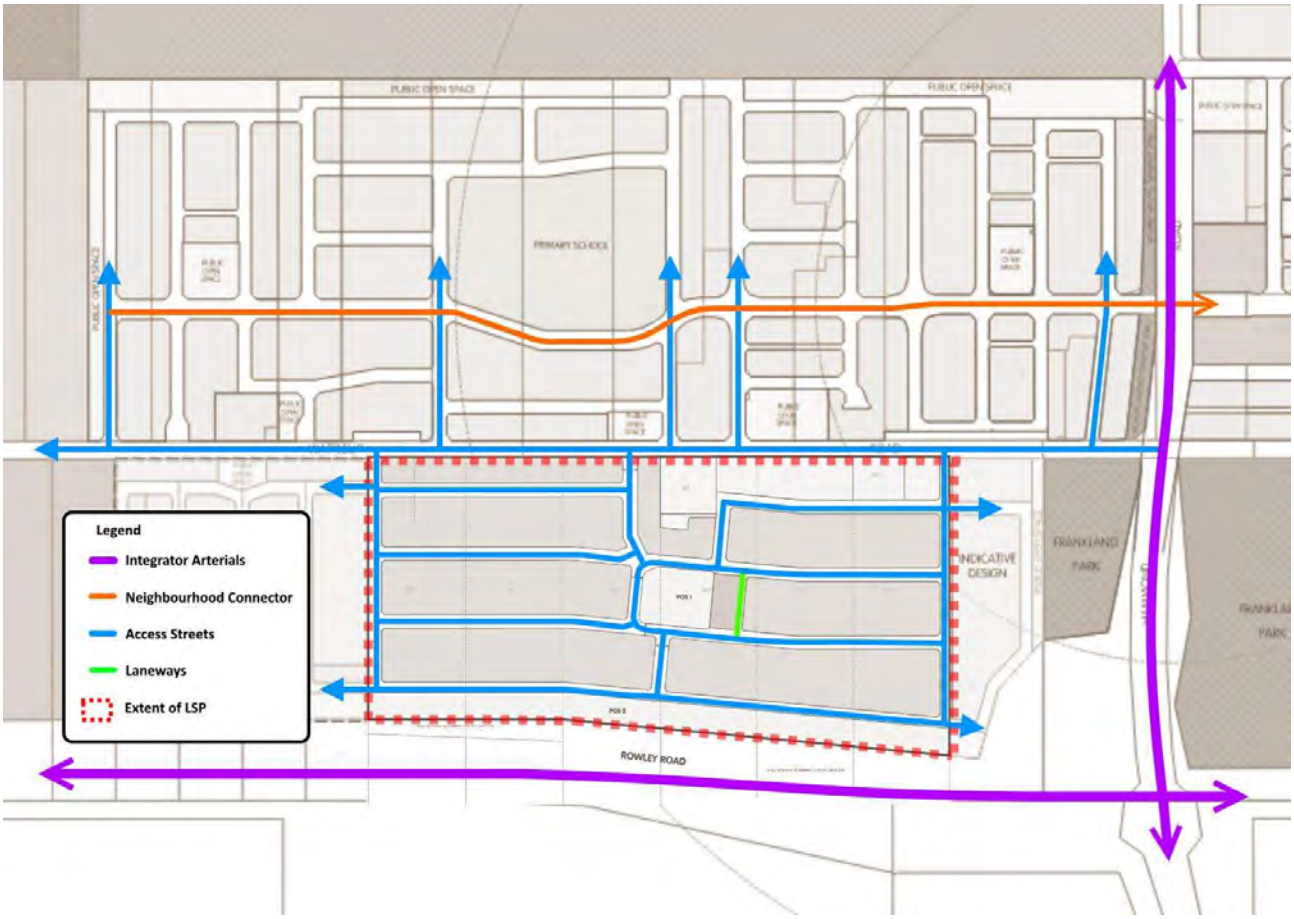


Figure 4-15 Indicative Internal Road Hierarchy – Long Term



4.3 Intersection Control & Traffic Management

All intersections internal to the LSP has been arranged as T-intersections and as such give-way control will be sufficient. Due to the length of east-west roads withing the LSP, traffic calming measures will be provided along all east-west roads. The type of measure will be determined later in detailed design or subdivision stage, however they could be in the form of blister islands, chicanes, lane narrowing, etc.

4.4 Pedestrian/Cycling Network

As detailed in the SSDSP, an interconnecting network of shared paths is proposed within the District Structure Plan area with the main connections being identified as Hammond Road, Rowley Road, Wattleup Road, Aubin Grove Station and the Kwinana Freeway. Also, as detailed in the SSDSP, a major shared path will be provided on Whadjuk Drive.

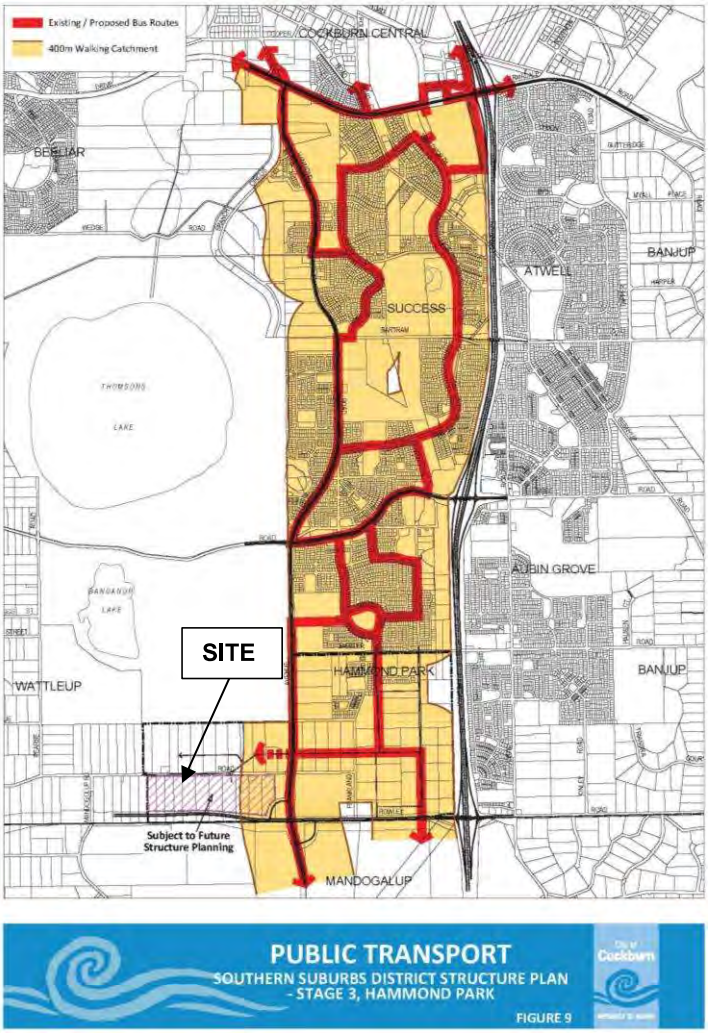
Pedestrian and cycling facilities will be provided within the LSP consistent with the appropriate road hierarchy as per Liveable Neighbourhood guidelines with at least a standard footpath along all roads within the LSP.

A crossing facility should be provided on Wattleup Road to provide a safer crossing location for parents and students to cross from the residential area within the LSP towards the future primary school located to the north of Wattleup Road.

4.5 Public Transport Network

The SSDSP also provides detail on the provision of a future bus service potentially along Whadjuk Drive and Wattleup Road which may also link to the Latitude 32 Industrial area and terminate at the Fremantle Rockingham transit system which is to be routed down the west side of the freight line within the industrial area. The proposed bus and train services will provide a comprehensive public transport system for the area linking major land use activities. The proposed location of the future bus routes are shown on **Figure 4-16**.

Figure 4-16 Proposed Public Transport Routes



Source: Southern Suburbs District Structure Plan (SSDSP) (2012)

5 Integration with Surrounding Area

5.1 Surrounding Attractors and Generators

Hammond Park Primary School is located approximately 1km to the north east, while Hammond Park Catholic Primary School and Hammond Park Secondary School is located approximately 1.2km east of the LSP boundary. Additionally, a future primary school is proposed to be built within the residential area to the north of Wattleup Road. These schools are likely to be a major trip attractor from the LSP.

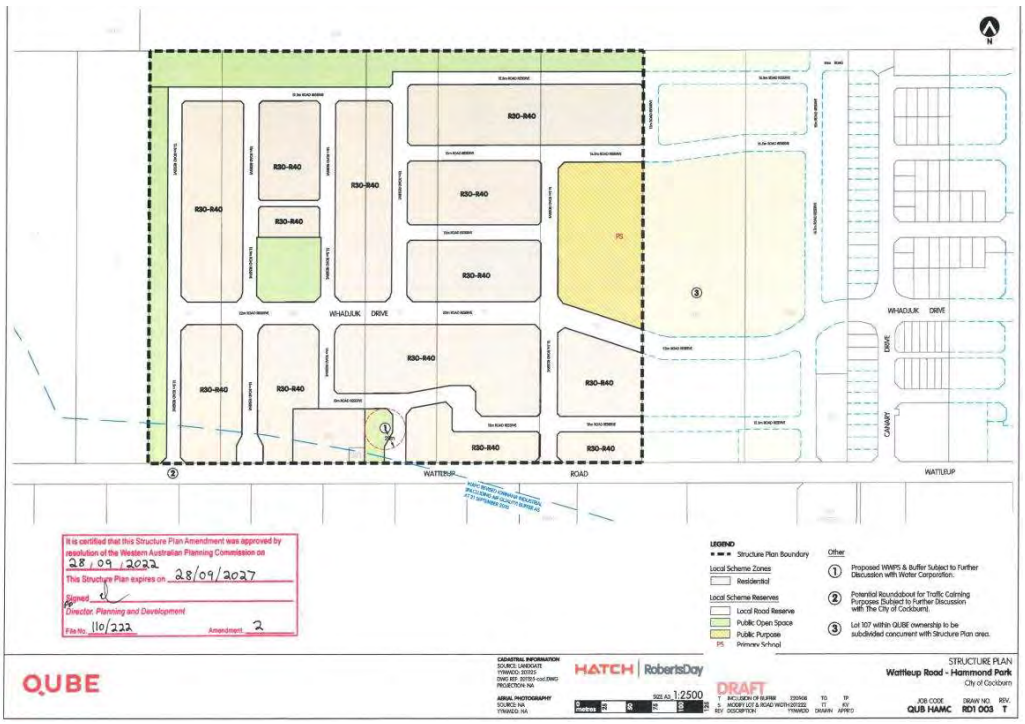
Other site that would attract trips from the LSP includes a “Neighbourhood Centre” adjacent to the future intersection of Whadjuk Drive and Hammond Road, as well as the Aubin Grove train station.

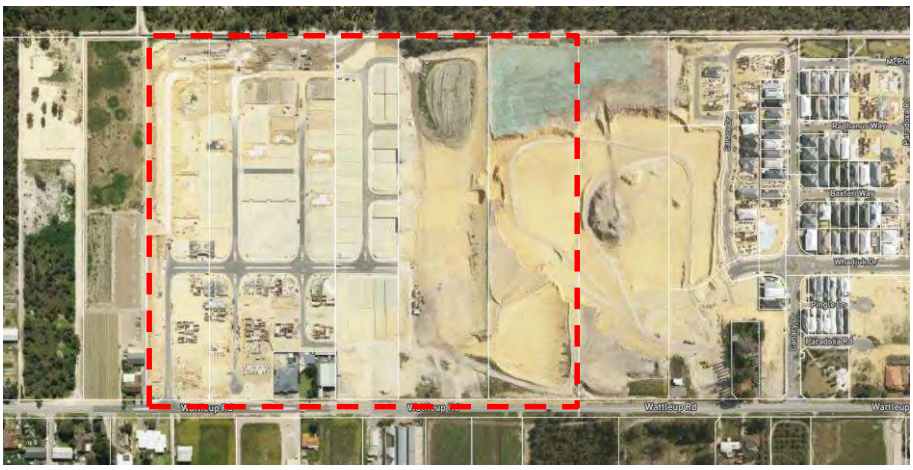
5.2 Proposed Changes to Surrounding Land Uses

5.2.1 Hammond Park West Structure Plan (North of Wattleup Road)

The land to the north of Wattleup Road is currently being developed into residential area and a primary school. **Figure 5-1** below shows the approved Structure Plan layout and its current development status as of September 2022.

Figure 5-1 Hammond Park West Structure Plan





5.2.2 Future Development Adjacent to the Site

Vacant lands to the east and west of the Site are also currently zoned as 'Development' and are likely to be developed into residential lots. **Figure 5-2** below shows an indicative layout of the future residential area (highlighted in red). There are no approved structure plans for these areas.

Figure 5-2 Future Residential Development Adjacent to the Site

Source: Hatch Roberts Day

5.3 Transport Connectivity to Surrounding Areas

The proposed development will have easy vehicular access to Kwinana Freeway from Wattleup Road via Frankland Avenue and Rowley Road.

With regards to pedestrian and cyclist accessibility, as mentioned in **Section 4.2.2**, a network of shared paths is proposed in the SSDSP. Shared path and footpaths will be provided along internal access roads providing access to nearby schools and local centres. A crossing facility is also proposed on Wattleup Road near the future primary school to provide safer crossing location for students and parents from the LSP.

6 Analysis of Transport Network

6.1 Assessment Parameters

6.1.1 Assessment Years and Time Period

The assessment years are assumed as follows:

> Year 2031 – Future year with LSP completed.

As per WAPC TIA Guidelines for Structure Plans, analysis will be undertaken only for the full build-out of the development due to the nature of the development occurring over a number of years. Peak times selected are 7:45am – 8:45am and 4:00pm – 5:00pm, which are the peak times of Frankland Avenue and Wattleup Road intersection based on the 24-hour intersection count provided in Main Roads WA Traffic Map.

6.1.2 Subject Intersections

SIDRA analysis was undertaken at the following intersection to estimate the impact of the development generated traffic on the surrounding transport network:

> Wattleup Road/ Access Road 2

> Hammond Road / Wattleup Road (as 3-way roundabout)

The South Access Road 2 is one of two full movement intersections servicing the LSP. The central location would see it having a wider traffic catchment, and therefore is selected for analysis.

Hammond Road / Wattleup Road 3-way roundabout is an intersection that is proposed by the City of Cockburn to be included in the analysis. In this scenario, Hammond Road is only extended until Wattleup Road with Rowley Road not yet constructed. This represents a worst-case scenario, in which Wattleup Road still function as the major east-west regional distributor road instead of Rowley Road. In this scenario Whadjuk Drive is assumed to be constructed, therefore it would be the main east-west local distributor for residential area north of Wattleup Road.

Figure 6-1 Subject Intersections

6.2 LSP Traffic Generation

The trip generation rates for the residential component were sourced from *Road and Maritime Services (RMS) New South Wales Guide to Traffic Generating Developments, Updated Surveys (2013)*. **Table 6-1** below shows the adopted trip rates for the proposed land use and **Table 6-2** shows the directional distribution. **Table 6-3** shows the resultant trip generation.

Table 6-1 Trip Generation Rate – Peak hour of Generator

Land Use	Source	AM Peak	PM Peak
Residential	RMS	0.95 trips per dwelling	0.99 trips per dwelling

Table 6-2 Directional Distribution

Land Use	AM Peak		PM Peak	
	In	**Out**	**In**	**Out**
Residential	26%	74%	65%	36%

Table 6-3 Net Trip Generation of the Proposed Development

Land Use	Yield	AM Peak		PM Peak	
		In	**Out**	**In**	**Out**
Residential Dwellings	294 dwellings	73	207	187	105
Total		**280**		**292**	

6.3 LSP Traffic Distribution

Residential trip distribution into the surrounding network is based on likely routes taken by the residents towards employment destinations and such as Perth CBD, Kwinana, Henderson, Cockburn Central, and Bibra Lake. As such, the following distribution percentage were adopted:

> 30% heading west along Wattleup Road

> 70% heading east along Wattleup Road

Due to the likely demand for left turns into the site during the PM peak (traffic returning from Freeway), it is proposed to install an AUL on the easternmost LI/LO access, where 60% of west bound trips are likely to enter the LSP from. With a provision of this turn treatment installed on access 3, it is expected that a larger proportion of traffic entering the LSP site will use the eastern most access, reducing the demand on the other two accesses. This has been reflected in values shown in **Figure 6-5.**

6.4 Background Traffic

Background traffic data for Wattleup Road is sourced from 24-hour intersection count of Frankland Avenue/Wattleup Road provided in Main Roads WA Traffic Map.

Background traffic growth assumption of 1% per annum has been adopted to derive background traffic volume for year 2031 on Wattleup Road. Additional traffic growth on Wattleup Road will also be derived from future developments in the area including the structure plans north of Wattleup Road currently under construction and the proposed LSP itself, which is further discussed in **Section 6.4.1**.

6.4.1 Other Developments to be Included

Adjacent developments and structure plans, shown in **Figure 6-2** below, will also be included in background traffic 2031.

Figure 6-2 Adjacent Developments Included in Background Traffic

The estimated yield and trip generation for these developments are summarised in **Table 6-4** and **Table 6-7** below. For the school component, the rates provided in the WAPC *Traffic Impact Assessment Guidelines* will be used. Some assumptions on the trip distribution of the adjacent developments are:

> 70% internal school traffic catchment is assumed for this analysis, i.e. 30% of school trips arrived externally e.g. via Wattleup Road.

> Whadjuk Drive is assumed to have been constructed, providing east-west connection to Frankland Avenue. Therefore, less traffic generated from Hammond West structure plan would rely on Wattleup Road for access. For the purpose of the assessment, approximately 60% of residential traffic on the north of Wattleup Road is assumed to use Wattleup Road.

Table 6-4 Other Developments

Development	Estimated Yield
Hammond West Structure Plan + Adjacent undeveloped land	▪ 330 residential dwellings ▪ Primary school for 540 students

Table 6-5 Trip Generation Rate

Land Use	Source	AM Peak Rate	PM Peak Rate
Residential Dwellings	RMS	0.95 trips per dwelling	0.99 trips per dwelling
Primary School	WAPC	1 trip per student	1 trip per student

Table 6-6 Trip Directional Distribution

Land Use	AM Peak		PM Peak	
	In	Out	In	Out
Residential Dwellings	23%	74%	65%	36%
Primary School	50%	50%	50%	50%

Table 6-7 Other Developments Trip Generation

Development	Yield	AM Peak		PM Peak	
		IN	OUT	IN	OUT
Hammond West Structure Plan + Adjacent undeveloped land	▪ 330 residential dwellings ▪ Primary school for 540 students*	163	313	291	199

**Note: only external school trips included in the trip generation estimate*

6.4.2 Other Developments Not Included

Figure 6-3 below shows future development area that will not be included in background traffic 2031. These future development areas do not have a structure plan proposal as of the writing of this report and as such, will be assumed to be completed after 2031.

Figure 6-3 Adjacent Developments Not Included in Background Traffic

6.4.3 Hammond Road

For the Hammond Road / Wattleup Road 3-way roundabout, the estimated traffic volumes on Hammond Road is obtained from the existing 2021 midblock traffic data on Hammond Road, 310m south of Gaebler Road, obtained from the City of Cockburn (see **Table 3-3** in **Section 3.3)**. 2% of annual growth will be applied to this base volume.

As no other traffic data or modelling is available for the extension of Hammond Road, this existing traffic volume will be assumed to be the midblock volume of Hammond Road just north of Wattleup Road. The assumed volume on the Hammond Road extension is then distributed to Wattleup Road, further adding to the assumed traffic growth on Wattleup Road for robust assessment.

6.5 Peak Hour Total Traffic Flow

Figure 6-4 and **Figure 6-5** below show the adopted traffic flow at Hammond Road / Wattleup Road 3-way roundabout and at the Access Roads.

Figure 6-4 Hammond Road / Wattleup Road 3-way Roundabout Peak Hour Traffic Volume (2031 +Development)

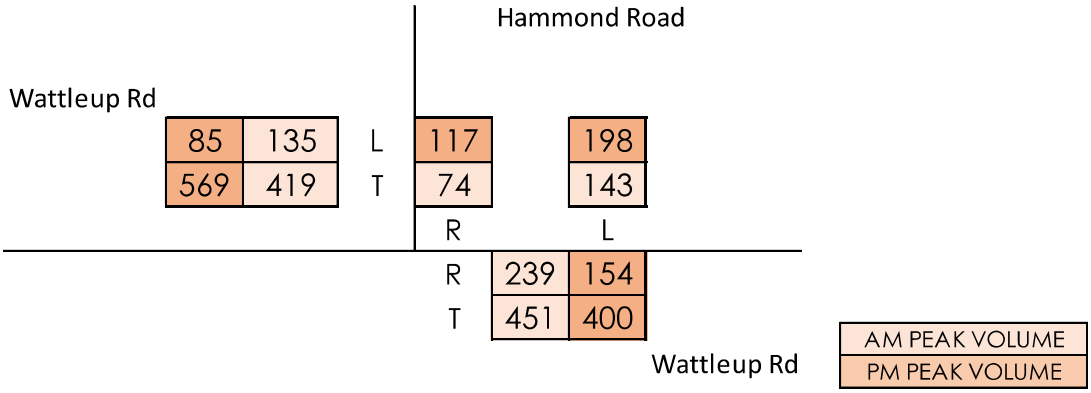
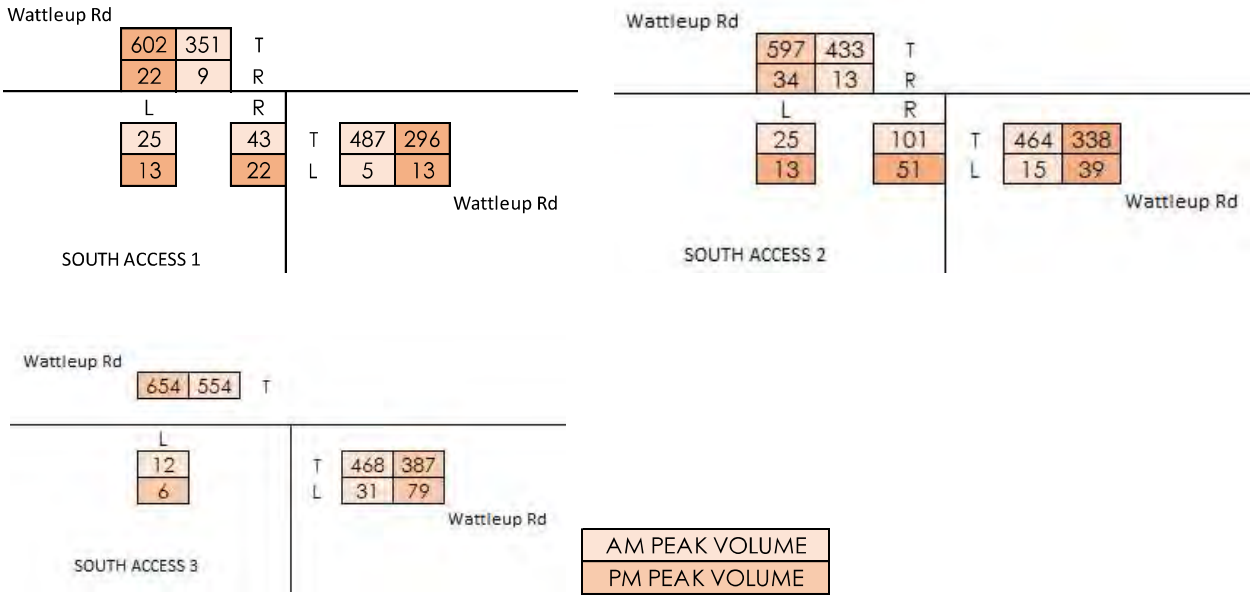


Figure 6-5 Wattleup Road and Access Roads Peak Hour Traffic Volume (2031 +Development)



6.6 Turn Warrant Assessment

A turn warrant was undertaken for the three main accesses to the Site as discussed in **Section 2.2**. The assessment was conducted as per *Main Roads WA Supplement to Austroads Guide to Road Design – Part 4 Appendix A*, using the provided spreadsheet (**See Figure 6-1**)

Figure 6-1 Turn Warrant Assessment Spreadsheet Example

INTERSECTION WARRANTS

Main Roads WA Supplement to Austroads Guide to Road Design - Part 4 A.8

DESIGN SPEED =	70km/h
SPLITTER ISLAND YES / NO =	No
DUAL CARRIAGEWAY YES / NO =	No

MOVEMENT	COUNT (v/h)	HV (%)
Q_{T1} =	200	10
Q_R =	20	1
Q_{T2} =	100	10
Q_L =	20	1
Q_{LM} =	50	1
Q_{RM} =	50	1

RIGHT TURN ASSESSMENT

Q_m =	320
% HV =	9.438
x =	1.46
TREATMENT =	BAR

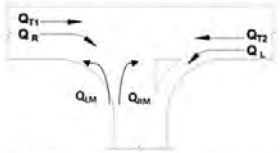
LEFT TURN ASSESSMENT

Q_m =	100
% HV =	10.000
x =	0.51
TREATMENT =	BAL
OFFSET?	NO

Source: Austroads GTM Part 6 - 2017

Guide to Traffic Management Part 6: Intersections, Interchanges and Crossings

Figure 2.27: Calculation of the major road traffic volume Q_M



Road type	Turn type	Splitter island	Q_M (veh/h)
Two-lane two-way	Right	No	= Q_{T1} + Q_{T2} + Q_L
		Yes	= Q_{T1} + Q_{T2}
	Left	Yes or no	= Q_{T2}
Four-lane two-way	Right	No	= 50% x Q_{T1} + Q_{T2} + Q_L
		Yes	= 50% x Q_{T1} + Q_{T2}
	Left	Yes or no	= 50% x Q_{T2}
Six-lane two-way	Right	No	= 33% x Q_{T1} + Q_{T2} + Q_L
		Yes	= 33% x Q_{T1} + Q_{T2}
	Left	Yes or no	= 33% x Q_{T2}

Source: TMR (2016a)

6.6.1 Peak Hour Assessment

The AM Peak assessment results are shown in **Figure 6-2**

Figure 6-2 Turn Warrant Assessment (AM Peak – 60km/h)

WESTERN ACCESS AM

DESIGN SPEED =	60km/h
SPLITTER ISLAND YES / NO =	No
DUAL CARRIAGEWAY YES / NO =	No

MOVEMENT	COUNT (v/h)	HV (%)
Q_{T1} =	351	20
Q_R =	9	1
Q_{T2} =	487	20
Q_L =	5	1
Q_{LM} =	25	1
Q_{RM} =	43	1

RIGHT TURN ASSESSMENT

Q_m =	843
% HV =	19.887
x =	2.77
TREATMENT =	AUR

LEFT TURN ASSESSMENT

Q_m =	487
% HV =	20.000
x =	1.33
TREATMENT =	SL
OFFSET?	NO

CENTRAL ACCESS AM

DESIGN SPEED =	60km/h
SPLITTER ISLAND YES / NO =	No
DUAL CARRIAGEWAY YES / NO =	No

MOVEMENT	COUNT (v/h)	HV (%)
Q_{T1} =	433	20
Q_R =	13	1
Q_{T2} =	464	20
Q_L =	13	1
Q_{LM} =	25	1
Q_{RM} =	101	1

RIGHT TURN ASSESSMENT

Q_m =	910
% HV =	19.729
x =	3.45
TREATMENT =	AUR

LEFT TURN ASSESSMENT

Q_m =	464
% HV =	20.000
x =	1.87
TREATMENT =	BAL
OFFSET?	NO

EASTERN ACCESS AM

DESIGN SPEED =	60km/h
SPLITTER ISLAND YES / NO =	No
DUAL CARRIAGEWAY YES / NO =	No

MOVEMENT	COUNT (v/h)	HV (%)
Q_{T1} =	554	20
Q_R =	0	1
Q_{T2} =	465	20
Q_L =	33	1
Q_{LM} =	12	1
Q_{RM} =		1

RIGHT TURN ASSESSMENT

Q_m =	1052
% HV =	19.404
x =	0.00
TREATMENT =	SR

LEFT TURN ASSESSMENT

Q_m =	465
% HV =	20.000
x =	2.74
TREATMENT =	AUL(S)
OFFSET?	NO

Table 6-1 AM Peak Turn Warrant Assessment Summary

	AM Peak Turn Warrant Assessment Results Summary							
Intersection	**Q_{T1} (EB)**	**Q_{T2} (WB)**	**Q_R**	**Q_L**	**Q_{LM}**	**Q_{RM}**	**Right Turn Treatment**	**Left Turn Treatment**
Western Access	351	487	9	5	25	43	AUR	SL
Central Access	433	464	13	13	25	101	AUR	BAL
Eastern Access (Left-in left-out only)	554	465	-	33	12	-	-	AUL (S)

The PM Peak assessment results are shown in **Figure 6-3**.

Figure 6-3 Turn Warrant Assessment (PM Peak)

WESTERN ACCESS PM

DESIGN SPEED =	60km/h
SPLITTER ISLAND YES / NO =	No
DUAL CARRIAGEWAY YES / NO =	No

MOVEMENT	COUNT (v/h)	HV (%)
Q_{T1} =	602	20
Q_R =	22	1
Q_{T2} =	296	20
Q_L =	13	1
Q_{LM} =	13	1
Q_{RM} =	22	1

RIGHT TURN ASSESSMENT

Q_m =	911
% HV =	19.729
x =	4.28
TREATMENT =	AUR

LEFT TURN ASSESSMENT

Q_m =	296
% HV =	20.000
x =	1.24
TREATMENT =	BAL
OFFSET?	NO

CENTRAL ACCESS PM

DESIGN SPEED =	60km/h
SPLITTER ISLAND YES / NO =	No
DUAL CARRIAGEWAY YES / NO =	No

MOVEMENT	COUNT (v/h)	HV (%)
Q_{T1} =	597	20
Q_R =	34	1
Q_{T2} =	338	20
Q_L =	33	1
Q_{LM} =	13	1
Q_{RM} =	51	1

RIGHT TURN ASSESSMENT

Q_m =	968
% HV =	19.352
x =	5.38
TREATMENT =	CHR

LEFT TURN ASSESSMENT

Q_m =	338
% HV =	20.000
x =	2.05
TREATMENT =	BAL
OFFSET?	NO

EASTERN ACCESS PM

DESIGN SPEED =	60km/h
SPLITTER ISLAND YES / NO =	No
DUAL CARRIAGEWAY YES / NO =	No

MOVEMENT	COUNT (v/h)	HV (%)
Q_{T1} =	654	20
Q_R =	0	1
Q_{T2} =	381	20
Q_L =	85	1
Q_{LM} =	6	1
Q_{RM} =		1

RIGHT TURN ASSESSMENT

Q_m =	1120
% HV =	18.558
x =	0.00
TREATMENT =	SR

LEFT TURN ASSESSMENT

Q_m =	381
% HV =	20.000
x =	3.35
TREATMENT =	AUL(S)
OFFSET?	NO

PM Peak Turn Warrant Assessment Summary

	PM Peak Turn Warrant Assessment Results Summary							
Intersection	**Q_{T1} (EB)**	**Q_{T2} (WB)**	**Q_R**	**Q_L**	**Q_{LM}**	**Q_{RM}**	**Right Turn Treatment**	**Left Turn Treatment**
Western Access	302	296	22	13	13	22	AUR	BAL
Central Access	597	338	34	33	13	51	CHR	BAL
Eastern Access (Left-in left-out only)	654	381	-	85	6	-	-	AUL (S)

6.6.2 Assessment Results Summary

Based on the assessment for both peak hours the required turn treatments are:

- Western Access: AUR and BAL
- Central Access: CHR and BAL
- Eastern Access: AUL (s)

According to *Austroads Guide to Road Design Part 4A,* a Simple Left (SL) and Basic Left-turn treatment (BAL) is a simple treatment where the kerb lines of the intersecting roads are joined by a single radius circular arc and tapers to accommodate the swept path of turning (design) vehicles. The left turn should be designed to enable the design vehicle to turn from the left lane into the minor road without crossing the centreline of the minor road.

6.6.3 Road Reserve Constraint

Road reserve constraints prevent the construction of both right and left turn treatment along Wattleup Road. As such it is recommended that right turn lane treatments are constructed as a priority over left turn pockets as left turning movements do not have opposing movements and as such would have minimal impact to traffic flow. Given that the eastern most access is left in / left out only and no right turn pocket is required, a left turn pocket can likely be accommodated at this access.

It is also noted that consideration for turn warrants should have due regard to the long term planning for Wattleup Road, where the district structure planning suggests a downgrading of the road environment leading to lower speed limits and significantly reduced traffic volumes (**See Section 6.8**). As such, given the peak demand for turning vehicles into the LSP will take several years to occur, by which time the environment of Wattleup Road is likely to have downgraded, the requirements for left turning treatments at the western and central access are expected to still only warrant BAL treatments in the future. This assessment is also consistent with the sections of Wattleup Road east of the LSP which have already been upgraded to urban standard and where no intersection turning treatments have been provided.

6.7 Key Intersections Analysis

6.7.1 SIDRA Results Definition

The subject intersections have been analysed using the SIDRA analysis program. This program calculates the performance of intersections based on input parameters, including geometry and traffic volumes. As an output SIDRA provides values for the Degree of Saturation (DOS), queue lengths, delays, level of service, and 95th Percentile Queue. These parameters are defined as follows:

> Degree of Saturation (DOS) is the ratio of the arrival traffic flow to the capacity of the approach during the same period. The theoretical intersection capacity is exceeded for an un-signalized intersection where DOS > 0.80;

> 95% Queue is the statistical estimate of the queue length up to or below which 95% of all observed queues would be expected;

> Average Delay is the average of all travel time delays for vehicles through the intersection. An unsignalised intersection can be considered to be operating at capacity where the average delay exceeds 55 seconds for any movement; and

> Level of Service (LOS) is the qualitative measure describing operational conditions within a traffic stream and the perception by motorists and/or passengers. The different levels of service can generally be described as shown in **Table 6-8.**

Table 6-8 Level of Service (LoS) Performance Criteria

LOS	Description	Signalised Intersection	Unsignalised Intersection
A	Free-flow operations (best condition)	≤10 sec	≤10 sec
B	Reasonable free-flow operations	10-20 sec	10-15 sec
C	At or near free-flow operations	20-35 sec	15-25 sec
D	Decreasing free-flow levels	35-55 sec	25-35 sec
E	Operations at capacity	55-80 sec	35-50 sec
F	A breakdown in vehicular flow (worst condition)	≥80 sec	≥50 sec

A LOS exceeding these values indicates that the road section is exceeding its practical capacity. Above these values, users of the intersection are likely to experience unsatisfactory queueing and delays during the peak hour periods.

6.7.2 Hammond Road / Wattleup Road (3-way Roundabout)

The following presents the results of the analysis of the Hammond Road / Wattleup Road 3-way roundabout in the assumed year of completion. **Figure 6-6** is a SIDRA layout representation of the intersection. Hammond Road is assumed to have dual carriageway with two lanes on each carriageway. This represents the ultimate cross-section for Hammond Road. Wattleup Road is assumed to still be a single carriageway road.

Table 6-9 shows the results of the analysis. It shows that the proposed intersection layout would be able to cater for the development traffic, as well as the additional traffic from adjacent structure plans to be developed or currently under construction.

Figure 6-6 Hammond Road / Wattleup Road 3-way Roundabout SIDRA Layout

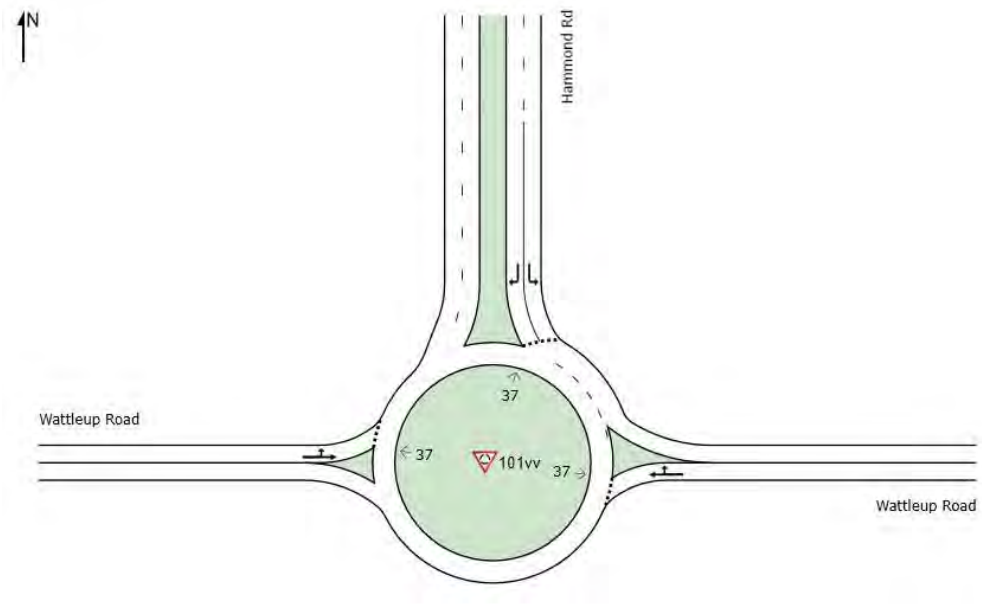


Table 6-9 2031 + Development Results – Hammond Road / Wattleup Road 3-way Roundabout

Intersection Approach		2031withDevelopment AM Peak				2031withDevelopment PM Peak			
		DOS	Delay (s)	LOS	95% Queue (m)	DOS	Delay (s)	LOS	95% Queue (m)
Wattleup Rd (East)	T	0.529	5.2	A	50.1	0.44	5.3	A	32.9
	R	0.529	11.5	B	50.1	0.44	11.8	B	32.9
Hammond Road (North)	L	0.134	4.5	A	7.7	0.193	5.1	A	11.3
	R	0.094	10.7	B	4.8	0.155	11.4	B	8
Wattleup Rd (West)	L	0.582	6.4	A	54.1	0.525	5.5	A	38.5
	T	0.582	7.7	A	54.1	0.525	5.6	A	38.5
All Vehicles		**0.582**	**7.3**	**A**	**54.1**	**0.525**	**6.5**	**A**	**38.5**

6.7.3 Wattleup Road / LSP Access Road 2

The following presents the results of the analysis of the Wattleup Road / Access Road 2 intersection in the assumed year of completion. **Figure 6-7** is a SIDRA layout representation of the intersection. Note that right turn pocket length is to be further confirmed during detailed design stage.

Table 6-10 shows the results of the analysis. It shows that the proposed intersection layout would be able to cater for the development traffic. No significant queue within the right turn pocket, indicating that the proposed right turn lane would be sufficient to cater for the queue length. Left turn movement performance from Wattleup Road is also performing satisfactorily within minimal impact to Wattleup Road.

Some delay may be experienced by drivers exiting from the access road, however this level of service may be expected at the completion of the LSP with Wattleup Road still functioning as a regional distributor road. When Rowley Road is built, it is expected that through traffic along Wattleup Road will ease and delays when exiting from the access road would be reduced.

Figure 6-7 Wattleup Road / LSP South Access Road 2 SIDRA Layout

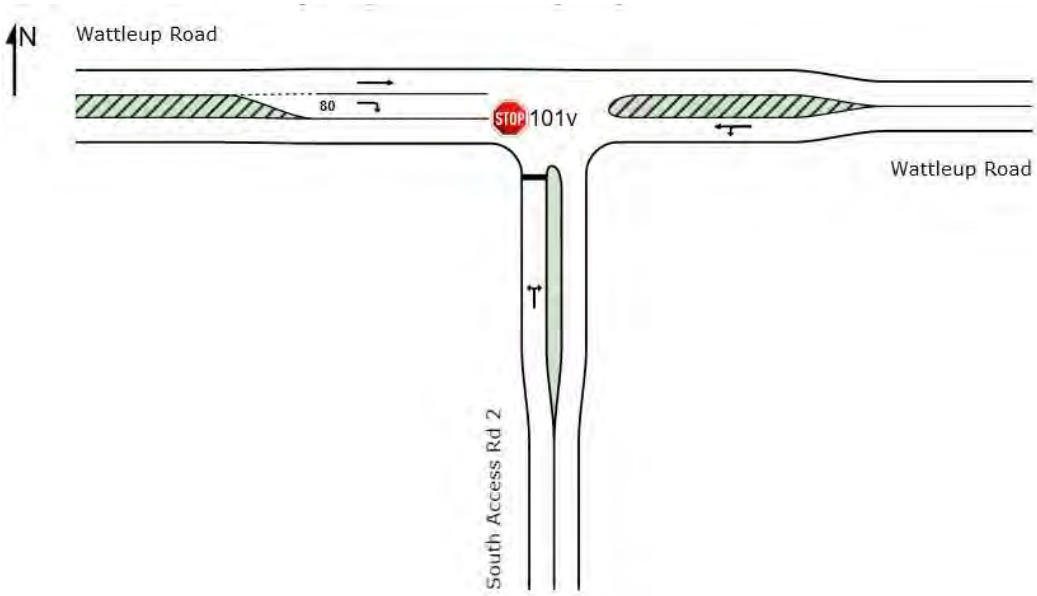


Table 6-10 2031 + Development Results – Wattleup Road / Access Road 2

Intersection Approach		2031withDevelopment AM Peak				2031withDevelopment PM Peak			
		DOS	Delay (s)	LOS	95% Queue (m)	DOS	Delay (s)	LOS	95% Queue (m)
South Access Rd 2 (South)	L	0.622	21.4	C	22.5	0.298	11.5	B	8.2
	R	0.622	39.9	E	22.5	0.298	28.9	D	8.2
Wattleup Rd (East)	L	0.332	6.5	A	0	0.244	6.5	A	0
	T	0.332	0.1	A	0	0.244	0.1	A	0
Wattleup Rd (West)	T	0.341	0.1	A	0	0.344	0.1	A	0
	R	0.014	8.5	A	0.4	0.032	7.8	A	1

6.8 Review of Future Wattleup Road LILO at Hammond Road

Following the construction of Rowley Road and the extension of Hammond Road to Rowley Road, Wattleup Road is expected to terminate at Hammond Road with only left-in and left-out movement permitted. In this future scenario, some changes to traffic behaviour are expected:

> Regional and heavy vehicle traffic will shift to Rowley Road, causing Wattleup Road to be downgraded in function as an access road, and traffic will decrease significantly.

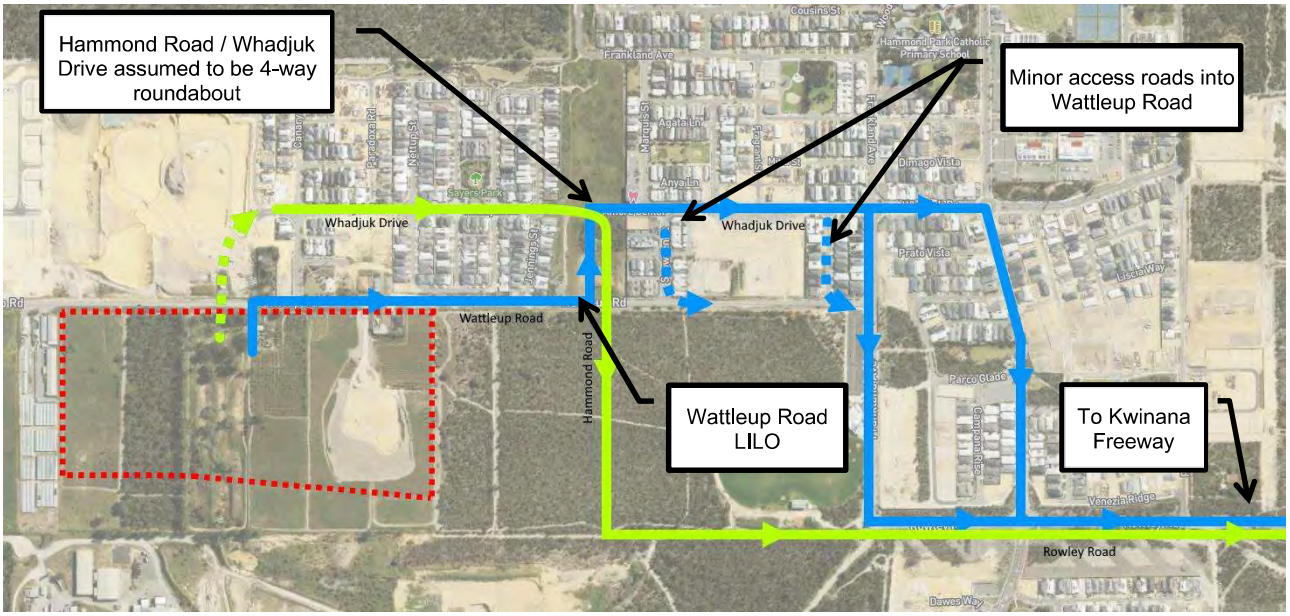
> LSP traffic bound for Kwinana Freeway (southbound) will be required to go via a different traffic route. The LSP traffic is expected to go via the following routes (**Figure 6-8**):

- Wattleup Road > Hammond Road > Whadjuk Drive > Frankland Avenue or Irvine Parade > Rowley Road > Kwinana Freeway
- Wattleup Road > any residential access roads north of Wattleup Road > Whadjuk Drive > Hammond Road > Rowley Road > Kwinana Freeway

> Whadjuk Drive will replace Wattleup Road's function as the 'Neighbourhood Connector' as indicated in the expected travel route in the above bullet point, and expected to be able to cater for the volume.

> The expected travel route to reach Rowley Road en route to Kwinana Freeway would also be divided into three major roads: Hammond Road, Frankland Avenue, and Irvine Parade. There are also minor access roads that connects to Wattleup Road.

Figure 6-8 Expected Travel Route to Kwinana Freeway with Wattleup Road LILO



As discussed above, there will be changes in traffic behaviour due to Wattleup Road LILO, particularly route from the LSP towards Kwinana Freeway. The surrounding road network is permeable enough to be able to cater for the traffic diversions and therefore, Wattleup Road LILO is not expected to have detrimental impact to the surrounding area or road network.

6.9 Pedestrian and Cycling Network

Pedestrian and cycling facilities will be provided within the LSP consistent with the appropriate road hierarchy, including pedestrian paths along at least one side of all roads within the LSP. This would provide excellent connectivity to the surrounding path network and any future public transport services.

6.10 Safe Walk and Cycling to School

As mentioned previously, a path is expected to be provided on at least one side of all roads within the LSP. This would provide excellent facility for nearby students to walk or cycle to school.

A crossing facility should be provided on Wattleup Road to provide a safer crossing location for parents and students to cross from the Site towards the primary school located on the structure plan area north of Wattleup Road.

6.11 Public Transport Access

At present public transport access is poor as there are no bus routes passing through the LSP. As mentioned previously, the SSDSP indicates a provision of a future bus service along Wattleup Road which may also link to the Latitude 32 Industrial area. Further discussion with PTA should be held to provide bus services in the vicinity of the area once the local road network is complete.

7 Conclusion

Stantec has been commissioned by Qube Property to prepare a Transport Impact Assessment (TIA) for the proposed Structure Plan (the Site) located in Hammond Park, City of Cockburn. The Structure Plan consists of lots 117, 200, 805, 809, 1000, 1001, 9001, 9002, 9003 Wattleup Road.

This assessment has been prepared in accordance with the WAPC "*Transport Impact Assessment Guidelines Volume 2: Planning Schemes, Structure Plans and Activity Centre Plans*" (2016).

The following conclusions have been made:

> The LSP is proposed to yield 294 residential dwellings.

> The LSP contemplated is estimated to generate approximately 280 trips in the AM peak and 292 trips in the PM peak

> A SIDRA analysis of Wattleup Road and access roads indicates that the intersections would performed adequately in the year of completion. Some delay may be experienced by drivers exiting right out from the access roads, however this level of service can be expected at the completion of the LSP with Wattleup Road still functioning as a regional distributor road. When Rowley Road is built, it is expected that through traffic along Wattleup Road will ease and delays when exiting from the access road would be reduced.

> The SIDRA analysis of Hammond Road / Wattleup Road the 3-way roundabout scenario, shows that the roundabout can cater for the LSP and background traffic growth, including other approved LSP currently under construction.

> Wattleup Road speed limit is proposed to be reduced to 60km/h at the opening of the LSP subdivision. In the long term following the completion of Rowley Road, Wattleup Road would be downgraded into a Neighbourhood Connector as all regional and freight traffic would move into Rowley Road. At this point Wattleup Road speed limit is proposed to be reduced to 50km/h.

> Future Wattleup Road LILO intersection at Hammond Road will not have detrimental impact to the surrounding road network. The existing and future road network surrounding the LSP is permeable and will be able to cater for the traffic diversions caused by Wattleup Road LILO.

APPENDIX

A

STRUCTURE PLAN

Cardno

now

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Appendix G

Transportation Noise Assessment

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Transportation Noise Assessment

Lot 813, Lot 78, Lot 815 and Lot 80 Wattleup Rd, Hammond Park

Reference: 24058981-01B

Prepared for:
Qube

Association of Australasian Acoustical Consultants

Reference: 24058981-01B

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This report has been prepared in accordance with the scope of services described in the contract or agreement between Lloyd George Acoustics Pty Ltd and the Client. The report relies upon data, surveys, measurements and results taken at or under the particular times and conditions specified herein. Any findings, conclusions or recommendations only apply to the aforementioned circumstances and no greater reliance should be assumed or drawn by the Client. Furthermore, the report has been prepared solely for use by the Client, and Lloyd George Acoustics Pty Ltd accepts no responsibility for its use by other parties.

Date	Rev	Description	Author	Verified
8-May-24	0	Issued to Client	Terry George	Matt Moyle
18-Jun-24	A	Typographical error corrected in Figure 4-2	Terry George	-
18-Jun-26	B	Updated subdivision plan	Terry George	-

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1. INTRODUCTION

It is proposed to subdivide land at Lot 813, Lot 78, Lot 815 and Lot 80 Wattleup Rd, Hammond Park (refer *Figure 1-1*) with the proposed subdivision plan shown in *Figure 1-2*. To the south is the future extension of Rowley Road, which is considered a 'Strategic Freight/Major Traffic Route' as shown on PlanWA Maps (red dashed line), such that a noise assessment is required in accordance with *State Planning Policy No. 5.4 Road and Rail Noise*, being the subject of this report.

A previous assessment[1] was undertaken for a similar proposed subdivision (refer *Figure 1-1*), such that this current assessment uses similar methodology by updating the previous noise model with the subject site subdivision.

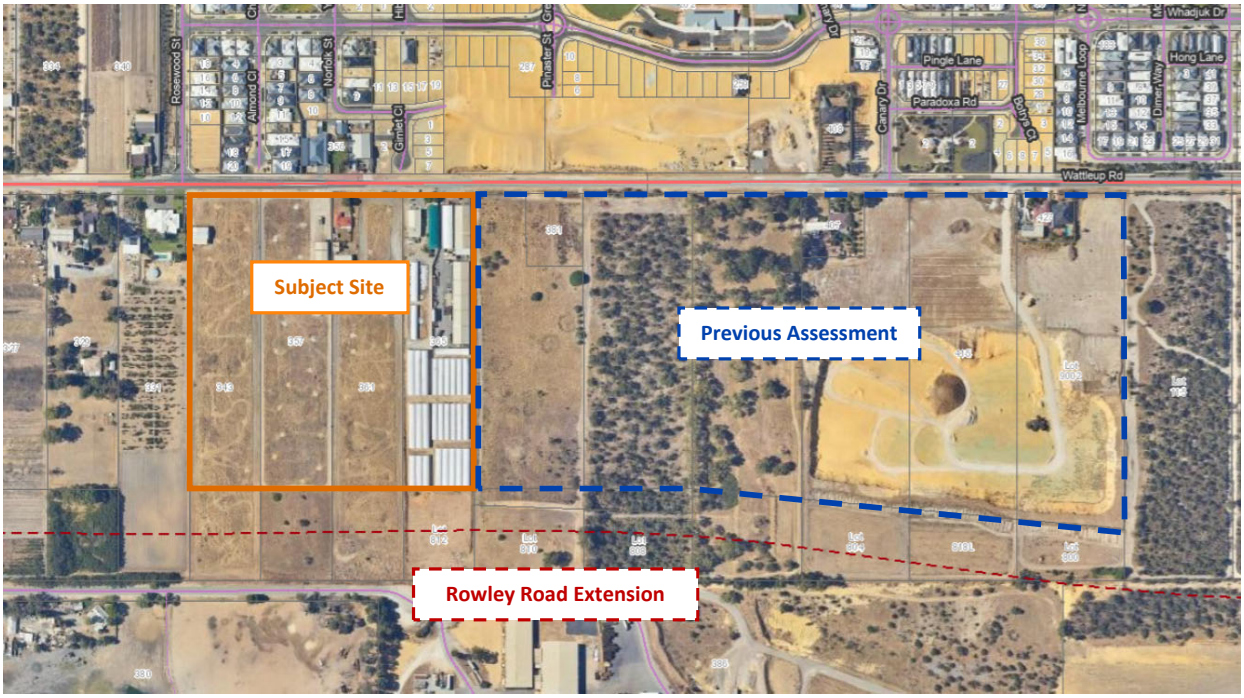


Figure 1-1: Subdivision Location (Source: DPLH PlanWA)

Appendix B contains a description of some of the terminology used throughout this report.

[1] *Transportation Noise Assessment, Lots 9003, 809, 805, 9001, 117 & 9002 Hammond Park*; Reference: 21026117-01e, 27 October 2023

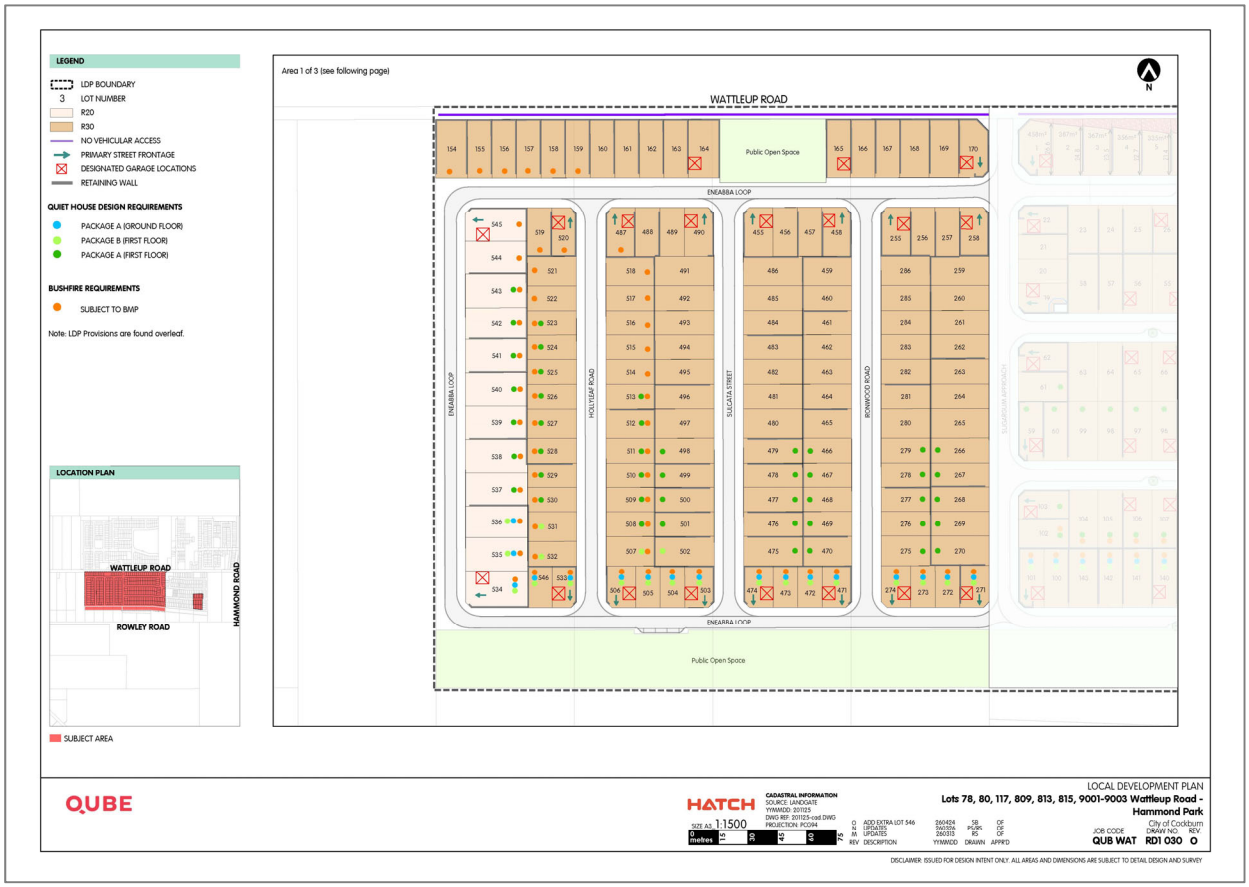


Figure 1-2: Subdivision Layout

2. CRITERIA

The criteria relevant to this project is provided in *State Planning Policy No. 5.4 Road and Rail Noise* (hereafter referred to as SPP 5.4) produced by the Western Australian Planning Commission (WAPC). SPP 5.4 is supported by the *Road and Rail Noise Guidelines* (the Guidelines) and the Department of Planning, Lands and Heritage mapping. The objectives of SPP 5.4 are to:

- Protect the community from unreasonable levels of transport noise;
- Protect strategic and other significant freight transport corridors from incompatible urban encroachment;
- Ensure transport infrastructure and land-use can mutually exist within urban corridors;
- Ensure that noise impacts are addressed as early as possible in the planning process; and
- Encourage best practice noise mitigation design and construction standards.

Table 2-1 sets out noise targets that are to be achieved by proposals under which SPP 5.4 applies. Where the targets are exceeded, an assessment is required to determine the likely level of transport noise and management/mitigation required.

Table 2-1: Noise Targets for Noise Sensitive Land-Use

Scenario	Outdoor Noise Target		Indoor Noise Target	
Noise-sensitive land-use and/or development	55 dB $L_{Aeq(Day)}$	50 dB $L_{Aeq(Night)}$	40 dB $L_{Aeq(Day)}$ (Living and Work Areas)	35 dB $L_{Aeq(Night)}$ (Bedrooms)

Notes:

- Day period is from 6am to 10pm and night period from 10pm to 6am.
- The outdoor noise target is to be measured at 1-metre from the most exposed, habitable[2] facade of a noise sensitive building.
- For all noise-sensitive land-use and/or development, indoor noise targets for other room usages may be reasonably drawn from Table 1 of Australian Standard/New Zealand Standard AS/NZS 2107:2016 *Acoustics – Recommended Design Sound Levels and Reverberation Times for Building Interiors* (as amended) for each relevant time period.
- Outdoor targets are to be met at all outdoor areas as far as is reasonable and practicable to do so using the various noise mitigation measures outlined in the Guidelines.

The application of SPP 5.4 is to consider anticipated traffic volumes for the next 20 years from when the noise assessment has been undertaken.

[2] *A habitable room is defined in State Planning Policy 3.1 as a room used for normal domestic activities that includes a bedroom, living room, lounge room, music room, sitting room, television room, kitchen, dining room, sewing room, study, playroom, sunroom, gymnasium, fully enclosed swimming pool or patio.*

Table 2-2 sets out noise targets that are to be achieved by new or upgraded roads, under which SPP 5.4 applies.

Table 2-2: Noise Targets for Roads

Scenario	Outdoor Noise Target	
Road Upgrade	60 dB $L_{Aeq(Day)}$	55 dB $L_{Aeq(Night)}$

Notes:

- Day period is from 6am to 10pm and night period from 10pm to 6am.
- The outdoor noise target is to be measured at 1-metre from the most exposed, habitable[1] facade of a noise sensitive building.
- Outdoor targets are to be met at all outdoor areas as far as is reasonable and practicable to do so using the various noise mitigation measures outlined in the Guidelines. For example, it is likely unreasonable for a transport infrastructure provider to achieve the outdoor targets at more than 1 or 2 floors of an adjacent development with direct line of sight to the traffic.

In this case, Rowley Road extension will be a new road and therefore the 55 dB $L_{Aeq(Day)}$ and 50 dB $L_{Aeq(Night)}$ criteria of *Table 2-2* are applicable. If these criteria were achieved by the road builder, there would be no mitigation requirements to the subdivision, although such performance may not be practicable.

3. METHODOLOGY

Noise modelling has been undertaken in accordance with the requirements of SPP 5.4 and associated Guidelines. As this section of Rowley Road does not yet exist, noise monitoring has not been undertaken.

To predict the noise emissions, the computer program *SoundPLAN 8.2* was utilised incorporating the *Calculation of Road Traffic Noise* (CoRTN) algorithms, modified to reflect Australian conditions. The modifications included the following:

- Vehicles were separated into heavy (Austroads Class 3 upwards) and non-heavy (Austroads Class 1 and 2) with non-heavy vehicles having a source height of 0.5 metres above road level and heavy vehicles having two source heights at 1.5 metres and 3.6 metres above road level;
- A -0.8 dB correction has been applied to the lower level heavy vehicle noise source and -8.0 dB to the higher level noise source based on the *Transportation Noise Reference Book*; Paul Nelson (1987), so as to provide consistent results with the CoRTN algorithms;
- Adjustments of -0.8 dB and -1.7 dB have been applied to the predicted levels for the 'free-field' and 'at façade' cases respectively, based on the findings of *An Evaluation of the U.K. DoE Traffic Noise Prediction*; Australian Road Research Board, Report 122 ARRB – NAASRA Planning Group (March 1983).

Predictions are made at heights of 1.4 metres above ground floor level for single storey buildings and 4.2 metres above ground floor level for possible first floors of double storey buildings. The noise is predicted at 1-metre from an assumed building façade, resulting in a + 2.5 dB correction due to reflected noise.

Various input data are included in the modelling and these are discussed in *Section 3.1* to *Section 3.2*.

3.1. Ground Topography

The road design data was provided by Cossill & Webley dated 17 May 2022, as a 3D AutoCAD file and is understood to be the latest provided by Main Roads WA, however is subject to change noting there is no planned timeframe for the construction of this road. This was the same road design used for the future subdivision to the east of the subject site. Finished lot levels for the subject site subdivision were provided by Cossill & Webley (18 June 2026) as a 3D AutoCAD file, which has been merged with the existing topography in the area.

Indicative building outlines have been included as these can provide barrier attenuation when located between a source and a receiver, in much the same way as a hill or wall. All buildings are assumed to be single storey with heights of 3.5 metres. This means where modelling is undertaken to a possible upper floor, the noise is predicting above these building outlines.

3.2. Road Surface

The corrections applied for different road surface finishes are provided in *Table 3-1*.

Table 3-1: Noise Relationship Between Different Road Surfaces

Chip Seal				Asphalt			
14mm	10mm	5mm	Slurry	Dense Graded	Novachip	Stone Mastic	Open Graded
+3.5 dB	+2.5 dB	+1.5 dB	+1.0 dB	0.0 dB	-0.2 dB	-1.5 dB	-2.5 dB

Given the obligations for a new road to achieve the outdoor noise target, the assumed road surface is for the purpose of noise modelling is:

- Rowley Road – Dense Graded Asphalt.

3.3. Vehicle Speed

The posted speed is assumed to be:

- Rowley Road – 80 km/hr.

3.4. Traffic Volumes

Forecast 2041 traffic volumes were obtained from Main Roads WA to City of Cockburn (Lang Fong, Planning Information Manager, Email dated 24 January 2022). A 2046 plot was also more recently obtained from Main Roads WA (Scott Hazebroek, Traffic Modelling Analyst, Reference: #42809, dated 7 February 2024), showing volumes within a few hundred vehicles of those previously provided. *Table 3-2* provides the traffic volume input data in the model.

Table 3-2: Traffic Information Used in Noise Modelling

Road	Section	Direction	Traffic Volume	% Heavy Vehicles
Rowley Road	West of Hammond Road	Eastbound	19,200	19
		Westbound	14,900	19

3.5. Ground Absorption

The ground absorption has been assumed to be 0.0 (0%) for the roads and 0.5 (50%) through the subdivision, noting that 0.0 represents hard reflective surfaces such as water and 1.0 represents absorptive surfaces such as grass.

4. RESULTS

The noise modelling results are provided in *Figure 4-1* and *Figure 4-2* as $L_{Aeq(Day)}$ noise level contour plots, being for the future traffic conditions at ground floor height and first floor height level. It can be seen that the outdoor noise target will be exceeded assuming no mitigation.

Figure 4-1: Future $L_{Aeq(Day)}$ Noise Contour Plot – Ground Floor Level

Figure 4-2: Future $L_{Aeq(Day)}$ Noise Contour Plot – First Floor Level

5. ASSESSMENT

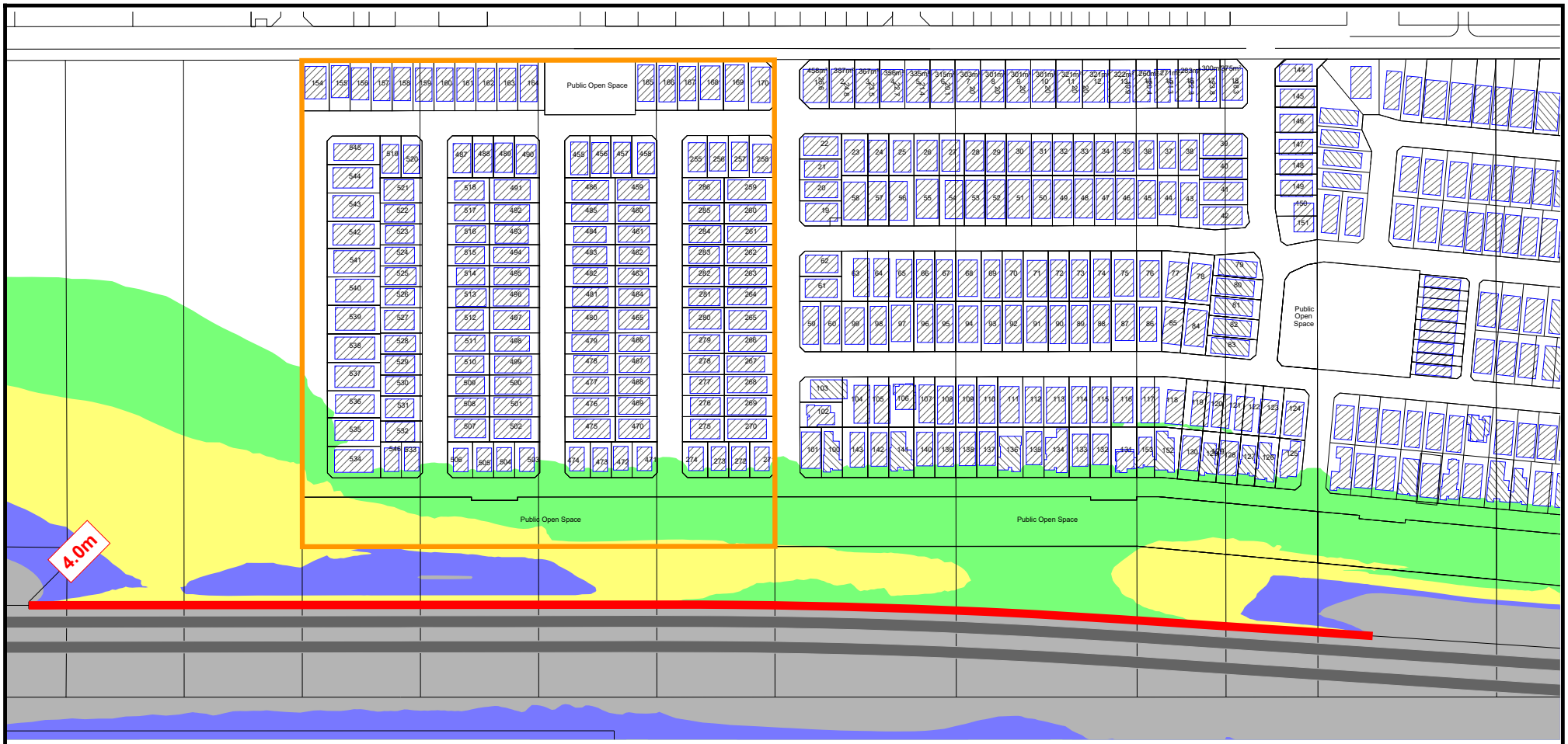
The objectives of SPP 5.4 are to achieve:

- Indoor noise levels specified in *Table 2-1* in noise-sensitive areas (e.g. bedrooms and living rooms of houses); and
- A reasonable degree of acoustic amenity for outdoor living areas on each residential lot.

Where the outdoor noise targets of *Table 2-1* are achieved, no further noise controls are necessary. With reference to *Section 4*, it is evident the outdoor noise target will be exceeded at some lots. Following discussions between stakeholders for the subdivision to the east, the preferred noise mitigation strategy is:

- Road builder to construct a nominal 4-metre high wall alongside the road or mitigation to provide an equivalent result; and
- Developer is to incorporate Quiet House Packages to affected lots, including notifications on lot titles. *Appendix A* provides the Quiet House Packages, as taken from the SPP 5.4 Guidelines. Alternatives to the provided Packages can be accepted if supported by a report from a suitably qualified acoustical consultant (member firm of the Association of Australasian Acoustical Consultants (AAAC)) once the specific house plans for the lot are available.

The noise contours associated with the above are provided in *Figure 5-1* (ground floor) and *Figure 5-2* (first floor) with the noise mitigation shown on *Figure 5-3* (ground floor) and *Figure 5-4* (first floor).



Lots 813, 78, 815 & 80, Hammond Park - Future 2046 $L_{Aeq(Day)}$ Noise Level Contours to Ground Floor

Assumed Road Surface is:
Rowley Road: Dense Graded Asphalt

SoundPLAN v8.2
CoRTN Algorithms

18 June 2026

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Length Scale 1:3500

0 20 40 80 120 160 m

Figure 5-1

Signs and symbols

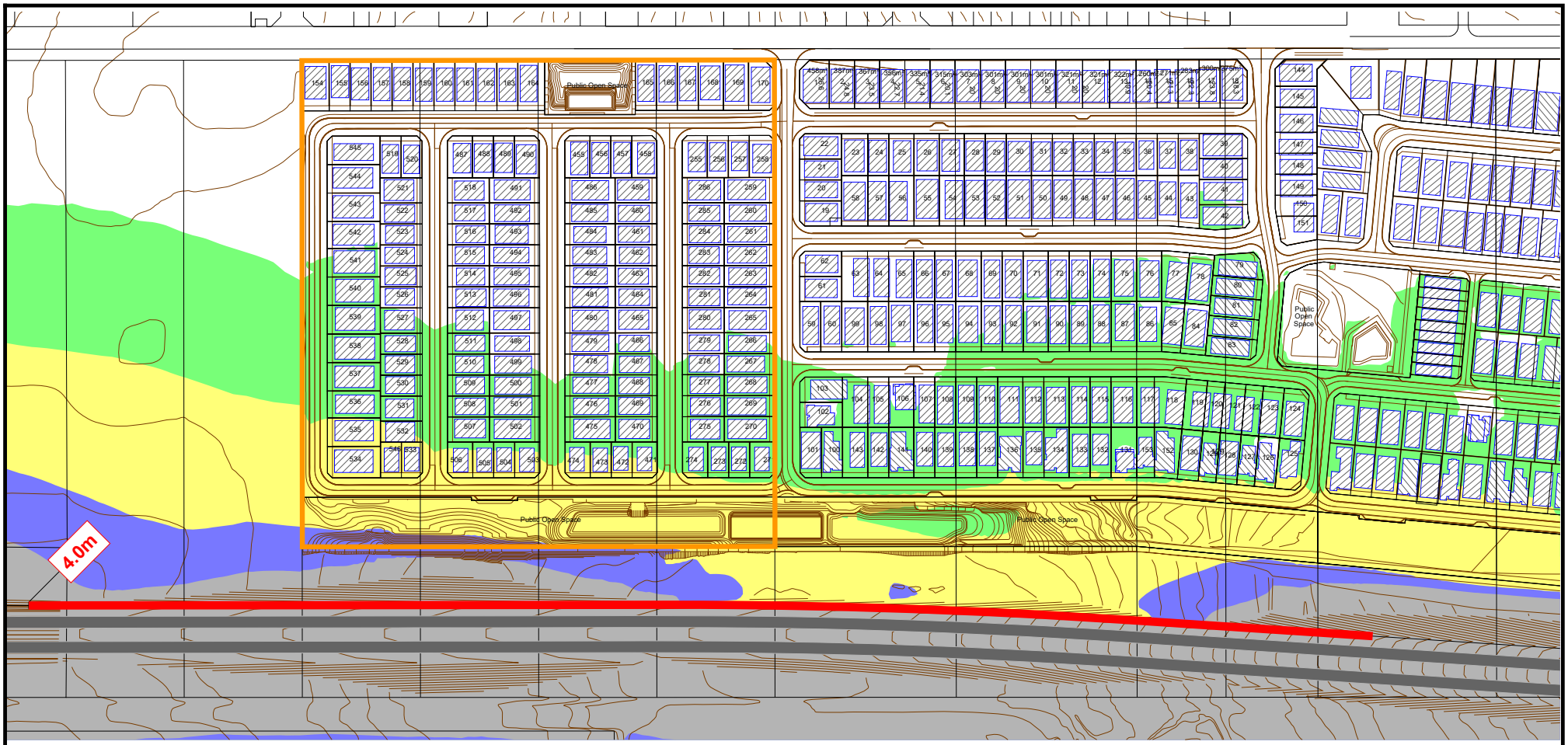
- Road
- Indicative Building
- Indicative Wall
- Subject Site

N

Noise levels $L_{Aeq(Day)}$ dB

<= 55	
<= 56	Exposure A
<= 57	
<= 58	
<= 59	Exposure B
<= 60	
<= 61	
<= 62	
<= 63	Exposure C
<= 64	
<= 65	
<= 66	
> 66	Exposure D

SPP 5.4 (Sep 2019)



Lots 813, 78, 815 & 80, Hammond Park - Future 2046 $L_{Aeq(Day)}$ Noise Level Contours to First Floor

Assumed Road Surface is:
Rowley Road: Dense Graded Asphalt

SoundPLAN v8.2
CoRTN Algorithms

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Length Scale 1:3500

0 20 40 80 120 160 m

Figure 5-2

Signs and symbols

- Road
- Indicative Building
- Indicative Wall
- Subject Site

N

Noise levels $L_{Aeq(Day)}$ dB

<= 55	
<= 56	Exposure A
<= 57	
<= 58	
<= 59	Exposure B
<= 60	
<= 61	
<= 62	
<= 63	Exposure C
<= 64	
<= 65	
<= 66	
> 66	Exposure D

SPP 5.4 (Sep 2019)

Lots 813, 78, 815 & 80, Hammond Park - Noise Mitigation to Ground Floor

Assumed Road Surface is:
Rowley Road: Dense Graded Asphalt

SoundPLAN v8.2
CoRTN Algorithms

18 June 2026

Signs and symbols

- Road
- Indicative Wall
- Subject Site
- Package A
- Package B

N

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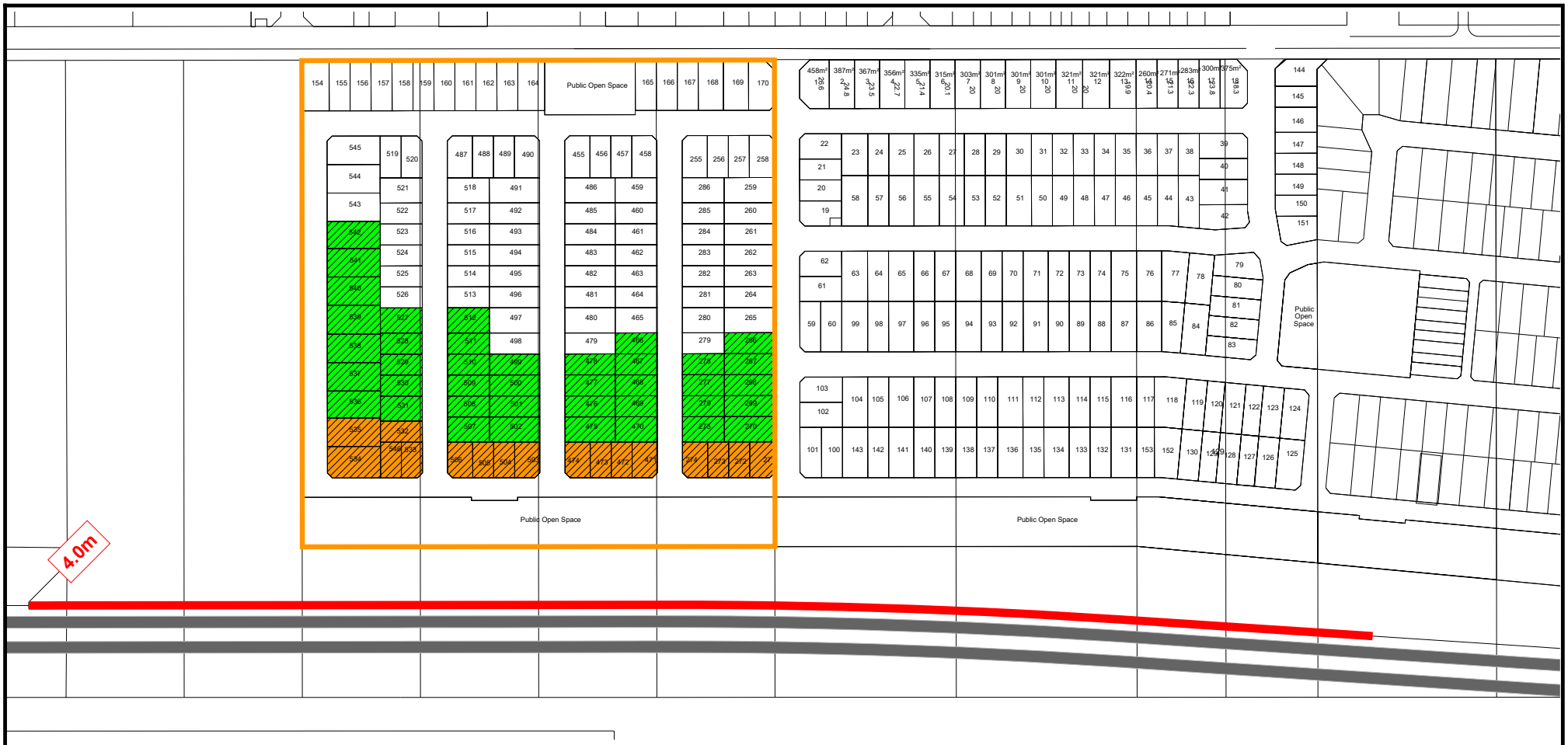
Length Scale 1:3500

0 20 40 80 120 160 m

Figure 5-3



Lots 813, 78, 815 & 80, Hammond Park - Noise Mitigation to First Floor

Assumed Road Surface is:
Rowley Road: Dense Graded Asphalt

SoundPLAN v8.2
CoRTN Algorithms

18 June 2026

Signs and symbols

- Road
- Indicative Wall
- Subject Site
- Package A
- Package B

N

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Length Scale 1:3500

0 20 40 80 120 160 m

Figure 5-4

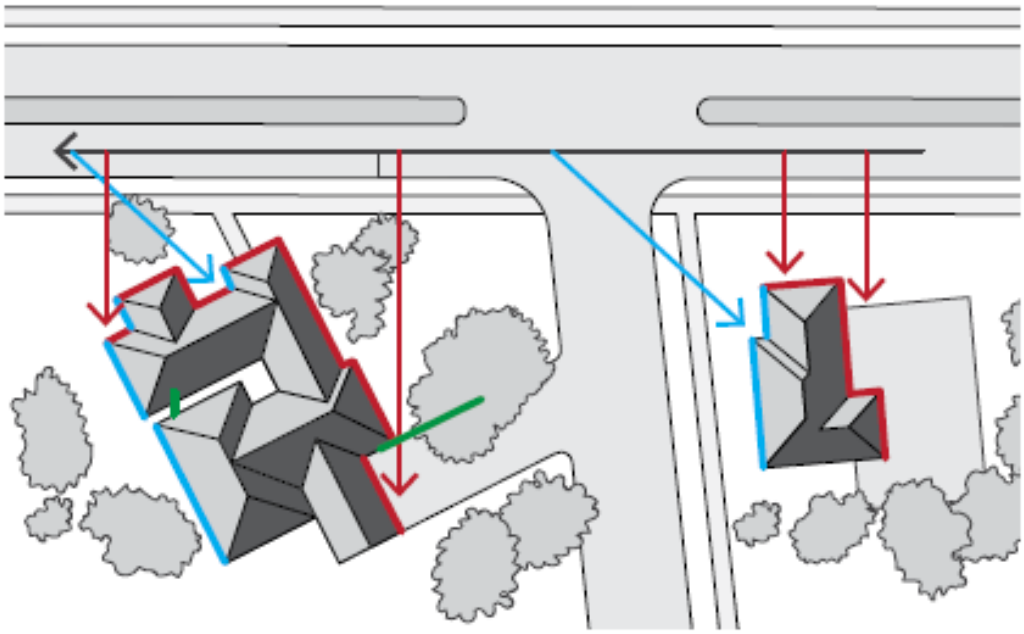
Appendix A – Quiet House Packages

The packages and information provided on the following pages are taken from *Road and Rail Noise Guidelines* (September 2019).

Where outdoor and indoor noise levels received by a noise-sensitive land-use and/or development exceed the policy's noise target, implementation of quiet house requirements is an acceptable solution.

With regards to the packages, the following definitions are provided:

- **Facing** the transport corridor (red): Any part of a building façade is 'facing' the transport corridor if any straight line drawn perpendicular (at a 90 degree angle) to its nearest road lane or railway line intersects that part of the façade without obstruction (ignoring any fence).
- **Side-on** to transport corridor (blue): Any part of a building façade that is not 'facing' is 'side-on' to the transport corridor if any straight line, at any angle, can be drawn from it to intersect the nearest road lane or railway line without obstruction (ignoring any fence).
- **Opposite** to transport corridor (green): Neither 'side on' nor 'facing', as defined above.



Quiet House Package A

56-58 dB $L_{Aeq(Day)}$ & 51-53 dB $L_{Aeq(Night)}$

Element	Orientation	Room	
		Bedroom	Indoor Living and Work Areas
External Glazing	Facing	• Up to 40% floor area ($R_w + C_{tr} \geq 28$): – Sliding or double hung with minimum 10mm single or 6mm-12mm-10mm double insulated glazing; – Sealed awning or casement windows with minimum 6mm glass. • Up to 60% floor area ($R_w + C_{tr} \geq 31$): – Sealed awning or casement windows with minimum 6mm glass.	• Up to 40% floor area ($R_w + C_{tr} \geq 25$): – Sliding or double hung with minimum 6mm single or 6mm-12mm-6mm double insulated glazing; • Up to 60% floor area ($R_w + C_{tr} \geq 28$); • Up to 80% floor area ($R_w + C_{tr} \geq 31$).
	Side On	As above, except $R_w + C_{tr}$ values may be 3 dB less or max % area increased by 20%.	
	Opposite	No specific requirements	
External Doors	Facing	• Fully glazed hinged door with certified $R_w + C_{tr} \geq 28$ rated door and frame including seals and 6mm glass.	• Doors to achieve $R_w + C_{tr} \geq 25$: – 35mm Solid timber core hinged door and frame system certified to R_w 28 including seals; – Glazed sliding door with 10mm glass and weather seals.
	Side On	As above, except $R_w + C_{tr}$ values may be 3 dB less.	
	Opposite	No specific requirements	
External Walls	All	• $R_w + C_{tr} \geq 45$: – Two leaves of 90mm thick clay brick masonry with minimum 20mm cavity; or – Single leaf of 150mm brick masonry with 13mm cement render on each face; or – One row of 92mm studs at 600mm centres with: ▪ Resilient steel channels fixed to the outside of the studs; and ▪ 9.5mm hardboard or fibre cement sheeting or 11mm fibre cement weatherboards fixed to the outside; ▪ 75mm thick mineral wool insulation with a density of at least 11kg/m^3; and ▪ 2 x 16mm fire-rated plasterboard to inside.	
Roofs and Ceilings	All	• $R_w + C_{tr} \geq 35$: • Concrete or terracotta tile or metal sheet roof with sarking and at least 10mm plasterboard.	

Quiet House Package B

59-62 dB $L_{Aeq(Day)}$ & 54-57 dB $L_{Aeq(Night)}$

Element	Orientation	Room	
		Bedroom	Indoor Living and Work Areas
External Glazing	Facing	• Up to 40% floor area ($R_w + C_{tr} \geq 31$): – Fixed sash, awning or casement with minimum 6mm glass or 6mm-12mm-6mm double insulated glazing. • Up to 60% floor area ($R_w + C_{tr} \geq 34$): – Fixed sash, awning or casement with minimum 10mm glass or 6mm-12mm-10mm double insulated glazing.	• Up to 40% floor area ($R_w + C_{tr} \geq 28$): – Sliding or double hung with 6mm-12mm-10mm double insulated glazing; – Sealed awning or casement windows with minimum 6mm glass. • Up to 60% floor area ($R_w + C_{tr} \geq 31$); • Up to 80% floor area ($R_w + C_{tr} \geq 34$).
	Side On	As above, except $R_w + C_{tr}$ values may be 3 dB less or max % area increased by 20%.	
	Opposite	As above, except $R_w + C_{tr}$ values may be 6 dB less or max % area increased by 20%.	
External Doors	Facing	• Fully glazed hinged door with certified $R_w + C_{tr} \geq 31$ rated door and frame including seals and 10mm glass.	• Doors to achieve $R_w + C_{tr} \geq 28$: – 40mm Solid timber core hinged door and frame system certified to R_w 32 including seals; – Fully glazed hinged door with certified $R_w + C_{tr} \geq 28$ rated door and frame including seals and 6mm glass.
	Side On	As above, except $R_w + C_{tr}$ values may be 3 dB less or max % area increased by 20%.	
	Opposite	As above, except $R_w + C_{tr}$ values may be 6 dB less or max % area increased by 20%.	
External Walls	All	• $R_w + C_{tr} \geq 50$: – Two leaves of 90mm thick clay brick masonry with minimum 50mm cavity between leaves and 25mm glasswool or polyester (24kg/m³). Resilient ties used where required to connect leaves. – Two leaves of 110mm clay brick masonry with minimum 50mm cavity between leaves and 25mm glasswool or polyester insulation (24kg/m³). – Single leaf of 220mm brick masonry with 13mm cement render on each face. – 150mm thick unlined concrete panel or 200mm thick concrete panel with one layer of 13mm plasterboard or 13mm cement render on each face. – Single leaf of 90mm clay brick masonry with: ▪ A row of 70mm x 35mm timber studs or 64mm steel studs at 600mm centres; ▪ A cavity of 25mm between leaves; ▪ 50mm glasswool or polyester insulation (11kg/m³) between studs; and ▪ One layer of 10mm plasterboard fixed to the inside face.	
Roofs and Ceilings	All	• $R_w + C_{tr} \geq 35$: – Concrete or terracotta tile or metal sheet roof with sarking and at least 10mm plasterboard ceiling with R3.0+ fibrous insulation.	

Mechanical Ventilation requirements

In implementing the acceptable treatment packages, fresh air requirements of the National Construction Code must be satisfied on the basis of windows closed. Whilst not the only solution, the most common is mechanical ventilation / air-conditioning is installed with the following considerations:

- Acoustically rated openings and ductwork to provide a minimum sound reduction performance of R_w 40 dB into sensitive spaces;
- Evaporative systems require attenuated ceiling air vents to allow closed windows;
- Refrigerant based systems need to be designed to achieve National Construction Code fresh air ventilation requirements;
- Openings such as eaves, vents and air inlets must be acoustically treated, closed or relocated to building sides facing away from the corridor where practicable.

Notification

Notifications on title advise prospective purchasers of the potential for noise impacts from major transport corridors and help with managing expectations.

The Notification is to state as follows:

This lot is in the vicinity of a transport corridor and is affected, or may in the future be affected, by road and rail transport noise. Road and rail transport noise levels may rise or fall over time depending on the type and volume of traffic.

Appendix B – Terminology

The following is an explanation of the terminology used throughout this report:

- **Decibel (dB)**

The decibel is the unit that describes the sound pressure levels of a noise source. It is a logarithmic scale referenced to the threshold of hearing.

- **A-Weighting**

An A-weighted noise level has been filtered in such a way as to represent the way in which the human ear perceives sound. This weighting reflects the fact that the human ear is not as sensitive to lower frequencies as it is to higher frequencies. An A-weighted sound level is described as L_A, dB.

- **L_{eq}**

The L_{eq} level represents the average noise energy during a measurement period.

- **L_1**

The L_1 level represents the noise level exceeded for 1 percent of the measurement period and is considered to represent the average of the maximum noise levels measured.

- **L_{10}**

The L_{10} level represents the noise level exceeded for 10 percent of the measurement period and is considered to represent the "intrusive" noise level.

- **L_{90}**

The L_{90} level represents the noise level exceeded for 90 percent of the measurement period and is considered to represent the "background" noise level.

- **$L_{Aeq(Day)}$**

The $L_{Aeq(Day)}$ level is the logarithmic average of the L_{Aeq} levels from 6.00am to 10.00pm.

- **$L_{Aeq(Night)}$**

The $L_{Aeq(Night)}$ level is the logarithmic average of the L_{Aeq} levels from 10.00pm to 6.00am.

- **$L_{A10,18hour}$**

The $L_{A10,18hour}$ level is the arithmetic average of the hourly L_{A10} levels between 6.00am and midnight.

- **$L_{Aeq,24hour}$**

The $L_{Aeq,24hour}$ level is the logarithmic average of the L_{Aeq} levels from over an entire day.

- **Noise-sensitive land use and/or development**

Land-uses or development occupied or designed for occupation or use for residential purposes (including dwellings, residential buildings or short-stay accommodation), caravan park, camping ground, educational establishment, child care premises, hospital, nursing home, corrective institution or place of worship.

- **R_w**

This is the weighted sound reduction index. It is a single number rating determined by moving a grading curve in integral steps against the laboratory measured transmission loss until the sum of the deficiencies at each one-third-octave band, between 100 Hz and 3.15 kHz, does not exceed 32 dB. The higher the R_w value, the better the acoustic performance.

- **C_{tr}**

This is a spectrum adaptation term for airborne noise and provides a correction to the R_w value to suit source sounds with significant low frequency content such as road traffic or home theatre systems. A wall that provides a relatively high level of low frequency attenuation (i.e. masonry) may have a value in the order of – 4 dB, whilst a wall with relatively poor attenuation at low frequencies (i.e. stud wall) may have a value in the order of -12 dB.

- **About the Term 'Reasonable'**

An assessment of reasonableness should demonstrate that efforts have been made to resolve conflicts without comprising on the need to protect noise-sensitive land-use activities. For example, have reasonable efforts been made to design, relocate or vegetate a proposed noise barrier to address community concerns about the noise barrier height? Whether a noise mitigation measure is reasonable might include consideration of:

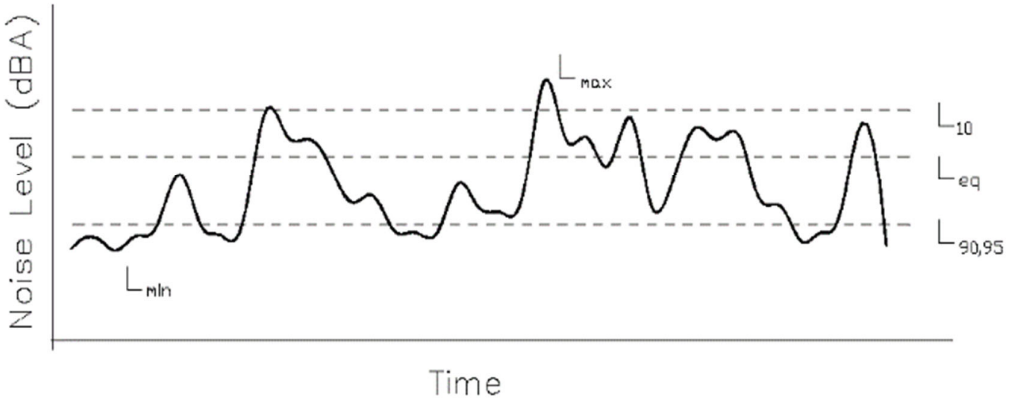
- The noise reduction benefit provided;
- The number of people protected;
- The relative cost vs benefit of mitigation;
- Road conditions (speed and road surface) significantly differ from noise forecast table assumptions;
- Existing and future noise levels, including changes in noise levels;
- Aesthetic amenity and visual impacts;
- Compatibility with other planning policies;
- Differences between metropolitan and regional situations and whether noise modelling requirements reflect the true nature of transport movements;
- Ability and cost for mobilisation and retrieval of noise monitoring equipment in regional areas;
- Differences between Greenfield and infill development;
- Differences between freight routes and public transport routes and urban corridors;
- The impact on the operational capacity of freight routes;
- The benefits arising from the proposed development;
- Existing or planned strategies to mitigate the noise at source.

- **About the Term 'Practicable'**

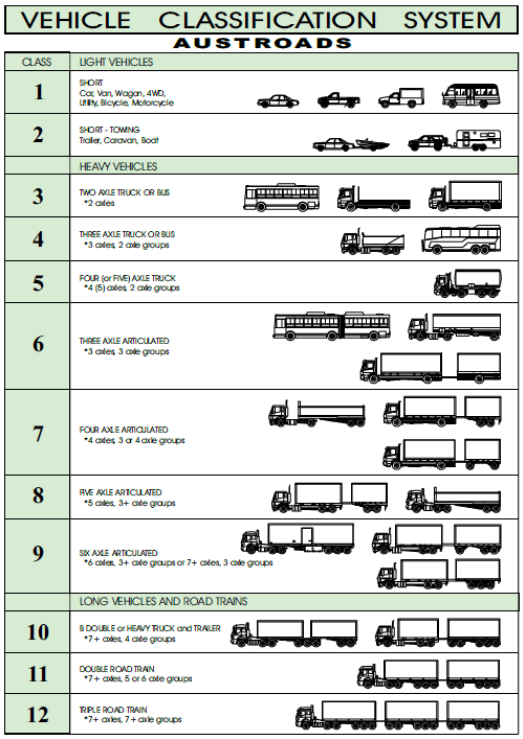
'Practicable' considerations for the purposes of the policy normally relate to the engineering aspects of the noise mitigation measures under evaluation. It is defined as "reasonably practicable having regard to, among other things, local conditions and circumstances (including costs) and to the current state of technical knowledge" (*Environmental Protection Act 1986*). These may include:

- Limitations of the different mitigation measures to reduce transport noise;
- Competing planning policies and strategies;
- Safety issues (such as impact on crash zones or restrictions on road vision);
- Topography and site constraints (such as space limitations);
- Engineering and drainage requirements;
- Access requirements (for driveways, pedestrian access and the like);
- Maintenance requirements;
- Bushfire resistance or BAL ratings;
- Suitability of the building for acoustic treatments.

- **Chart of Noise Level Descriptors**



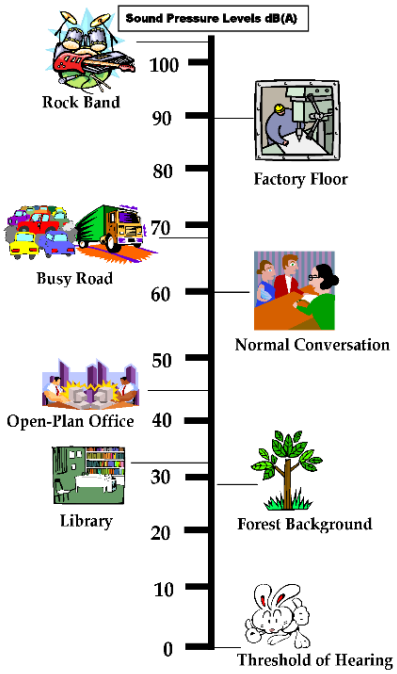
- **Austroads Vehicle Class**



VEHICLE CLASSIFICATION SYSTEM
AUSTROADS

CLASS	LIGHT VEHICLES
1	SHORT Car, Van, Wagon, 4WD, Utility, Bicycle, Motorcycle
2	SHORT - TOWING Trailer, Caravan, Boat
	HEAVY VEHICLES
3	TWO AXLE TRUCK OR BUS *2 axles
4	THREE AXLE TRUCK OR BUS *3 axles, 2 axle groups
5	FOUR (or FIVE) AXLE TRUCK *4 (5) axles, 2 axle groups
6	THREE AXLE ARTICULATED *3 axles, 3 axle groups
7	FOUR AXLE ARTICULATED *4 axles, 3 or 4 axle groups
8	FIVE AXLE ARTICULATED *5 axles, 3+ axle groups
9	SIX AXLE ARTICULATED *6 axles, 3+ axle groups or 7+ axles, 3 axle groups
	LONG VEHICLES AND ROAD TRAINS
10	B DOUBLE or HEAVY TRUCK and TRAILER *7+ axles, 4 axle groups
11	DOUBLE ROAD TRAIN *7+ axles, 5 or 6 axle groups
12	TRIPLE ROAD TRAIN *7+ axles, 7+ axle groups

- **Typical Noise Levels**



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Transportation Noise Assessment

Lots 9003, 809, 805, 9001, 117 & 9002 Hammond Park

Reference: 21026117-01e

Prepared for:
Qube + Primewest

Reference: 21026117-01e

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This report has been prepared in accordance with the scope of services described in the contract or agreement between Lloyd George Acoustics Pty Ltd and the Client. The report relies upon data, surveys, measurements and results taken at or under the particular times and conditions specified herein. Any findings, conclusions or recommendations only apply to the aforementioned circumstances and no greater reliance should be assumed or drawn by the Client. Furthermore, the report has been prepared solely for use by the Client, and Lloyd George Acoustics Pty Ltd accepts no responsibility for its use by other parties.

Date	Rev	Description	Author	Verified
26-May-21	1	Issued to Client	Terry George	Matt Moyle
03-Jun-21	2	Updated Draft report	Terry George	-
21-Jun-21	0	Finalised report	Terry George	-
18-Feb-22	A	Updated traffic volumes	Terry George	-
20-May-22	B	No noise wall option added	Terry George	-
8-Aug-22	C	Rowley modelled using DGA. Modification to ground levels option at eastern end removed (Not completed).	Terry George	-
18-Oct-23	D	Updated subdivision and address comments	Terry George	-
27-Oct-23	E	Report finalised.	Terry George	-

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1. INTRODUCTION

It is proposed to subdivide land at Lots 9003, 809, 805, 9001, 117 & 9002 Hammond Park (refer *Figure 1-1*) with the proposed subdivision plan shown in *Figure* 1-2. To the south of the site will be the Rowley Road extension and on the eastern side the future Hammond Road extension. Expected noise emissions from these future roads are the subject of this noise assessment.

Figure 1-1: Subdivision Location (Source: DPLH PlanWA)

Appendix C contains a description of some of the terminology used throughout this report.

Figure 1-2: Subdivision Layout

2. CRITERIA

The criteria relevant to this project is provided in *State Planning Policy No. 5.4 Road and Rail Noise* (hereafter referred to as SPP 5.4) produced by the Western Australian Planning Commission (WAPC). SPP 5.4 is supported by the *Road and Rail Noise Guidelines* (the Guidelines) and the Department of Planning, Lands and Heritage mapping. The objectives of SPP 5.4 are to:

- Protect the community from unreasonable levels of transport noise;
- Protect strategic and other significant freight transport corridors from incompatible urban encroachment;
- Ensure transport infrastructure and land-use can mutually exist within urban corridors;
- Ensure that noise impacts are addressed as early as possible in the planning process; and
- Encourage best practice noise mitigation design and construction standards.

Table 2-1 sets out noise targets that are to be achieved by proposals under which SPP 5.4 applies. Where the targets are exceeded, an assessment is required to determine the likely level of transport noise and management/mitigation required.

Table 2-1: Noise Targets for Noise Sensitive Land-Use

Scenario	Outdoor Noise Target		Indoor Noise Target	
Noise-sensitive land-use and/or development	55 dB $L_{Aeq(Day)}$	50 dB $L_{Aeq(Night)}$	40 dB $L_{Aeq(Day)}$ (Living and Work Areas)	35 dB $L_{Aeq(Night)}$ (Bedrooms)

Notes:

- Day period is from 6am to 10pm and night period from 10pm to 6am.
- The outdoor noise target is to be measured at 1-metre from the most exposed, habitable[1] facade of a noise sensitive building.
- For all noise-sensitive land-use and/or development, indoor noise targets for other room usages may be reasonably drawn from Table 1 of Australian Standard/New Zealand Standard AS/NZS 2107:2016 *Acoustics – Recommended Design Sound Levels and Reverberation Times for Building Interiors* (as amended) for each relevant time period.
- Outdoor targets are to be met at all outdoor areas as far as is reasonable and practicable to do so using the various noise mitigation measures outlined in the Guidelines.

The application of SPP 5.4 is to consider anticipated traffic volumes for the next 20 years from when the noise assessment has been undertaken.

Table 2-2 sets out noise targets that are to be achieved by new or upgraded roads, under which SPP 5.4 applies.

Table 2-2: Noise Targets for Roads

Scenario	Outdoor Noise Target	
Road Upgrade	60 dB $L_{Aeq(Day)}$	55 dB $L_{Aeq(Night)}$

Notes:

- Day period is from 6am to 10pm and night period from 10pm to 6am.
- The outdoor noise target is to be measured at 1-metre from the most exposed, habitable[1] facade of a noise sensitive building.
- Outdoor targets are to be met at all outdoor areas as far as is reasonable and practicable to do so using the various noise mitigation measures outlined in the Guidelines. For example, it is likely unreasonable for a transport infrastructure provider to achieve the outdoor targets at more than 1 or 2 floors of an adjacent development with direct line of sight to the traffic.

In this case, Rowley Road extension will be a new road and therefore the 55 dB $L_{Aeq(Day)}$ and 50 dB $L_{Aeq(Night)}$ criteria of *Table 2-2* are applicable. If these criteria were achieved by the road builder, there would be no mitigation requirements to the subdivision.

[1] *A habitable room is defined in State Planning Policy 3.1 as a room used for normal domestic activities that includes a bedroom, living room, lounge room, music room, sitting room, television room, kitchen, dining room, sewing room, study, playroom, sunroom, gymnasium, fully enclosed swimming pool or patio.*

3. METHODOLOGY

Noise modelling has been undertaken in accordance with the requirements of SPP 5.4 and associated Guidelines. As this section of Rowley Road does not yet exist and the existing section does not carry representative traffic volumes, noise monitoring has not been undertaken.

To predict the noise emissions, the computer program *SoundPLAN 8.2* was utilised incorporating the *Calculation of Road Traffic Noise* (CoRTN) algorithms, modified to reflect Australian conditions. The modifications included the following:

- Vehicles were separated into heavy (Austroads Class 3 upwards) and non-heavy (Austroads Class 1 and 2) with non-heavy vehicles having a source height of 0.5 metres above road level and heavy vehicles having two source heights at 1.5 metres and 3.6 metres above road level;
- A -0.8 dB correction has been applied to the lower level heavy vehicle noise source and -8.0 dB to the higher level noise source based on the *Transportation Noise Reference Book*; Paul Nelson (1987), so as to provide consistent results with the CoRTN algorithms;
- Adjustments of -0.8 dB and -1.7 dB have been applied to the predicted levels for the 'free-field' and 'at façade' cases respectively, based on the findings of *An Evaluation of the U.K. DoE Traffic Noise Prediction*; Australian Road Research Board, Report 122 ARRB – NAASRA Planning Group (March 1983).

Predictions are made at heights of 1.4 metres above ground floor level for single storey buildings and 4.2 metres above ground floor level for possible first floors of double storey buildings. The noise is predicted at 1-metre from an assumed building façade, resulting in a + 2.5 dB correction due to reflected noise.

Various input data are included in the modelling and these are discussed in *Section 3.1* to *Section 3.2*.

3.1. Ground Topography

Finished lot levels and road design data for this project were provided by Cossill & Webley dated 17 May 2022, as a 3D AutoCAD file. The road design is understood to be the latest provided by Main Roads WA, however is subject to change noting there is no planned timeframe for the construction of this road.

Indicative building outlines have been included as these can provide barrier attenuation when located between a source and a receiver, in much the same way as a hill or wall. All buildings are assumed to be single storey with heights of 3.5 metres. This means where modelling is undertaken to a possible upper floor, the noise is predicting above these building outlines.

3.2. Road Surface

The corrections applied for different road surface finishes are provided in *Table 3-1*.

Table 3-1: Noise Relationship Between Different Road Surfaces

Chip Seal				Asphalt			
14mm	10mm	5mm	Slurry	Dense Graded	Novachip	Stone Mastic	Open Graded
+3.5 dB	+2.5 dB	+1.5 dB	+1.0 dB	0.0 dB	-0.2 dB	-1.5 dB	-2.5 dB

Given the obligations for a new road to achieve the outdoor noise target, the assumed road surfaces are:

- Rowley Road – Dense Graded Asphalt; and
- Hammond Road – Dense Graded Asphalt.

3.3. Vehicle Speed

The posted speeds are assumed to be:

- Rowley Road – 80 km/hr; and
- Hammond Road – 70 km/hr.

3.4. Traffic Volumes

Forecast 2041 traffic volumes were obtained from Main Roads WA to City of Cockburn (Lang Fong, Planning Information Manager, Email dated 24 January 2022). *Table 3-2* provides the traffic volume input data in the model.

Table 3-2: Traffic Information Used in Noise Modelling

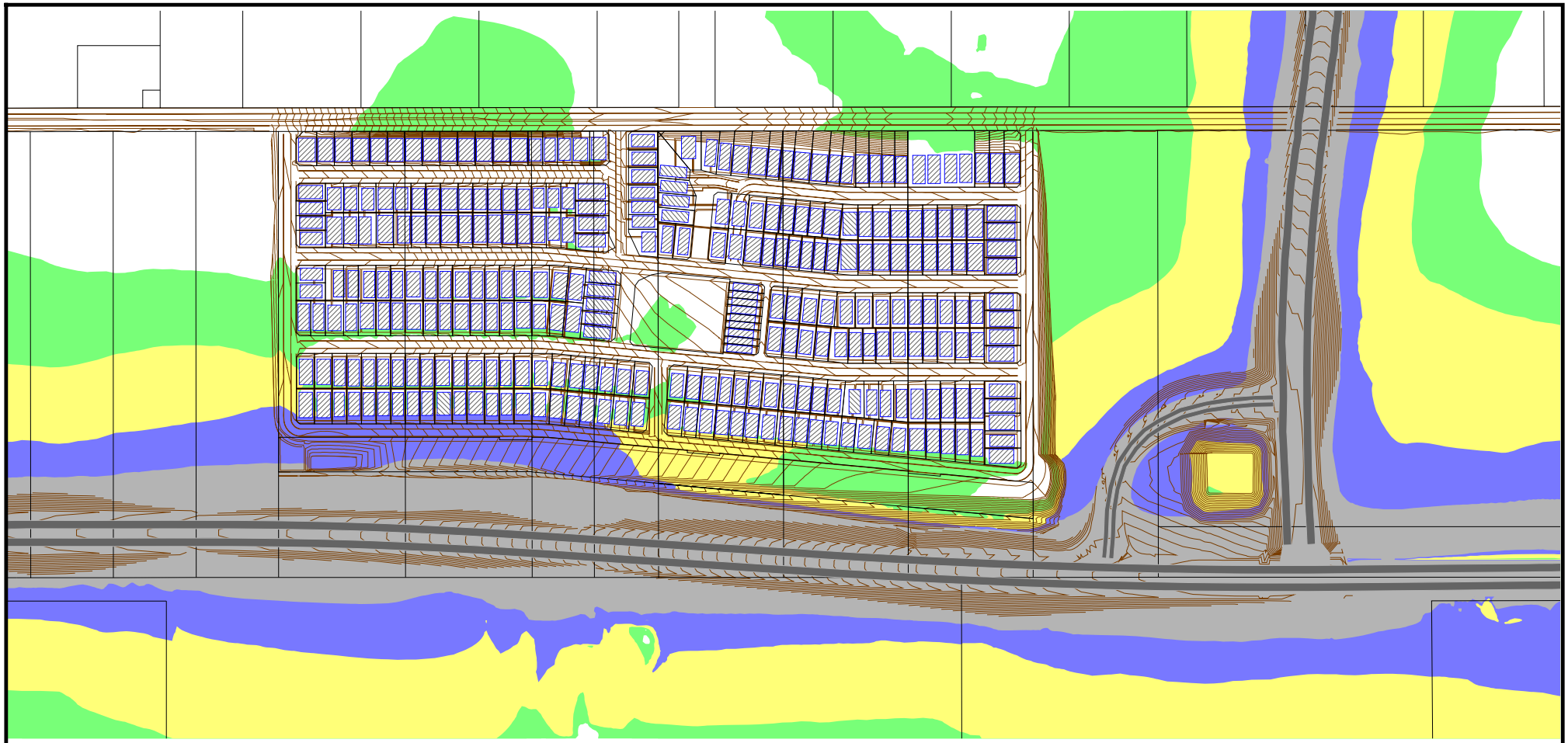
Road	Section	Direction	Traffic Volume	% Heavy Vehicles
Rowley Road	West of Hammond Road	Eastbound	19,200	19
		Westbound	14,900	19
	East of Hammond Road	Eastbound	17,700	19
		Westbound	15,700	19
Hammond Road	North of Rowley Road	Northbound	16,600	5
		Southbound	14,000	5
	Interchange	Northbound	12,700	5
		Southbound	11,600	5
	On/Off Ramps	Northbound	4,800	5
		Southbound	3,300	5

3.5. Ground Absorption

The ground absorption has been assumed to be 0.0 (0%) for the roads and 0.5 (50%) through the subdivision, noting that 0.0 represents hard reflective surfaces such as water and 1.0 represents absorptive surfaces such as grass.

4. RESULTS

The noise modelling results are provided in *Figure 4-1* and *Figure 4-2* as $L_{Aeq(Day)}$ noise level contour plots, being for the future traffic conditions at ground floor height and first floor height level. It can be seen that the outdoor noise target will be exceeded.



Lots 9003, 809, 805, 9001, 117 & 9002, Hammond Park - Future 2041 $L_{Aeq(Day)}$ Noise Level Contours to Ground Floor

Assumed Road Surfaces are:
Rowley Road: Dense Graded Asphalt
Hammond Road and Ramps: Dense Graded Asphalt

SoundPLAN v8.2
CoRTN Algorithms

17 October 2023

Lloyd George Acoustics
PO Box 717
HILLARYS WA 6923
(08) 9401 7770

Length Scale 1:5000

0 25 50 100 150 200 m

Figure 4-1

Signs and symbols

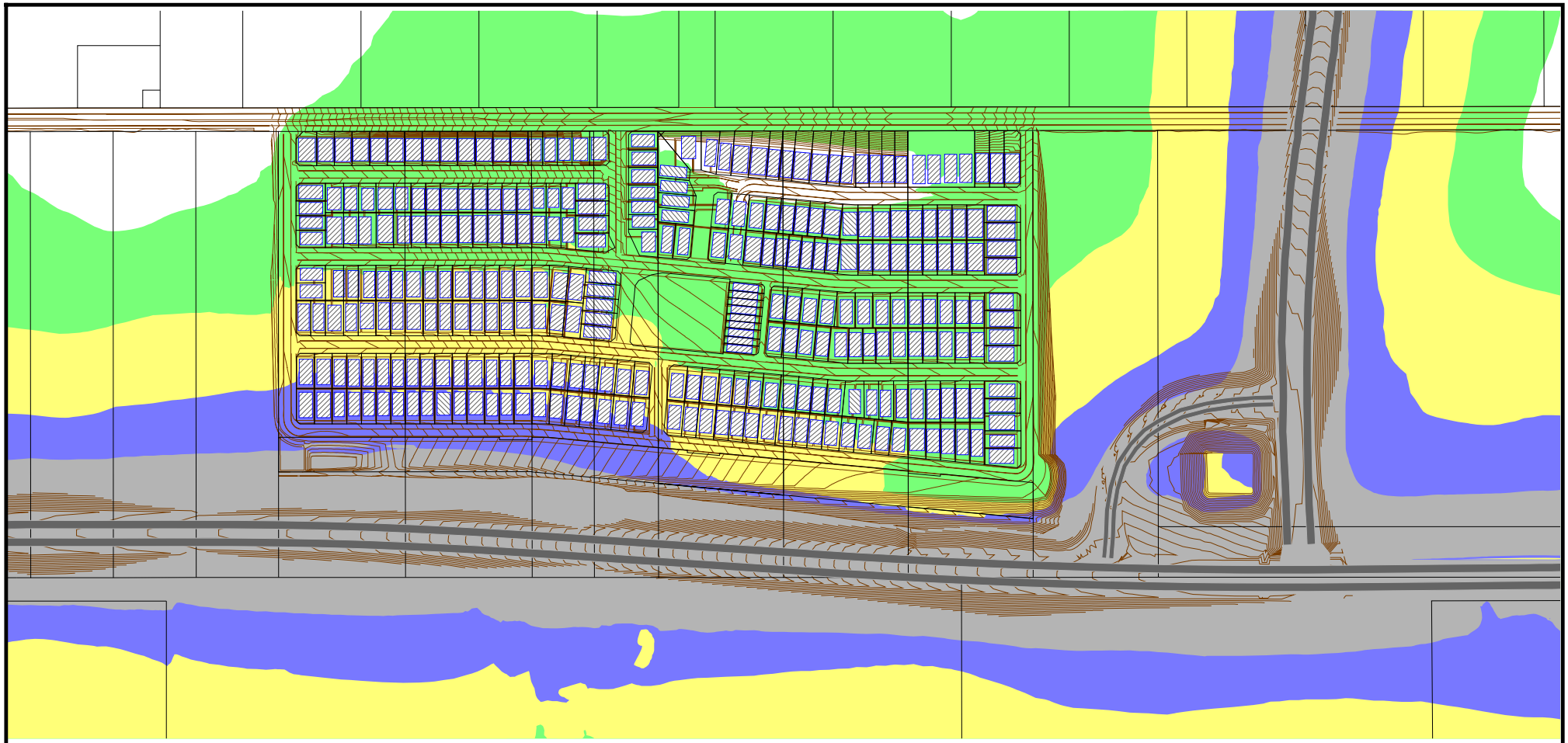
- Road
- Indicative Building
- Elevation line

N

Noise levels
$L_{Aeq(Day)}$ dB

<= 55	
<= 56	Exposure A
<= 57	
<= 58	
<= 59	Exposure B
<= 60	
<= 61	
<= 62	
<= 63	Exposure C
<= 64	
<= 65	
<= 66	
> 66	Exposure D

SPP 5.4 (Sep 2019)



Lots 9003, 809, 805, 9001, 117 & 9002, Hammond Park - Future 2041 $L_{Aeq(Day)}$ Noise Level Contours to First Floor

Assumed Road Surfaces are:
Rowley Road: Dense Graded Asphalt
Hammond Road and Ramps: Dense Graded Asphalt

SoundPLAN v8.2
CoRTN Algorithms

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Length Scale 1:5000

0 25 50 100 150 200 m

Figure 4-2

Signs and symbols

- Road
- Indicative Building
- Elevation line

N

Noise levels
$L_{Aeq(Day)}$ dB

<= 55	
<= 56	Exposure A
<= 57	
<= 58	
<= 59	Exposure B
<= 60	
<= 61	
<= 62	
<= 63	Exposure C
<= 64	
<= 65	
<= 66	
> 66	Exposure D

SPP 5.4 (Sep 2019)

5. ASSESSMENT

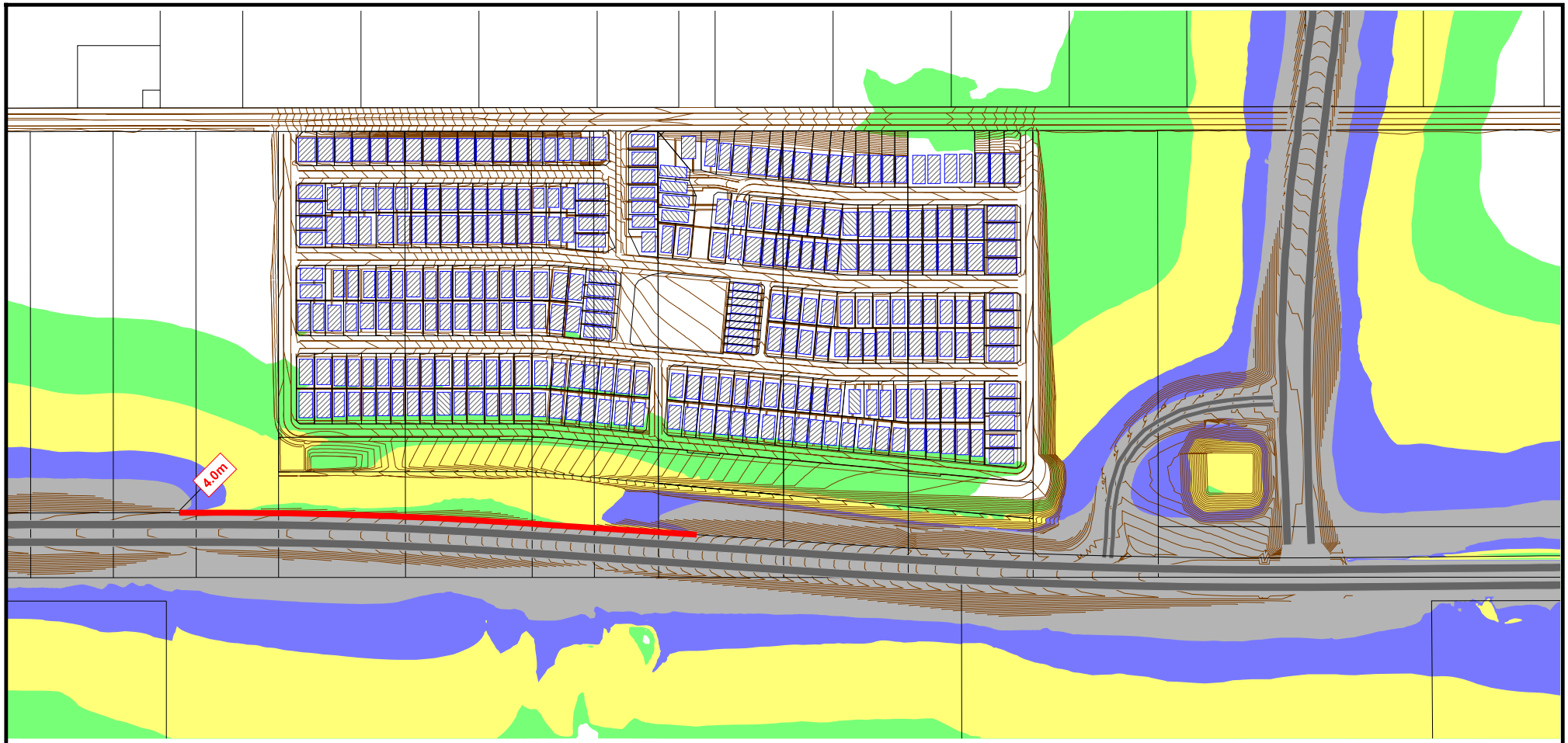
The objectives of SPP 5.4 are to achieve:

- Indoor noise levels specified in *Table 2-1* in noise-sensitive areas (e.g. bedrooms and living rooms of houses); and
- A reasonable degree of acoustic amenity for outdoor living areas on each residential lot.

Where the outdoor noise targets of *Table 2-1* are achieved, no further noise controls are necessary. With reference to *Section 4*, it is evident the outdoor noise target will be exceeded at some lots. Following discussions between stakeholders (refer *Appendix B*), the preferred noise mitigation strategy is:

- Road builder to construct a 4-metre high wall alongside the road or mitigation to provide an equivalent result;
- Developer is to incorporate Quiet House Packages to affected lots, including notifications on lot titles. *Appendix A* provides the Quiet House Packages, as taken from the SPP 5.4 Guidelines. Alternatives to the provided Packages can be accepted if supported by a report from a suitably qualified acoustical consultant (member firm of the Association of Australasian Acoustical Consultants (AAAC)) once the specific house plans for the lot are available.

The noise contours associated with the above are provided in *Figure 5-1* (ground floor) and *Figure 5-2* (first floor) with the noise mitigation shown on *Figure 5-3* (ground floor) and *Figure 5-4* (first floor).



Lots 9003, 809, 805, 9001, 117 & 9002, Hammond Park -
Future 2041 $L_{Aeq(Day)}$ Noise Level Contours to Ground Floor
Includes 4.0m High Wall to Achieve Exposure A at Ground Floor

Assumed Road Surfaces are:
Rowley Road: Dense Graded Asphalt
Hammond Road and Ramps: Dense Graded Asphalt

SoundPLAN v8.2
CoRTN Algorithms

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HILLARYS WA 6923
(08) 9401 7770

Length Scale 1:5000
0 25 50 100 150 200 m

Figure 5-1

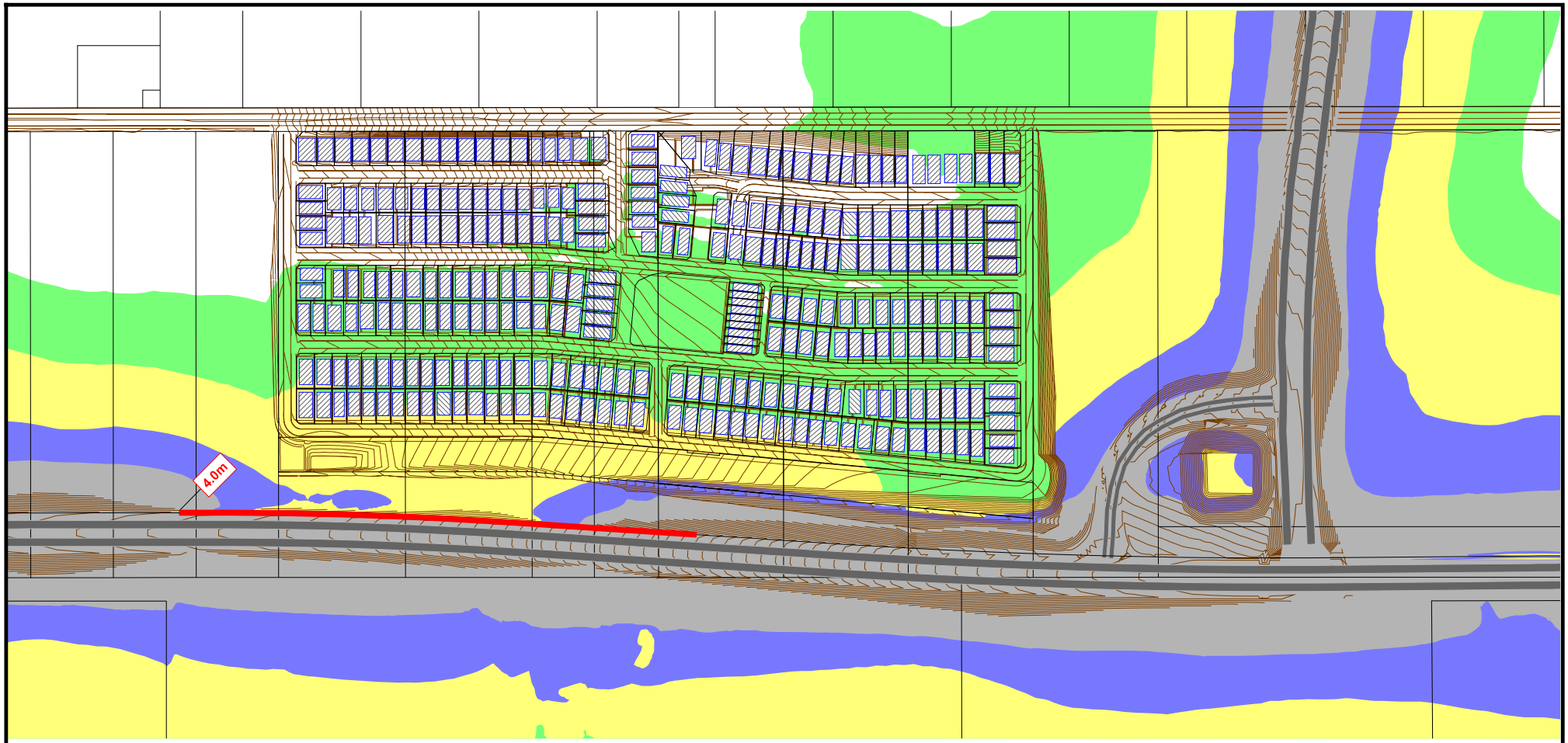
Signs and symbols
- Road
- Indicative Building
- Elevation line
- Wall

N

Noise levels
$L_{Aeq(Day)}$ dB

<= 55	
<= 56	Exposure A
<= 57	
<= 58	
<= 59	Exposure B
<= 60	
<= 61	
<= 62	
<= 63	Exposure C
<= 64	
<= 65	
<= 66	
> 66	Exposure D

SPP 5.4 (Sep 2019)



Lots 9003, 809, 805, 9001, 117 & 9002, Hammond Park -
Future 2041 $L_{Aeq(Day)}$ Noise Level Contours to First Floor
Includes 4.0m High Wall to Achieve Exposure A at Ground Floor

Assumed Road Surfaces are:
Rowley Road: Dense Graded Asphalt
Hammond Road and Ramps: Dense Graded Asphalt

SoundPLAN v8.2
CoRTN Algorithms

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Length Scale 1:5000
0 25 50 100 150 200 m

Figure 5-2

Signs and symbols
- Road
- Indicative Building
- Elevation line
- Wall

N

Noise levels
$L_{Aeq(Day)}$ dB

<= 55	
<= 56	Exposure A
<= 57	
<= 58	
<= 59	Exposure B
<= 60	
<= 61	
<= 62	
<= 63	Exposure C
<= 64	
<= 65	
<= 66	
> 66	Exposure D

SPP 5.4 (Sep 2019)

Lots 9003, 809, 805, 9001, 117 & 9002, Hammond Park -
Noise Mitigation to Ground Floor
Wall to Achieve Exposure A to Ground Floor

Assumed Road Surfaces are:
Rowley Road: Dense Graded Asphalt
Hammond Road and Ramps: Dense Graded Asphalt

SoundPLAN v8.2
CoRTN Algorithms

17 October 2023

Signs and symbols

- Road
- Wall
- Elevation line
- Quiet House A
- Quiet House B
- Quiet House C

N

Lloyd George Acoustics
PO Box 717
HILLARYS WA 6923
(08) 9401 7770

Length Scale 1:5000

0 25 50 100 150 200 m

Figure 5-3

Lots 9003, 809, 805, 9001, 117 & 9002, Hammond Park -
Noise Mitigation to First Floor
Wall to Achieve Exposure A to Ground Floor

Assumed Road Surfaces are:
Rowley Road: Dense Graded Asphalt
Hammond Road and Ramps: Dense Graded Asphalt

SoundPLAN v8.2
CoRTN Algorithms

17 October 2023

Signs and symbols

- Road
- Wall
- Elevation line
- Quiet House A
- Quiet House B
- Quiet House C

N

Lloyd George Acoustics
PO Box 717
HILLARYS WA 6923
(08) 9401 7770

Length Scale 1:5000

0 25 50 100 150 200 m

Figure 5-4

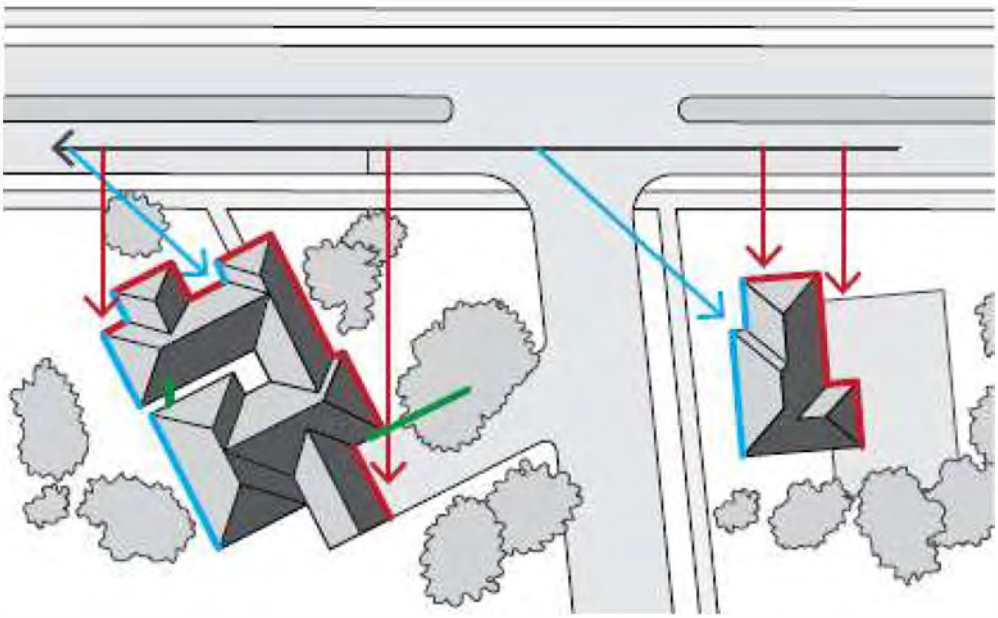
Appendix A – Quiet House Packages

The packages and information provided on the following pages are taken from *Road and Rail Noise Guidelines* (September 2019).

Where outdoor and indoor noise levels received by a noise-sensitive land-use and/or development exceed the policy's noise target, implementation of quiet house requirements is an acceptable solution.

With regards to the packages, the following definitions are provided:

- **Facing** the transport corridor (red): Any part of a building façade is 'facing' the transport corridor if any straight line drawn perpendicular (at a 90 degree angle) to its nearest road lane or railway line intersects that part of the façade without obstruction (ignoring any fence).
- **Side-on** to transport corridor (blue): Any part of a building façade that is not 'facing' is 'side-on' to the transport corridor if any straight line, at any angle, can be drawn from it to intersect the nearest road lane or railway line without obstruction (ignoring any fence).
- **Opposite** to transport corridor (green): Neither 'side on' nor 'facing', as defined above.



Quiet House Package A

56-58 dB $L_{Aeq(Day)}$ & 51-53 dB $L_{Aeq(Night)}$

Element	Orientation	Room	
		Bedroom	Indoor Living and Work Areas
External Windows	Facing	• Up to 40% floor area ($R_w + C_{tr} \geq 28$): – Sliding or double hung with minimum 10mm single or 6mm-12mm-10mm double insulated glazing; – Sealed awning or casement windows with minimum 6mm glass. • Up to 60% floor area ($R_w + C_{tr} \geq 31$): – Sealed awning or casement windows with minimum 6mm glass.	• Up to 40% floor area ($R_w + C_{tr} \geq 25$): – Sliding or double hung with minimum 6mm single or 6mm-12mm-6mm double insulated glazing; • Up to 60% floor area ($R_w + C_{tr} \geq 28$); • Up to 80% floor area ($R_w + C_{tr} \geq 31$).
	Side On	As above, except $R_w + C_{tr}$ values may be 3 dB less or max % area increased by 20%.	
	Opposite	No specific requirements	
External Doors	Facing	• Fully glazed hinged door with certified $R_w + C_{tr} \geq 28$ rated door and frame including seals and 6mm glass.	• Doors to achieve $R_w + C_{tr} \geq 25$: – 35mm Solid timber core hinged door and frame system certified to R_w 28 including seals; – Glazed sliding door with 10mm glass and weather seals.
	Side On	As above, except $R_w + C_{tr}$ values may be 3 dB less.	
	Opposite	No specific requirements	
External Walls	All	• $R_w + C_{tr} \geq 45$: – Two leaves of 90mm thick clay brick masonry with minimum 20mm cavity; or – Single leaf of 150mm brick masonry with 13mm cement render on each face; or – One row of 92mm studs at 600mm centres with: ▪ Resilient steel channels fixed to the outside of the studs; and ▪ 9.5mm hardboard or fibre cement sheeting or 11mm fibre cement weatherboards fixed to the outside; ▪ 75mm thick mineral wool insulation with a density of at least 11kg/m^3; and ▪ 2 x 16mm fire-rated plasterboard to inside.	
Roofs and Ceilings	All	• $R_w + C_{tr} \geq 35$: • Concrete or terracotta tile or metal sheet roof with sarking and at least 10mm plasterboard.	
Outdoor Living Areas		At least one outdoor living area located on the opposite side of the building from the transport corridor or at least one ground level outdoor living area screened using a solid continuous fence or other structure of minimum 2 metres height above ground level.	

Quiet House Package B

59-62 dB $L_{Aeq(Day)}$ & 54-57 dB $L_{Aeq(Night)}$

Element	Orientation	Room	
		Bedroom	Indoor Living and Work Areas
External Windows	Facing	• Up to 40% floor area ($R_w + C_{tr} \geq 31$): – Fixed sash, awning or casement with minimum 6mm glass or 6mm-12mm-6mm double insulated glazing. • Up to 60% floor area ($R_w + C_{tr} \geq 34$): – Fixed sash, awning or casement with minimum 10mm glass or 6mm-12mm-10mm double insulated glazing.	• Up to 40% floor area ($R_w + C_{tr} \geq 28$): – Sliding or double hung with 6mm-12mm-10mm double insulated glazing; – Sealed awning or casement windows with minimum 6mm glass. • Up to 60% floor area ($R_w + C_{tr} \geq 31$); • Up to 80% floor area ($R_w + C_{tr} \geq 34$).
	Side On	As above, except $R_w + C_{tr}$ values may be 3 dB less or max % area increased by 20%.	
	Opposite	As above, except $R_w + C_{tr}$ values may be 6 dB less or max % area increased by 20%.	
External Doors	Facing	• Fully glazed hinged door with certified $R_w + C_{tr} \geq 31$ rated door and frame including seals and 10mm glass.	• Doors to achieve $R_w + C_{tr} \geq 28$: – 40mm Solid timber core hinged door and frame system certified to R_w 32 including seals; – Fully glazed hinged door with certified $R_w + C_{tr} \geq 28$ rated door and frame including seals and 6mm glass.
	Side On	As above, except $R_w + C_{tr}$ values may be 3 dB less or max % area increased by 20%.	
	Opposite	As above, except $R_w + C_{tr}$ values may be 6 dB less or max % area increased by 20%.	
External Walls	All	• $R_w + C_{tr} \geq 50$: – Two leaves of 90mm thick clay brick masonry with minimum 50mm cavity between leaves and 25mm glasswool or polyester (24kg/m³). Resilient ties used where required to connect leaves. – Two leaves of 110mm clay brick masonry with minimum 50mm cavity between leaves and 25mm glasswool or polyester insulation (24kg/m³). – Single leaf of 220mm brick masonry with 13mm cement render on each face. – 150mm thick unlined concrete panel or 200mm thick concrete panel with one layer of 13mm plasterboard or 13mm cement render on each face. – Single leaf of 90mm clay brick masonry with: ▪ A row of 70mm x 35mm timber studs or 64mm steel studs at 600mm centres; ▪ A cavity of 25mm between leaves; ▪ 50mm glasswool or polyester insulation (11kg/m³) between studs; and ▪ One layer of 10mm plasterboard fixed to the inside face.	
Roofs and Ceilings	All	• $R_w + C_{tr} \geq 35$: – Concrete or terracotta tile or metal sheet roof with sarking and at least 10mm plasterboard ceiling with R3.0+ fibrous insulation.	
Outdoor Living Areas		At least one outdoor living area located on the opposite side of the building from the transport corridor or at least one ground level outdoor living area screened using a solid continuous fence or other structure of minimum 2.4 metres height above ground level.	

Quiet House Package C

63-66 dB $L_{Aeq(Day)}$ & 58-61 dB $L_{Aeq(Night)}$

Element	Orientation	Room	
		Bedroom	Indoor Living and Work Areas
External Windows	Facing	• Up to 20% floor area ($R_w + C_{tr} \geq 31$): – Fixed sash, awning or casement with minimum 6mm glass or 6mm-12mm-6mm double insulated glazing. • Up to 40% floor area ($R_w + C_{tr} \geq 34$): – Fixed sash, awning or casement with minimum 10mm glass or 6mm-12mm-10mm double insulated glazing.	• Up to 40% floor area ($R_w + C_{tr} \geq 31$): – Fixed sash, awning or casement with minimum 6mm glass or 6mm-12mm-6mm double insulated glazing. • Up to 60% floor area ($R_w + C_{tr} \geq 34$): – Fixed sash, awning or casement with minimum 10mm glass or 6mm-12mm-10mm double insulated glazing.
	Side On	As above, except $R_w + C_{tr}$ values may be 3 dB less or max % area increased by 20%.	
	Opposite	As above, except $R_w + C_{tr}$ values may be 6 dB less or max % area increased by 20%.	
External Doors	Facing	• Not recommended.	• Doors to achieve $R_w + C_{tr} \geq 30$: – Fully glazed hinged door with certified $R_w + C_{tr} \geq 31$ rated door and frame including seals and 10mm glass; – 40mm Solid timber core side hinged door, frame and seal system certified to R_w 32 including seals. Any glass inserts to be minimum 6mm.
	Side On	As above, except $R_w + C_{tr}$ values may be 3 dB less or max % area increased by 20%.	
	Opposite	As above, except $R_w + C_{tr}$ values may be 6 dB less or max % area increased by 20%.	
External Walls	All	• $R_w + C_{tr} \geq 50$: – Two leaves of 90mm thick clay brick masonry with minimum 50mm cavity between leaves and 25mm glasswool or polyester insulation (24kg/m³). Resilient ties used where required to connect leaves. – Two leaves of 110mm clay brick masonry with minimum 50mm cavity between leaves and 25mm glasswool or polyester insulation (24kg/m³). – Single leaf of 220mm brick masonry with 13mm cement render on each face. – 150mm thick unlined concrete panel or 200mm thick concrete panel with one layer of 13mm plasterboard or 13mm cement render on each face. – Single leaf of 90mm clay brick masonry with: ▪ A row of 70mm x 35mm timber studs or 64mm steel studs at 600mm centres; ▪ A cavity of 25mm between leaves; ▪ 50mm glasswool or polyester insulation (11kg/m³) between studs; and ▪ One layer of 10mm plasterboard fixed to the inside face.	
Roofs and Ceilings	All	• $R_w + C_{tr} \geq 40$: – Concrete or terracotta tile roof with sarking, or metal sheet roof with foil backed R2.0+ fibrous insulation between steel sheeting and roof battens; – R3.0+ insulation batts above ceiling; – 2 x 10mm plasterboard ceiling or 1 x 13mm sound-rated plasterboard affixed using steel furring channel to ceiling rafters.	
Outdoor Living Areas		At least one outdoor living area located on the opposite side of the building from the transport corridor or at least one ground level outdoor living area screened using a solid continuous fence or other structure of minimum 2.4 metres height above ground level.	

Mechanical Ventilation requirements

In implementing the acceptable treatment packages, fresh air requirements of the National Construction Code must be satisfied on the basis of windows closed. Whilst not the only solution, the most common is mechanical ventilation / air-conditioning is installed with the following considerations:

- Acoustically rated openings and ductwork to provide a minimum sound reduction performance of R_w 40 dB into sensitive spaces;
- Evaporative systems require attenuated ceiling air vents to allow closed windows;
- Refrigerant based systems need to be designed to achieve National Construction Code fresh air ventilation requirements;
- Openings such as eaves, vents and air inlets must be acoustically treated, closed or relocated to building sides facing away from the corridor where practicable.

Notification

Notifications on title advise prospective purchasers of the potential for noise impacts from major transport corridors and help with managing expectations.

The Notification is to state as follows:

This lot is in the vicinity of a transport corridor and is affected, or may in the future be affected, by road and rail transport noise. Road and rail transport noise levels may rise or fall over time depending on the type and volume of traffic.

Appendix B – Letter from Main Roads WA

Enquiries: Michelle Ferraro on (08) 9323 6390
Our Ref: 21/1076 (D22#1028706)

23 September 2022

Avril Thomson
Cossill & Webley
B12, 431 Roberts Road
SUBIACO WA 6008

Email: avrilt@cosweb.com.au (via email)

Dear Avril,

TRANSPORTATION NOISE ASSESSMENT - LOTS 117, 805, 809, 9001 AND 9003 WATTLEUP ROAD, HAMMOND PARK

Main Roads refers to your correspondence dated 11 August 2022 relating to the above approved subdivision.

Main Roads has reviewed the following documents:

External Reference	Document Title
21026117-03	Lloyd George Acoustics Transportation Noise Assessment

Please be advised that Main Roads finds the above revision of the Transportation Noise Assessment acceptable and agrees to Option 3 – Shared Noise Control Responsibility between the developer and the road builder subject to the relevant Quiet House design packages being applied to the subject lots by the developer.

In relation to works impacting the Rowley Road Planning Control Area, please continue to liaise with Lindsay Broadhurst (Director Road Planning) on 9323 4511.

If you require any further information regarding the above please email planninginfo@mainroads.wa.gov.au.

Yours sincerely

Maryanne Thornely
Road Access and Planning Manager

Appendix C – Terminology

The following is an explanation of the terminology used throughout this report:

- **Decibel (dB)**

The decibel is the unit that describes the sound pressure levels of a noise source. It is a logarithmic scale referenced to the threshold of hearing.

- **A-Weighting**

An A-weighted noise level has been filtered in such a way as to represent the way in which the human ear perceives sound. This weighting reflects the fact that the human ear is not as sensitive to lower frequencies as it is to higher frequencies. An A-weighted sound level is described as L_A, dB.

- **L_{eq}**

The L_{eq} level represents the average noise energy during a measurement period.

- **L_1**

The L_1 level represents the noise level exceeded for 1 percent of the measurement period and is considered to represent the average of the maximum noise levels measured.

- **L_{10}**

The L_{10} level represents the noise level exceeded for 10 percent of the measurement period and is considered to represent the "intrusive" noise level.

- **L_{90}**

The L_{90} level represents the noise level exceeded for 90 percent of the measurement period and is considered to represent the "background" noise level.

- **$L_{Aeq(Day)}$**

The $L_{Aeq(Day)}$ level is the logarithmic average of the L_{Aeq} levels from 6.00am to 10.00pm.

- **$L_{Aeq(Night)}$**

The $L_{Aeq(Night)}$ level is the logarithmic average of the L_{Aeq} levels from 10.00pm to 6.00am.

- **$L_{A10,18hour}$**

The $L_{A10,18hour}$ level is the arithmetic average of the hourly L_{A10} levels between 6.00am and midnight.

- **$L_{Aeq,24hour}$**

The $L_{Aeq,24hour}$ level is the logarithmic average of the L_{Aeq} levels from over an entire day.

- **Noise-sensitive land use and/or development**

Land-uses or development occupied or designed for occupation or use for residential purposes (including dwellings, residential buildings or short-stay accommodation), caravan park, camping ground, educational establishment, child care premises, hospital, nursing home, corrective institution or place of worship.

- **R_w**

This is the weighted sound reduction index. It is a single number rating determined by moving a grading curve in integral steps against the laboratory measured transmission loss until the sum of the deficiencies at each one-third-octave band, between 100 Hz and 3.15 kHz, does not exceed 32 dB. The higher the R_w value, the better the acoustic performance.

- **C_{tr}**

This is a spectrum adaptation term for airborne noise and provides a correction to the R_w value to suit source sounds with significant low frequency content such as road traffic or home theatre systems. A wall that provides a relatively high level of low frequency attenuation (i.e. masonry) may have a value in the order of – 4 dB, whilst a wall with relatively poor attenuation at low frequencies (i.e. stud wall) may have a value in the order of -12 dB.

- **About the Term 'Reasonable'**

An assessment of reasonableness should demonstrate that efforts have been made to resolve conflicts without comprising on the need to protect noise-sensitive land-use activities. For example, have reasonable efforts been made to design, relocate or vegetate a proposed noise barrier to address community concerns about the noise barrier height? Whether a noise mitigation measure is reasonable might include consideration of:

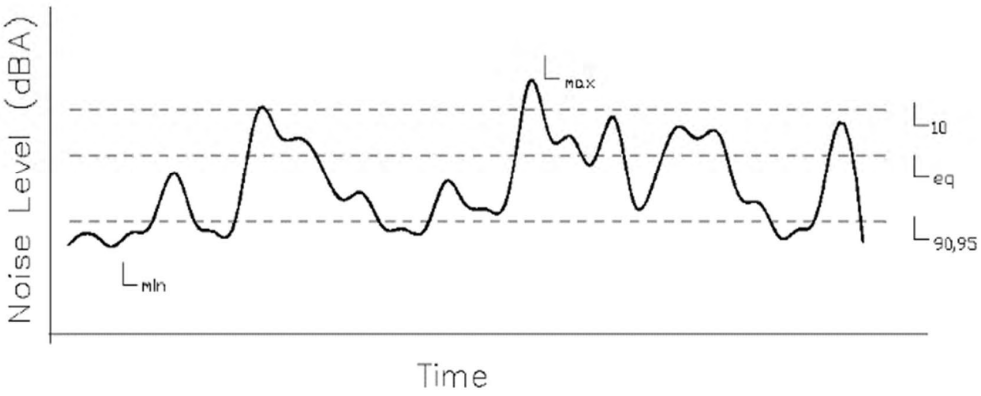
- The noise reduction benefit provided;
- The number of people protected;
- The relative cost vs benefit of mitigation;
- Road conditions (speed and road surface) significantly differ from noise forecast table assumptions;
- Existing and future noise levels, including changes in noise levels;
- Aesthetic amenity and visual impacts;
- Compatibility with other planning policies;
- Differences between metropolitan and regional situations and whether noise modelling requirements reflect the true nature of transport movements;
- Ability and cost for mobilisation and retrieval of noise monitoring equipment in regional areas;
- Differences between Greenfield and infill development;
- Differences between freight routes and public transport routes and urban corridors;
- The impact on the operational capacity of freight routes;
- The benefits arising from the proposed development;
- Existing or planned strategies to mitigate the noise at source.

- **About the Term 'Practicable'**

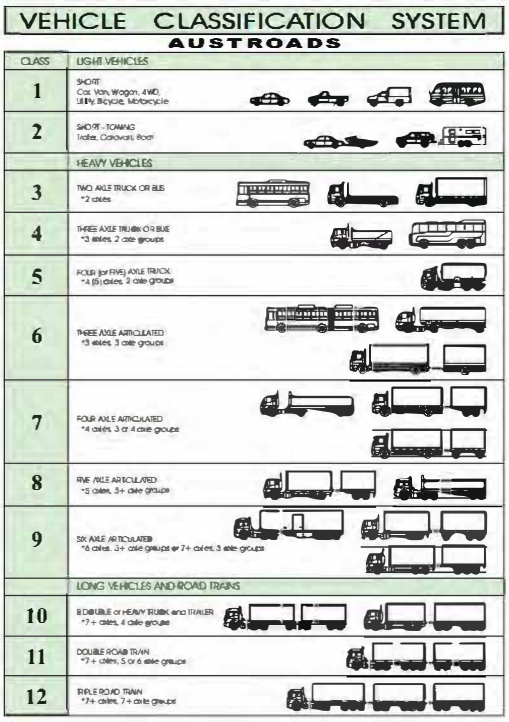
'Practicable' considerations for the purposes of the policy normally relate to the engineering aspects of the noise mitigation measures under evaluation. It is defined as "reasonably practicable having regard to, among other things, local conditions and circumstances (including costs) and to the current state of technical knowledge" (*Environmental Protection Act 1986*). These may include:

- Limitations of the different mitigation measures to reduce transport noise;
- Competing planning policies and strategies;
- Safety issues (such as impact on crash zones or restrictions on road vision);
- Topography and site constraints (such as space limitations);
- Engineering and drainage requirements;
- Access requirements (for driveways, pedestrian access and the like);
- Maintenance requirements;
- Bushfire resistance or BAL ratings;
- Suitability of the building for acoustic treatments.

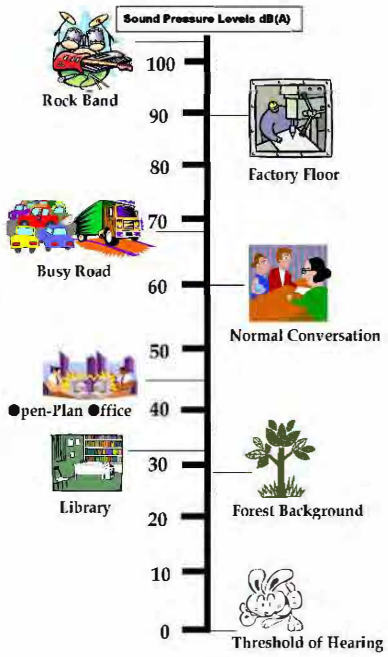
- **Chart of Noise Level Descriptors**



- **Austroads Vehicle Class**



- **Typical Noise Levels**



HATCH