Government of Western Australia
Development Assessment Panels

Metro Outer Joint Development Assessment Panel Agenda

Meeting Date and Time: Tuesday, 6 September 2022; 9:30am
Meeting Number: MOJDAP/196
Meeting Venue: Electronic Means

To connect to the meeting via your computer -
https://us06web.zoom.us/j/88174226721

To connect to the meeting via teleconference dial the following phone number -
+61 8 7150 1149

Insert Meeting ID followed by the hash (#) key when prompted –
881 7422 6721

This DAP meeting will be conducted by electronic means (Zoom) open to the public rather than requiring attendance in person.

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Attendance

DAP Members

Mr Eugene Koltazs (Presiding Member)
Mr Brian Curtis (A/Deputy Presiding Member)
Ms Diana Goldswain (A/Third Specialist Member)
Cr Lorna Buchan (Local Government Member, City of Rockingham)
Cr Mark Jones (Local Government Member, City of Rockingham)

Officers in attendance

Ms Casey Gillespe (City of Rockingham)
Mr David Waller (City of Rockingham)
Mr David Banovic (City of Rockingham)

Minute Secretary

Mr Stephen Haimes (DAP Secretariat)

Applicants and Submitters

Mr Shaun O'Neill (Ecograf Limited)

Members of the Public / Media

Nil.

1. Opening of Meeting, Welcome and Acknowledgement

The Presiding Member declares the meeting open and acknowledges the traditional owners and pay respects to Elders past and present of the land on which the meeting is being held.

This meeting is being conducted by electronic means (Zoom) open to the public. Members are reminded to announce their name and title prior to speaking.

2. Apologies

Ms Karen Hyde (Deputy Presiding Member)
Mr Jason Hick (Third Specialist Member)

3. Members on Leave of Absence

Nil.

4. Noting of Minutes

Signed minutes of previous meetings are available on the DAP website.

5. Declarations of Due Consideration

Any member who is not familiar with the substance of any report or other information provided for consideration at the DAP meeting must declare that fact before the meeting considers the matter.

6. Disclosure of Interests

Member	Item	Nature of Interest
Cr Mark Jones	8.1	Impartiality Interest – Under clause 2.4.9 of the DAP Code of Conduct, Cr Jones participated in the prior Council decision in accordance with his functions as a member of a local government. Cr Jones undertakes to exercise judgment in relation to any DAP application before him, which he will consider on its planning merits.
Cr Lorna Buchan	8.1	Impartiality Interest – Under clause 2.4.9 of the DAP Code of Conduct, Cr Buchan participated in the prior Council decision in accordance with her functions as a member of a local government. Cr Buchan undertakes to exercise judgment in relation to any DAP application before her, which she will consider on its planning merits.

7. Deputations and Presentations

7.1 Mr Shaun O'Neill (EcoGraf) presenting in support of the recommendation for the application at Item 8.1. The presentation will address the project purpose and overview.

The City of Rockingham may be provided with the opportunity to respond to questions of the panel, as invited by the Presiding Member.

8. Form 1 – Responsible Authority Reports – DAP Applications

8.1 Lot 2 Zirconia Drive, East Rockingham

Development Description:	Industry (Graphite Processing Plant)
Applicant:	Shaun O'Neill (Ecograf Limited)
Owner:	DevelopmentWA
Responsible Authority:	City of Rockingham
DAP File No:	DAP/22/02182

9. Form 2 – Responsible Authority Reports – DAP Amendment or Cancellation of Approval

Nil.

10. State Administrative Tribunal Applications and Supreme Court Appeals

Current SAT Applications				
File No. & SAT DR No.	**LG Name**	**Property Location**	**Application Description**	**Date Lodged**
DAP/18/01543 DR 75/2022	City of Joondalup	Lot 649 (98) O'Mara Boulevard, Iluka	Commercial development	02/05/2022

11. General Business

In accordance with Section 7.3 of the DAP Standing Orders 2020 only the Presiding Member may publicly comment on the operations or determinations of a DAP and other DAP members should not be approached to make comment.

12. Meeting Closure

Government of **Western Australia**
Development Assessment Panels

Presentation Request Form

Regulation 40(3) and DAP Standing Orders 2020 cl. 3.5

Must be submitted at least 72 hours (3 ordinary days) before the meeting

Presentation Request Guidelines

Persons interested in presenting to a DAP must first consider whether their concern has been adequately addressed in the responsible authority report or other submissions. Your request will be determined by the Presiding Member based on individual merit and likely contribution to assist the DAP's consideration and determination of the application.

Presentations are not to exceed **5 minutes**. It is important to note that the presentation content will be **published on the DAP website** as part of the meeting agenda.

Please complete a separate form for each presenter and submit to daps@dplh.wa.gov.au

Presenter Details

Name	Shaun O'Neill – Executive Manager Project Development
Company (if applicable)	EcoGraf Limited
Please identify if you have any special requirements:	**YES** ☐ **NO** ☒ If yes, please state any accessibility or special requirements:

Meeting Details

DAP Name	Metro Outer Joint Development Assessment Panel
Meeting Date	6 September 2022
DAP Application Number	DAP/22/02182
Property Location	Lot 2 on Plan 404186, Zirconia Drive, East Rockingham
Agenda Item Number	8.1

Presentation Details

I have read the contents of the report contained in the Agenda and note that my presentation content will be published as part of the Agenda:	**YES** ☒
Is the presentation in support of or against the report recommendation)? *(contained within the Agenda)*	**SUPPORT** ☒ **AGAINST** ☐
Is the presentation in support of or against the proposed development?	**SUPPORT** ☒ **AGAINST** ☐
Will the presentation require power-point facilities?	**YES** ☐ **NO** ☒ **If yes, please attach**

Presentation Content*

These details may be circulated to the local government and applicant if deemed necessary by the Presiding Member. Handouts or power points will not be accepted on the day.

Brief sentence summary for inclusion on the Agenda	*The presentation will address:* Brief outline of the project purpose and overview following by a request for any questions from the Panel members.

In accordance with Clause 3.5.2 of the *DAP Standing Orders*, your presentation request must also be accompanied with a written document detailing the content of your presentation.

Please attach detailed content of presentation or provide below:

nil

ZIRCONIA STREET, LOT 2 EAST ROCKINGHAM – INDUSTRY (GRAPHITE PROCESSING PLANT)

Form 1 – Responsible Authority Report
(Regulation 12)

DAP Name:	Metro Outer Joint Development Assessment Panel	
Local Government Area:	City of Rockingham	
Applicant:	Shaun O'Neill / EcoGraf Limited	
Owner:	Development WA	
Value of Development:	$50 million ☒ Mandatory (Regulation 5) ☐ Opt In (Regulation 6)	
Responsible Authority:	City of Rockingham	
Authorising Officer:	Mr Peter Ricci, Acting Director Planning and Development Services	
LG Reference:	DD020.2022.00000031	
DAP File No:	DAP/22/02182	
Application Received Date:	14 February 2022	
Report Due Date:	24 August 2022	
Application Statutory Process Timeframe:	90 Days	
Attachment(s):	1. Development Application 2. Development Plans 3. Schedule of Submissions 4. Government Agency Advice	
Is the Responsible Authority Recommendation the same as the Officer Recommendation?	☒ Yes ☐ N/A	Complete Responsible Authority Recommendation section
	☐ No	Complete Responsible Authority and Officer Recommendation sections

Responsible Authority Recommendation

That the Metro Outer Joint Development Assessment Panel resolves to:

1. **Approve** DAP Application reference DAP/22/02182 and accompanying plans being:

   - Site Plan - Drawing No DA-001; Rev H, dated 20 June 2022;
   - Cluster 2 - Drawing No DA-103; Rev C, dated 20 June 2022;
   - Streetscape Elevations - Drawing No DA-002; Rev A, dated 6 February 2022;
   - Cluster 1 - Sheet 1 - Drawing No DA-101; Rev B, dated 8 February 2022;
   - Cluster 1 - Sheet 2- Drawing No.DA-102; Rev B, dated 8 February 2022;

- Cluster 3 - Drawing No DA-104; Rev B, dated 8 February 2022;
- 3D Views - Drawing No DA-105; Rev A, dated 8 February 2022.

in accordance with Clause 68 of Schedule 2 (Deemed Provisions) of the *Planning and Development (Local Planning Schemes) Regulations 2015*, and the provisions of the City of Rockingham Local Planning Scheme No. 2, subject to the following conditions:

Conditions

1. Pursuant to clause 26 of the Metropolitan Region Scheme, this approval is deemed to be an approval under clause 24(1) of the Metropolitan Region Scheme.

2. This decision constitutes planning approval only and is valid for a period of 4 years from the date of approval. If the subject development is not substantially commenced within the specified period, the approval shall lapse and be of no further effect.

3. All development must be carried out in accordance with the approved plans as listed save that, in the event of an inconsistency between the approved plans and a requirement of the conditions, the requirement of the conditions shall prevail.

4. Prior to applying for a Building Permit, a Stormwater Management Plan must be prepared by a suitably qualified engineer showing how stormwater will be contained on-site and those plans must be submitted to the City of Rockingham for approval. All stormwater generated by the development must be managed in accordance with Planning Policy 3.4.3 - Urban Water Management to the satisfaction of the City of Rockingham. The approved plans must be implemented and all works must be maintained for the duration of the development.

5. Prior to the commencement of works a Construction Management Plan must be submitted and approved by the City of Rockingham. The Construction Management Plan shall include, but not be limited to, the following:

   (i) A Dust, Noise and Vibration Management Plan;

   (ii) Detail how access roads to and all trafficable areas on the site/s will be treated and maintained to prevent or minimise the generation of airborne dust;

   (iii) How any stockpiles on site/s are to be managed;

   (iv) Construction waste disposal strategy and location of waste disposal bins;

   (v) How materials and equipment will be delivered and removed from the site/s; and

   (vi) Parking arrangements for contractors.

   All works must be carried out in accordance with the approved Construction Management Plan and maintained at all times, for duration of the development.

6. The carpark must:

   (i) provide a minimum of 33 car parking spaces;

   (ii) be designed, constructed, sealed, kerbed, drained and marked in accordance with User Class 1A for staff and User Class 2 for Visitors of Australian/New Zealand Standard AS/NZS 2890.1:2004, Parking facilities, Part 1: Off-street car parking prior to applying for a Building Permit;

   (iii) provide 1 universal car parking space(s) dedicated to people with disabilities, which are designed, constructed, sealed, kerbed, drained and marked in accordance with Australian/New Zealand Standard AS/NZS 2890.6:2009, Parking facilities, Part 6: Off-street parking for people with disabilities and which are linked to the main entrance of the development by a continuous accessible path of travel designed and constructed in accordance with Australian Standard AS 1428.1—2009, Design for access and mobility, Part 1: General Requirements for access—New building work;

   (iv) have lighting installed, prior to the occupation of the development, to the satisfaction of the City of Rockingham; and

   (v) confine all illumination to the land in accordance with the requirements of Australian Standard AS 4282-1997, Control of the obtrusive effects of outdoor lighting, at all times.

7. In accordance with City of Rockingham Planning Policy 3.3.14 - Bicycle parking and End of Trip Facilities, six (6) long-term bicycle parking spaces must be provided for the development. The bicycle parking spaces must be designed in accordance with AS2890.3—1993, Parking facilities, Part 3: Bicycle parking facilities and must be approved by the City of Rockingham prior to applying for a Building Permit and constructed prior to occupancy of the development. The bicycle parking spaces must be retained and maintained in good and safe condition for the duration of the development.

8. Prior to applying for a building permit, the Applicant must submit full detailed engineering drawings showing the various pavement types and cross sectional profiles to be adopted across the entire development site and adjoining road reserves, for review and approval by the City of Rockingham.

9. Crossovers shall be designed and constructed in accordance with the City's *Commercial Crossover Specifications*.

10. Pavement markings and signage shall be provided at the vehicular crossover locations, to clearly delineate the intended traffic flow within the site as follows:

   (i) Restricted emergency exit only for heavy vehicles at the Zirconia Drive crossover;
   (ii) Full movement entry and exit only for heavy vehicles at the northern-most crossover on Alumina Road. No access permitted to staff or visitor vehicles; and

   (iii) Full movement entry and exit for staff and visitor vehicles only at the crossover for the administration building on Alumina Road.

11. Prior to the occupation of the development, a final illumination report must be prepared which demonstrates to the satisfaction of the City of Rockingham, that the completed development complies with the requirements of Australian Standard AS4282-1997, control of the obtrusive effects of outdoor lighting.

12. Prior to applying for a Building Permit, a Landscaping Plan must be submitted and approved to the satisfaction of the City of Rockingham and shall include the following detail:

    (i) the location, number and type of existing and proposed trees and shrubs, including calculations for the landscaping area;

    (ii) any lawns to be established and areas to be mulched;

    (iii) any natural landscape areas to be retained;

    (iv) those areas to be reticulated or irrigated;

    (v) the provision of shade trees at a ratio of 1 tree per 4 car bays;

    (vi) use of species consistent with the prescribed plant species list in the East Rockingham Development Guidelines;

    (vii) fencing type, height and alignments generally consistent with the plans referred in condition 1;

    (viii) Clearly defined APZ and landscaping consistent with and referenced against the *Bushfire Management Plan*, prepared by Bushfire Prone Planning - Job Number 190466, Ver 1.2; dated 22 June 2022;

    (ix) internal footpath and kerb ramps providing linkages between car parking areas to the main office, including any proposed lighting; and

    (x) proposed upgrading to landscaping, paving and reticulation of the street setback area and all verge areas;

    The landscaping (including all verge landscaping, reticulation and paving) must be completed prior to the occupation of the development, and must be maintained at all times to the satisfaction of the City of Rockingham.

13. Prior to occupation of the development, the Asset Protection Zone (APZ), as depicted in the *Bushfire Management Plan* prepared by Bushfire Prone Planning - Job Number 190466, Ver 1.2; dated 22 June 2022, must be installed on the site. The APZ must, be maintained in accordance with these requirements and in a good and safe condition for the duration of the development.

14. All works must be carried out in accordance with the Waste Management Plan titled *Processing Waste Management Plan*, prepared by Encycle Consulting, dated June 2022 (Rev 0) and maintained at all times, for the duration of development.

15. This approval is limited to production of 20,000 tonnes per annum purified spherical graphite.

16. The applicant is responsible for protecting any existing City streetscape assets along Zirconia Drive and Alumina Road during the course of the project. This includes any existing streetscape lighting, grated gully pits, side entry pits, kerbing, footpaths, trees, turf etc. If any damage is caused to the existing assets (identified to be retained), they must be rectified to the satisfaction of the Manager Land and Development Infrastructure. It is recommended that a photographic dilapidation report is undertaken by the applicant, to record the current condition of these assets.

17. Materials, sea containers, goods, bins or similar must not be stored within the carpark areas or vehicle access and movement areas at any time.

Advice Notes

1. This Approval relates to the details provided in the application; to undertake the development in a different manner to that stated in the application a fresh application for Development Approval must be submitted to the City.

2. In relation to Condition 4, the Stormwater Management Plan should be generally consistent with the *Surface Water Management Strategy* prepared by GR Engineering Services; Project Number 12332J, Rev A and dated 17 December 2021 and the Addendum titled *EcoGraf Stormwater Model Response*, prepared by 360 Environmental - Reference 5383AB, Rev 1 and dated 22 June 2022. The applicant is to liaise with the City's Land Development and Infrastructure Services in this regard.

3. In relation to Condition 5, dust management is to be in accordance with the Department of Environment and Conservation Guideline: A guideline for managing the impacts of dust and associated contaminants from land development sites, contaminated sites remediation and other related activities.
4. The proponent is advised that this approval is not a building permit. Prior to any building work commencing on site, a building permit must be obtained.

5. A Sign Permit must be obtained for any advertising associated with the development, including signage painted on the building; the applicant and owner should liaise with the City's Building Services in this regard.

6. With respect to the Landscape Plan, the applicant is to liaise with the City's Land Development and Infrastructure Services in this regard.

7. All works in the road reserve, including construction of a crossover or footpath and any other works to the road carriageway must be to the specifications of the City of Rockingham. The Applicant should liaise with the City of Rockingham's Land and Development Infrastructure Services and Engineering Services in this regard.

8. Water and sewerage services can be made available to the site. The water service to the development may need to be dealt with under the Water Corporation's Major Customer framework. The applicant and owner should liaise with the Water Corporation in this regard.

9. An application through the Water Corporation's Protection of Assets portal for any works/groundworks that could potentially impact on any pipes within the vicinity of the site may be required. The applicant and owner should liaise with the Water Corporation in this regard.

10. The subject property is located within the Cockburn Groundwater Area (Wellard subarea) as proclaimed under the Rights in Water and Irrigation Act 1914. Any groundwater abstraction for purposes other than domestic and/or stock watering taken from the superficial aquifer, is subject to licensing by the Department of Water.

11. A Works Approval for the development, being for Industry (Graphite processing plant) under the Processing Sector - Category 31: chemical manufacturing must be obtained from the Department of Water and Environmental Regulation.

Details: outline of development application

Region Scheme	Metropolitan Region Scheme
Region Scheme - Zone/Reserve	Industrial
Local Planning Scheme	City of Rockingham TPS2
Local Planning Scheme - Zone/Reserve	General Industry, Special Industry
Structure Plan/Precinct Plan	N/A
Structure Plan/Precinct Plan - Land Use Designation	N/A
Use Class and permissibility:	Industry
Lot Size:	37, 711m2
Existing Land Use:	Vacant
State Heritage Register	No
Local Heritage	☒ N/A ☐ Heritage List ☐ Heritage Area
Design Review	☒ N/A ☐ Local Design Review Panel ☐ State Design Review Panel ☐ Other
Bushfire Prone Area	Yes
Swan River Trust Area	No

Proposal:

Proposed Land Use	Industry – General (Licenced)
Proposed Net Lettable Area	5073m^2
Proposed No. Storeys	n/a
Proposed No. Dwellings	n/a

This DAP application is for an Industrial development for the purposes of 'Graphite Processing' to support the lithium-ion battery manufacturing industry. Specifically, the proposal seeks to establish a processing plant that mills high-quality graphite flakes into battery-grade spherical graphite to be used in lithium batteries. The proposal includes the following facilities and site improvements:

- 4,351m^2 battery anode facility, comprising of two main buildings where the milling and purification of uncoated spherical graphite products occurs;

- 400m^2 administrative building;

- 71m^2 workshop and store;
- 192m^2 control room and laboratory;
- 60m^2 motor control room;
- 30 car parks for staff, fenced and secured by a sliding gate; and
- 3 visitor car parks located adjacent to the site administration office.

The proposed graphite processing plant will operate on a 24hr/7 day basis, employing 46 staff. The site will accommodate 16 staff during standard shift operations with the number increasing to a total of 30 during shift changeover. On any one shift, staffing comprises 14 shift staff plus 2 shift staff contingent. A total production output of 20,000 tonnes per annum of purified spherical graphite is proposed.

An internal access way network will provide access through the site for heavy vehicles, including waste. Main heavy vehicle entry and exit is proposed via Alumina Road, with an emergency heavy vehicle exit connection to Zirconia Drive provided.

Background:

Rockingham Industrial Zone

The East Rockingham Industrial Park (ERIP), or the Rockingham Industrial Zone (RIZ) which it is also known as, adjoins the southern section of the Kwinana Industrial Area (KIA). The RIZ is a strategic precinct that was first identified for industrial development through the Kwinana-East Rockingham Industrial Area Improvement Plan No.14 (IP14).

IP14 was initiated in 1988 for the purpose of advancing the planning, development and use of the land affected by the Plan for industrial purposes. The IP14 Structure Plan was adopted by Cabinet and the Western Australian Planning Commission (WAPC). The IP14 Structure Plan was never adopted by the City of Rockingham (City) under its Town Planning Scheme, but it has guided the development of East Rockingham for a number of years. IP14 is a plan which supports port-related industry, environmentally acceptable heavy industry, general industry and light industry.

In recent years the Rockingham Industrial Zone Structure Plan (RIZ Structure Plan), which varies from the IP14 Structure Plan, has been used to guide the development of the East Rockingham Industrial area. The RIZ structure plan, which has also not been adopted by the City, is an internal government document used by Development WA to progress and market the RIZ Industrial Estate.

The land subject to this JDAP application is designated as Environmentally Acceptable Heavy Industry on the RIZ Structure Plan.

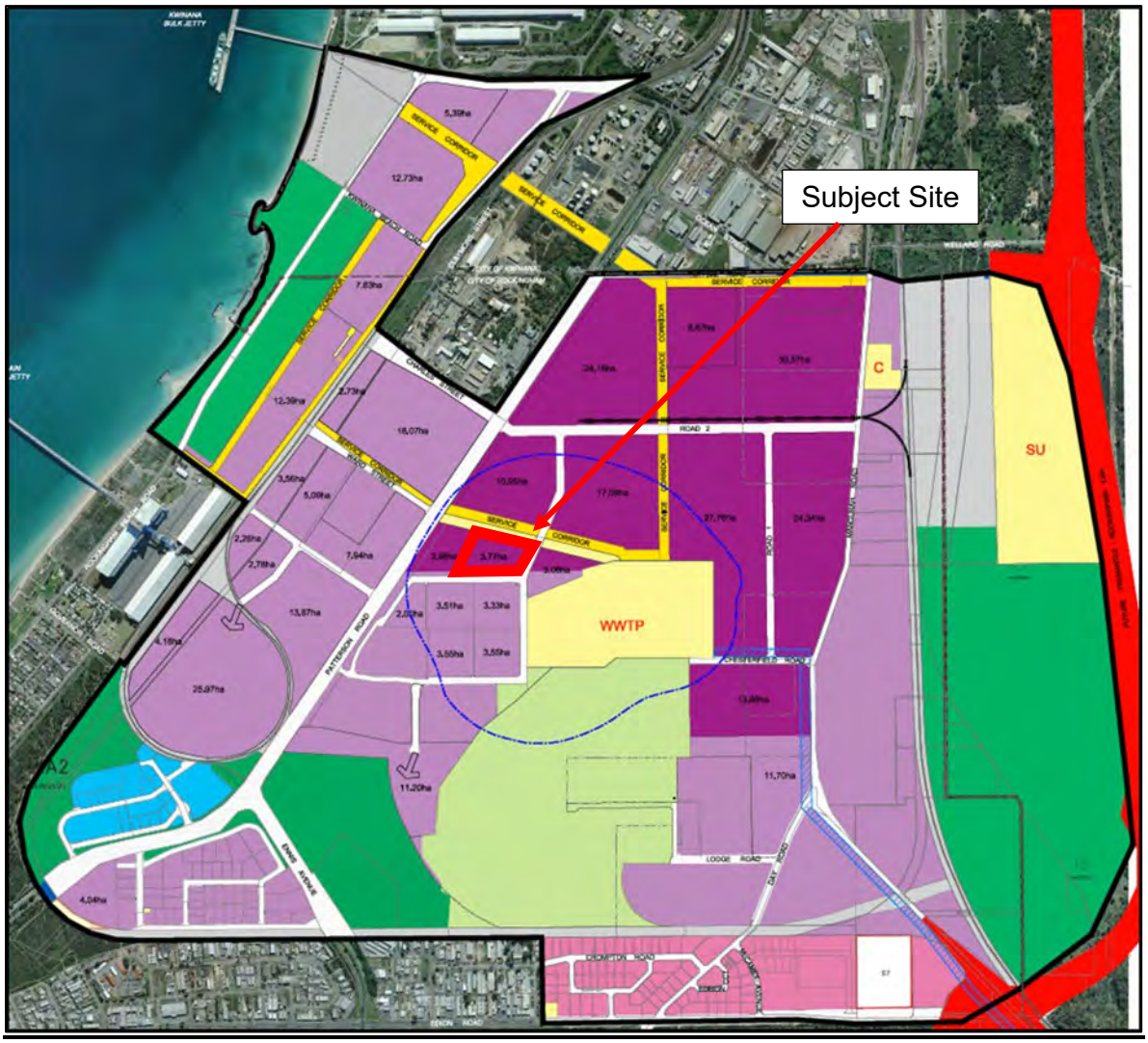


Figure 1 - RIZ (IP14) Structure Plan

Environmental Approvals

In May 2011, the Strategic Environmental Assessment (SEA) for the RIZ Structure Plan area was given approval by the Minster for Environment to be implemented. The SEA identified the development footprint for future industrial development over a 339 hectare area of the RIZ, while retaining an area as a conservation reserve (coloured light green on the Structure Plan above).

The Conservation Area was established in order to retain an area that exhibited significant environmental value, whilst the remainder of the site would be cleared for development. Further information on environmental approvals is available on the Environmental Protection Authority's (EPA) website:

Rockingham Industrial Zone Strategic Environmental Assessment (Formerly IP14) | EPA Western Australia

Scheme Amendment 178 and Review of Planning Policy P3.3.8 - East Rockingham Development Guidelines (PP3.3.8)

Proposed Scheme Amendment 178 and the review of PP3.3.8 sought to amend and update the provisions in conjunction with a broader review of the applicable planning framework for the ERIP.

The intended main change to the Industrial zone requirements in TPS2, was to include provisions to maintain existing vegetated buffers along Mandurah Road and Patterson Roads. The intention was to ensure appropriate setback and screening of large scale industrial developments along these major entryways into the City. The City sought a 50m landscaping/building setback to minor buildings/structures and 100m setbacks to major structures.

Ultimately, the Minister for Planning did not agree with the City's proposed setbacks and reduced them to 15m Primary Street building setback, 10m Secondary Street building setback, 10m Primary Street landscaping depth and 5m Secondary Street landscaping depth in the Special Industry and General Industry zones. The Minister has directed the City to make the changes to the Scheme Amendment documents and it is anticipated that it will be gazetted shortly.

Site and Locality

The site is bound by Zirconia Drive to the south and Alumina Road to the east, within an emerging industrial area in East Rockingham. Further south east of the site on the opposite side of Alumina Road is the East Rockingham Wastewater Treatment Plant. Further west of the site is Patterson Road. The site is vacant and currently unimproved.

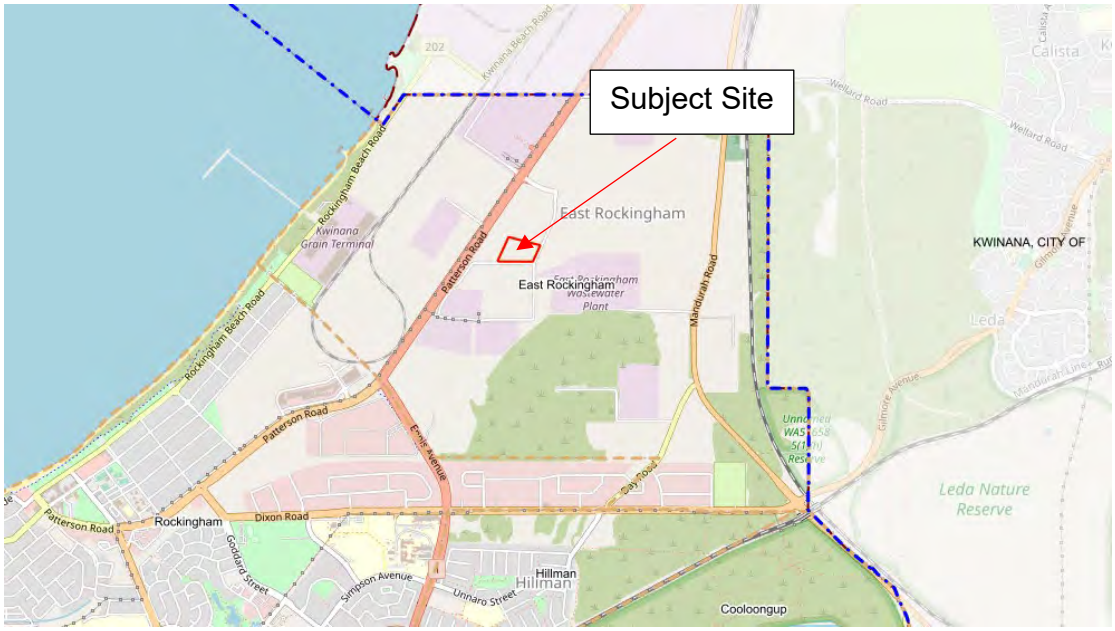


Figure 2 - Location Plan

Figure 3 - Aerial Location Plan

Current Development Application

In February 2022, this Development Assessment Panel (DAP) application was lodged by the Applicant for an Industrial development for the purposes of a Graphite Processing Plant.

The following summarises the DAP application history:

- On 10 March 2022, the City advised the Applicant that to meet the Responsible Authority Report (RAR) deadline of 9 May, the item would need to be on the City's Agenda for the April Council meeting, with the agenda close date being 25 March. This date was before the due date for external referral comments, and the City, bound by statutory requirements, cannot make a recommendation prior to the due date for receiving external referral comments. The City also advised that a formal request for further information (RFI) would be issued, and as such, the City requested that the applicant agree to an Extension of Time (EoT) to 29 June 2022;

- The formal RFI was issued to the Applicant on 8 April 2022, with an advised date of 19 April 2022, confirming the Applicant's acceptance or refusal to respond to the RFI;

- The matters in the RFI related to confirming the separation distance to sensitive land uses, gas, dust and odour emissions, water management and drainage, traffic, access and car parking, bushfire management and landscaping;

- The Applicant advised that they would respond to the RFI, however the response would not be available until 27 May 2022 and as such the Applicant sought a further EoT to 27 July 2022;

- An additional request for an EoT was sought by the Applicant on 24 May 2022, seeking an EoT date of 24 August 2022. This was agreed to by the City and the DAP;

- A complete response to the RFI was received by the City on 23 June 2022.

The following sections of this report are based on the additional supporting material submitted in response to the RFI in conjunction with the details at lodgement.

Legislation and Policy:

Legislation

- Planning and Development Act 2005
- Metropolitan Region Scheme
- Town Planning Scheme No.2
- Planning and Development (Local Planning Scheme) Regulations 2015
- Environmental Protection (Noise) Regulations 1997

State Government Policies

- State Planning Policy 3.7 - Planning in Bushfire Prone Areas
- State Planning Policy 4.1 - State Industrial Buffer Policy
- Environmental Protection Authority (EPA) - Separation Distance between Industrial and Sensitive Land Uses No.3 (Guidance Statement)

Structure Plans/Activity Centre Plans

Not Applicable

Local Policies

- Planning Policy 3.3.8 - East Rockingham Development Guidelines
- Planning Policy 3.3.14 - Bicycle Parking and End of Trip Facilities
- Planning Policy 3.4.3 - Urban Water Management

Consultation:

Public Consultation

The application was advertised for public comment in accordance with Clause 64 of the deemed provisions of the City's TPS2, in the following manner:

- Landowners and occupiers identified on the Consultation Map below were notified in writing of the proposed application;

- The application was made available for public inspection at the City's Administration Offices and published on the City's website; and

- Submissions were requested over the period between 25 February 2022 and 25 March 2022.

A 2km radius extending from the site boundaries was used to establish the consultation area, extending across properties located within the City of Rockingham and City of Kwinana, as depicted in the consultation map.

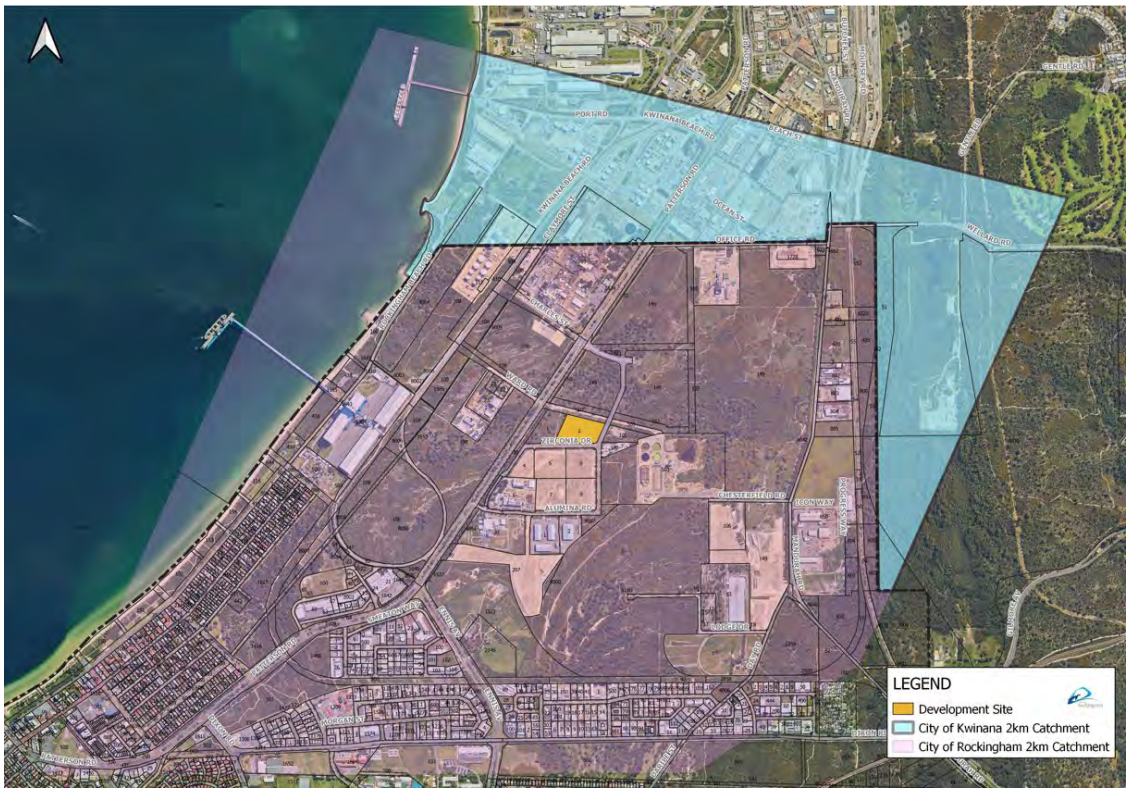


Figure 4 - Consultation Map

Two (2) submissions were received at the conclusion of the advertising period, with only 1 objection recorded. Matters raised in the submission are summarised in the Table below, along with the Applicant's and City's responses:

Issue Raised	**Officer comments**
Separation Distance and Emissions	As per the Environmental Protection Authority (EPA) Guidance Statement No.3 - Separation Distances between Industrial and Sensitive Land Uses 2005 (Guidance Statement), a graphite processing facility is an 'Industrial Use' and would be classified as Chemical Manufacturing facility. The EPA Guidance Statement recommends a buffer distance of 300m to 1,500m from 'Chemical Manufacturing' facilities to sensitive land uses, to eliminate the potential off site impacts. The applicant submitted an AQIA that modelled a duffer distance of 3.2km from the site, which considered wind speed and direction. The modelling concluded that emissions were considered insignificant and impacts at all nearest sensitive and commercial/industrial receptors is negligible. The City has reviewed the submitted AQIA and concurs with the assessment and findings that impacts will be negligible.

Issue Raised	Officer comments
	Furthermore, requirements for emission monitoring and compliance will be governed by a Works Approval issued by the Department of Water and Environmental Regulation (DWER). The City is satisfied that the site location, with respect to emission impacts, is appropriate.

Referrals/consultation with Government/Service Agencies

The following Government Departments were consulted:

- Department of Planning, Lands and Heritage (DPLH);
- Department of Water and Environmental Regulation (DWER);
- Main Roads Western Australia;
- Public Transport Authority;
- Westport;
- Water Corporation;
- Department of Mines, Industry Regulations and Safety (DMIR); and
- Department of Health (DoH).

Where advice and/or comments have been received relevant to the assessment, these are summarised below. Where advice of "no comment" or "no concern" has been provided, this has been excluded from the table. The Applicant was provided a copy of the advice received from the Government Agencies, and responded as deemed necessary to inform the response to the RFI the City issued on the basis that the matters raised in the RFI were similarly raised based on the Government Agency advice and comments.

1. Department of Water and Environmental Regulation (DWER) summarised
• DWER advise that the proposal has the potential for impacts on water resource values and/or management. • DWER does not object to the proposal however key issues, recommendations and advice are provided below and these matters should be addressed. Stormwater Management • The proponent should manage stormwater in accordance with the 'Decision process for stormwater management in WA (DoW 2016)' and the 'Stormwater Management Manual for Western Australia (DoW 2004–2007)'; • The Surface Water Management Strategy provided uses the Perth Groundwater Atlas to determine the maximum groundwater level (MGL) The use of the Perth Groundwater Atlas to determine MGL for stormwater infrastructure design is not supported as MGLs are based on levels for May when MGLs are lower. DWER prefers the use of historical MGL levels as it gives a higher degree of confidence in drainage basin design given the natural variations in yearly rainfall and likely increase in groundwater levels that occur through development.

1. Department of Water and Environmental Regulation (DWER) summarised

• DWERs Lower Serpentine Region Groundwater Contours records a historical MGL in the area of Lot 2 of between 2.5 – 2.75 metres AHD and this level should be used when determining inverts of drainage basins and biofiltration basins.
• At-source infiltration of the first 15 mm of stormwater runoff from carpark areas should be integrated into the carpark design and should undergo water quality treatment via biofiltration.
• The proposed parabolic channel drains should be converted to vegetated biofiltration swales rather than be lined with bituminous geomembrane. Vegetated biofiltration swales will increase at-source infiltration and potentially reduce the required size of drainage basins. Biofiltration areas should be lined with amended soil with a PRI of at least 10. The amended soil should have a minimum thickness of 300 mm.
<u>Industrial Regulation</u>
• DWER has received and is currently assessing a Works Approval application for this proposed graphite processing plant under the Processing Sector - Category 31: chemical manufacturing.
<u>Native Vegetation</u>
• Under section 51C of the Environmental Protection Act 1986 (EP Act), clearing of native vegetation is an offence unless:
  • it is undertaken under the authority of a clearing permit
  • it is done after the person has received notice under Section 51DA(5) that a clearing permit is not required
  • the clearing is subject to an exemption.
• Based on the information provided, the proposal is likely to be exempt from the requirement for a clearing permit under either Regulation 5, Item 1 of the Clearing Regulations (clearing for a building or structure), or under Schedule 6 Clause 2 of the EP Act, noting that proposed industrial development of the lot was assessed by the Environmental Protection Authority, and subsequently approved under Ministerial Statement 863, subject to conditions.
• Based on the information provided, should development approval be issued, the proposal is likely to be exempt from the requirement for a clearing permit under Regulation 5, Item 1 of the Clearing Regulations.
<u>Groundwater</u>
• The subject property is located within the Cockburn Groundwater Area (Wellard subarea) as proclaimed under the Rights in Water and Irrigation Act 1914. Any groundwater abstraction in this proclaimed area for purposes other than domestic and/or stock watering taken from the superficial aquifer, is subject to licensing by the Department of Water. The issuing of a groundwater licence is not guaranteed but if issued will contain a number of conditions that are binding upon the licensee.

<u>City's Comment</u> In lieu of a Stormwater Management Plan being submitted as part of the JDAP Application, the applicant has submitted a SWMS and subsequent Addendum which has clarified and addressed surface water management calculations and on site filtration, however, further refinement is still required.

1. Department of Water and Environmental Regulation (DWER) summarised
It is recommended that a Development Approval condition be included requiring submission of a Stormwater Management Plan, generally consistent with the SWMS and Addendum, to satisfy DWER advice and the City's requirement under PP3.4.3 - Urban Water Management. The City has also received advice from DWER that the Works Approval application is pending a decision by the Delegated officer, which should occur prior to the determination of the Development Application. Comments relating to native vegetation and groundwater are noted and shall be included Development Approval advice.
2. Main Roads summarised
Main Roads has no objection subject to the following condition being imposed: • This approval is limited to production of 20,000 tonnes per annum purified spherical graphite. The condition of approval limiting the scale of facilities is based on the detail within the application, including the Transport Impact Statement, based on a certain production output. If an approval was granted that did not specify a maximum output and production exceeds what was originally proposed, the traffic and any other impacts have not been assessed and might not be acceptable. If in future it is proposed to increase production of such facilities then an application will need to be made for an amendment to the development approval, with appropriate supporting information such as a revised Transport Impact Statement.
City's Comment: The City accepts the condition to be included in any Development Approval issued.
3. Water Corporation summarised
• Water and sewerage services can be made available to the development site. Depending on the proponent's water demands, the water service to the development may need to be dealt with under the Water Corporation's Major Customer framework. • A major (900mm diameter) treated wastewater outfall pipeline extending from the East Rockingham Waste Water Treatment Plant runs within a pipe reserve approximately 20m from the northern boundary of the site. The proposal should consider the impacts of any ground disturbing works on the site and to make application through the Corporation's Protection of Assets portal for any works that could potentially impact on the pipe • Buildings and structures will require approval by our Building Services section prior to the commencement of works.
City's Comment: The City notes the advice received and acknowledges that the applications required are outside the jurisdiction of the City. Advice notes can be included in any Development Approval issued referencing this advice.

4. Department of Health (DoH) summarised

Water Supply and Wastewater Disposal

- The proposal highlights wastewater generated from the project will undergo treatment to ensure it meets the Water Corporation Trade Waste receival requirements. Please advise the Department of Health if domestic wastewater is accepted on this industrial wastewater deep sewerage line, if there is a separate connection required to deep sewerage for domestic wastewater or if an alternative method is proposed.

Public Health Impacts

- With reference to Appendix E "Environmental Assessment" of the submission, it notes that 14.5kL of acids (HF) and alkalis will be stored in iso-containers in a partly enclosed bunded area on site. Production will be within a sealed positive pressure building with air scrubbers to remove PM10/25 dusts and other gaseous emissions. The submission makes no reference to air quality monitoring or appropriate risk-based air quality standards.
- The nearest sensitive residential uses are 1.5km to the west although there are other industrial uses (depot, wastewater treatment and other industrial manufacturing units) within 250m of the proposed facility. The EPA (2005) Separation Distance guidelines does not provide a default separation distance for this new and evolving industry and recommends in such cases that an emission/risk assessment is conducted. However, comparable fine particle (TiO) manufacture does require 3km, and sulphuric acid storage and use also requires 3km. On this basis the actual 1.5km separation is likely to not be sufficient.
- The public health (air/dust and gas (HF) issues affecting the suitability of the site and as described in the information provided have not be assessed in sufficient detail. DoH recommends that public health emissions and risk assessments (air/dust and gases) and appropriate monitoring and management measures will be required at Works Approval and as operating license conditions.
- The site is not recorded on the Contaminated Sites Database. The proponent should submit a Basic Summary of Records search to complete their enquiries

<u>City's Comments</u>

The City agreed with the advice provided by the DoH that the proposal is a new and evolving industry and the process may not be adequately covered in the categories of the Guidance Statement. The initial Environmental Assessment provided with the application assessed the impacts of the proposal on sensitive land-uses, within 1,500m of the site. Following consultation with DWER and DOH, it was considered that further investigation of Dust, Gas and Odour Impacts for sensitive uses within 3000m of the proposed facility was more appropriate. The City requested an AQIA be provided, independent of any request made by referral agencies.

The applicant's subsequent AQIA, following consultation, modelled a radius of 3.2km from the subject site to determine and assess any impacts. The modelling concludes that emissions are insignificant and impacts at all nearest sensitive and commercial/industrial receptors is negligible. The City is satisfied that the separation distance based on the AQIA and perceived public health impacts have therefore been addressed and the separation distance is appropriate. The City concurs with DoH that public health emissions and risk assessments, and appropriate monitoring and management measures, will form part of any operating license conditions as part of the pending Works Approval issued by DWER.

4. Department of Health (DoH) summarised
Reference to advice received from the Water Corporation, matters of water supply and connection will be required to be dealt with by the applicant with the Water Corporation.

A copy of the external comments received from the consulted Government Agencies is within Attachment 4.

Planning Assessment:

State Government Policy 3.7 - Planning in Bushfire Prone Areas (SPP3.7)

SPP3.7 seeks 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.

The development site has been designated bushfire prone under the *Fire and Emergency Services Act 1998 (as amended)* and therefore the requirements of SPP3.7 are applicable.

The applicant has provided a Bushfire Management Plan (BMP) that confirms that the site will be maintained to a low bushfire threat state. The proposed development will provide a development footprint within the required BAL ratings of BAL-29, or lower. The required asset protection zone (APZ) specifications of width, location and management can be achieved within the lot boundaries. Application of appropriate building design, bushfire construction standards and the ongoing maintenance of the APZ will ensure the buildings will not be impacted by bushfire threat. The BMP has adequately addressed the requirement of the SPP3.7.

State Planning Policy 4.1 - State Industrial Buffer Policy (SPP4.1)

The key objective of SPP4.1 is to protect industry, infrastructure and special uses from the encroachment of incompatible land uses as well as provide for the safety and amenity of land uses surrounding industry, infrastructure and special uses. As a result, most industries and infrastructure as well as other uses need to be separated from residential areas and other sensitive uses within a buffer area.

The objectives of SPP4.1 are as follows:

- *"To provide a consistent Statewide approach for the definition and securing of buffer areas around industry, infrastructure and some special uses;*
- *To protect industry, infrastructure and special uses from the encroachment of incompatible land uses;*
- *To provide for the safety and amenity of land uses surrounding industry, infrastructure and special uses; and*
- *To recognise the interest of existing landowners with buffer areas who may be affected by residual emissions and risk, as well as the interests, needs and economic benefits of existing industry and infrastructure which may be affected by encroaching incompatible land uses".*

The proposal is considered to be compatible with existing and future industrial development, within the East Rockingham Industrial Area. Detailed discussion is provided in the following section regarding separation distances.

Environmental Protection Authority - Separation Distance between Industrial and Sensitive Land Uses No.3 (Guidance Statement)

The EPA Guidance Statement provides advice to proponents, responsible authorities, stakeholders and the public, on the minimum requirements for environmental management which the EPA would expect to be met when the Authority considers a development proposal.

For the purpose of the Guidance Statement, 'industrial land use' is used in a general way to encompass a range of industrial, commercial and rural activities, associated with off-site emissions that may affect adversely the amenity of sensitive land uses.

As per the Guidance Statement, for a graphite processing facility, it is recommended that a buffer distance of 300 to 1,500m from 'Chemical Manufacturing' facilities to sensitive land uses be established. Notwithstanding this minimum requirement, the City considered the advice from DoH as outlined in the section 'Consultation with Government Agencies' of this Report, and requested an AQIA be provided to address the buffer separation.

The submitted AQIA, which for the purposes of modelling, used a separation distance radius of 3.2km from the subject site to determine and assess any impacts. The City has reviewed the AQIA and is satisfied that the modelling demonstrates and concludes that emissions are insignificant and impacts at all nearest sensitive and commercial/industrial receptors will be negligible.

EcoGraf Ltd (the Applicant) has applied concurrently for a Works Approval under Division 3 Part V of the *Environmental Protection Act 1986*. At the time of writing this Report, the City has been advised by the assessing officer at DWER that the Works Approval Permit is under assessment and is to be determined by the Delegated Officer. Matters and compliance relating to emissions and monitoring will be managed by any Works Approval issued by DWER. It is also noted that DWER did not require an odour report as part of the Works Approval assessment.

Town Planning Scheme No. 2

Clause 4.10.3 Car Parking

TPS2 requires the provision for the on-site parking of vehicles for all development in accordance with Table No.2 and the provisions of Clause 4.15. The proposed development is a land use that is not specified in Table No.2. In accordance with Clause 4.15.1.4, where land is proposed to be developed for a purpose which is not specified in table No.2, the Council is to determine the number of car parking bays required in regards to the following:

"(i) the nature of the proposed development;
(ii) the number of employees likely to be employed on the site;
(iii) the anticipated demand for parking; and
(iv) the orderly and proper planning of the locality"

The proposal provides 33 car parking spaces comprising 30 staff bays, two visitor bays and one ACROD bay. Based on the proposed operation of the processing plant with a shift roster where a maximum of 30 employees will be on site at peak shift change over only, the car parking provision is considered appropriate to the nature of the development, the anticipated demand and number of employees. The car parking is considered acceptable.

Form of Development

Provision	Requirement	Proposal	Assessment
TPS2 - clause 4.10.4 - General Development Provisions (Industrial zones)	The facades of all buildings visible from the primary road or open space area shall be of masonry construction or any other material approved by the Local Government in respect of the ground floor level, provided that if concrete panels are used, such panels must have an exposed aggregate or textured finished. The second floor level or its equivalent may be constructed of any other material in accordance with the Building Code of Australia and to the satisfaction of Local Government.	The administration building provides an interface to the public realm and defines the site entry from Alumina Road. The facades of the building are not masonry, but typical of a modular building design. The administration building provides a focal point and an identifiable arrival destination for the site. The building form has been articulated with glazing and a screening feature. The screening provides a perforated screen creating a layering affect with light and shadow and mitigates glare internal to the work areas of the administration building. The colour palette is complementary to the overall design intent and aesthetic.	Considered to be an appropriate design alternative and outcome.

Fencing

Provision	Requirement	Proposal	Assessment
Planning Policy 3.3.8 - East Rockingham Development Guidelines	• Security fencing will be permitted along side and rear boundaries;	• Security fencing is proposed along northern and western side boundaries;	• Complies
	• Front fencing to any street frontage should be limited to a minimum; • The fenceline for street frontage fencing is preferably setback to the building line but as a minimum, must be set behind the required landscaping buffer strip;	• Fencing along Alumina Road is setback 25m to the building line, except for that portion of the staff car park area to be fenced securely along the 10m landscape setback; • Fencing along Zirconia Drive aligns with the lot boundary and is not setback;	• Complies and is setback to the 10m landscape strip for that portion of the staff carpark area along Alumina Road; • Does not comply along Zirconia Drive, but considered to achieve an acceptable outcome for the secondary street frontage when considered with the landscaping.
	• The minimum standard for fencing is black PVC coasted galvanised linkmesh.	• Material – 2.4m black PVC coated chain mesh with black posts.	• Noted, complies

Landscaping

Provision	Requirement	Proposal	Assessment
Planning Policy 3.3.8 - East Rockingham Development Guidelines	• Lots greater than 3,000m2 in area must provide a 10m landscaping strip to the front of the lot;	• A 10m wide landscaped strip is provided to Alumina Drive, increasing to 25m at the northern and southern extremities of the frontage;	• Yes- complies along the Alumina Road frontage.

Provision	Requirement	Proposal	Assessment
		• A 5m wide landscaped strip is proposed to the Zirconia Drive street frontage	• Considered to comply as this outcome is consistent with Planning Scheme Amendment 178, which entertains a 5m landscape setback on a secondary frontage for Industrial sites within the ERIP.

Planning Policy 3.4.3 - Urban Water Management

In lieu of a Stormwater Management Plan being submitted, the applicant has provided a SWMS as part of the Development Application, supplemented with an Addendum in response to the City's RFI.

The SWMS and Addendum has clarified and addressed surface water calculations and on site filtration, however requires further refinement to satisfy the City's assessment. It is recommended that a condition be included on any development approval contemplated by the DAP recommending submission of a Stormwater Management Plan, generally consistent with the SWMS and Addendum, to satisfy the City's requirements under PP3.4.3.

Conclusion:

The proposed development is an industrial land use for the purposes of a Graphite Processing Plant, to support the lithium-ion battery manufacturing industry. The plant will mill high-quality graphite flakes into battery- grade spherical graphite to be used in lithium batteries.

The context of the surrounding locality is a mix of industry land uses and vacant development sites. The proposed development is considered compatible with the existing surrounding context of the locality. The design intent and aesthetic is sympathetic and responsive to the industrial and practical operations of the site.

The proposed industry is a 'Prescribed Premises', categorised as 'Chemical Manufacturing', requiring a Works Approval through DWER. The Works Approval Permit will monitor and regulate the industrial operations with respect to air, dust and odour emissions in conjunction with industrial buffer and separation requirements under the *Environmental Protection Act 1986*.

To address onsite drainage and stormwater management, the submitted SWMS and Addendum require further refinement to satisfy the City's assessment. It is recommended that through conditions of Development Approval, the submission of a Stormwater Management Plan, generally consistent with the SWMS and Addendum, will satisfy the City's requirements under PP3.4.3.

Having due regard to the relevant planning considerations, including the public submission received regarding emission impacts, this proposal is considered to comply with the applicable planning framework and conditional approval is therefore recommended.

Government of **Western Australia**
Development Assessment Panels

DAP FORM 1

Notice of Development Application to be Determined by a Development Assessment Panel

Planning and Development Act 2005
Planning and Development (Development Assessment Panel) Regulations 2011 – regulations 7, 10 and 21

Application Details

To	*Name of local government and/or Western Australian Planning Commission* City of Rockingham	
Planning Scheme(s)	*Name of planning scheme(s) that applies to the prescribed land* Town Planning Scheme 2	
Land	*Lot number, street name, town/suburb* Lot 2 Zirconia Drive, East Rockingham	
Certificate of Title (provide copy)	*Volume Number*	*Folio*
	Location Number	*Plan / Diagram Number* 404186
Details of development application made to responsible authority	*Summary of Proposal* Development of an industrial graphite processing plant inclusive of process buildings, machinery and equipment, site services infrastructure, administration offices, staff amenities, training and meeting rooms, roads, secure staff carpark, visitor carpark, site fencing and landscaping.	
Development Use	*Residential / Commercial / Industrial / Rural / Mixed Use / Other* Industrial	
Estimated cost of development (GST Exc)	$50.0M	

Part A – Acknowledgement by Applicant and Landowner

Mandatory Application	☒ I give notice that I understand that this is a mandatory Development Assessment Panel application *(regulation 5)*
Optional Application	☐ I give notice that I have elected to have the development application that accompanies this form determined by a Development Assessment Panel *(regulation 6)*
Delegated Application	☐ I give notice that I understand that this is an application of a class delegated to a Development Assessment Panel for determination *(regulation 9)*

Applicant Details (to be completed and signed by applicant)

- By completing this notice, I declare that all the information provided in this application is true and correct.
- I understand that the information provided in this notice, and attached forming part of the development application will be made available to the public on the Development Assessment Panel and local government websites.

Name	Shaun O'Neill	
Company	Ecograf Limited	
Address	*Street Number/PO Box number, street name, suburb, state, postcode* 18 Richardson Street, West Perth, WA 6005	
Contact Details	*Email* soneill@ecograf.com.au	*Phone* 0428112815
Signature		*Date* 25/1/22

Landowner Details (to be completed and signed if landowner is different from applicant)

- By completing this notice, consent is provided to submitting this application.
- If there are more than two landowners, please provide all relevant information on a separate page.
- Signatures must be provided by all registered proprietors or by an authorised agent as shown on the Certificate of Title.
- Alternatively, a letter of consent, which is signed by all registered proprietors or by the authorised agent, can be provided.
- Companies, apart from sole directors, are required to provide signatories for two directors, a director and the company seal or a director and a company secretary.

Company (if applicable)	WESTERN AUSTRALIAN LAND AUTHORITY T/AS DEVELOPMETNWA	
Contact Details	*Email* ellen.sherman@developmentwa.com.au	*Phone* 9482 7522
Address	*Street Number/PO Box number, street name, suburb, state, postcode* LOCKED BAG 5 PERTH BC WA 6849	
Name/s	VAUGHAN BRAZIER	ELLEN SHERMAN
Title/s	*Landowner/Sole Director/Director (2 signatures required)* MANAGER - STRATEGIC INDUSTRIAL & ASSET MANAGEMENT	*Additional Landowner/ Director/Secretary (if applicable)* LEASING MANAGER
Signature/s		
Date	4/2/2022	4/2/2022

Part B – Local government acceptance for assessment

Responsible Authority	☐ Local Government (LG) ☐ * Western Australian Planning Commission (WAPC) ☐ * Dual – Local Government and Western Australian Planning Commission ☐ Building Management and Works (Department of Finance) – *Public Primary School Applications*	
* WAPC/DUAL reporting details	*If WAPC or DUAL is selected, please provide details of relevant provision (or within covering letter)*	
Fees for applications *(DAP Regulations - Schedule 1)*	$ Amount that has been paid by the applicant $ Amount to be paid by local government *(delegated applications only - regulation 22)*	
Statutory Timeframe *(regulation 12)*	☐ 60 days (advertising not required) ☐ 90 days (advertising required or other scheme provision)	
LG Reference Number		
Name of planning officer *(Report Writer)*		
Position/Title		
Contact Details	*Email*	*Phone*
Planning Officer's Signature		*Date accepted for assessment*

Please refer to the Guidance Note: Lodging a DAP Application for further information.

APPLICATION FOR DEVELOPMENT APPROVAL

Before completing this form, please consider lodging your application on-line - https://rockingham.wa.gov.au and register via Rock Port to lodge your application.

OWNER DETAILS

Name : WESTERN AUSTRALIAN LAND AUTHORITY T/AS DEVELOPMENTWA

ABN (if applicable) 34 868 192 835

Address : LOCKED BAG 5, PERTH BC WA Postcode: 6849

Phone: Work: 9482 7522 Home: _____ Mobile: _____

Fax: _____ Email: ellen.sherman@developmentwa.com.au

Contact Person for correspondence: Ellen Sherman

Signature _____ Date 4/2/2022

Vaughan Brazier - Manager Strategic Industrial & Asset Management

Signature _____ Date _____

The signature of the owner(s) is required on all applications. This application will not proceed without that signature. For the purposes of signing this application an owner includes the persons referred to in the Planning and Development (Local Planning Schemes) Regulations 2015 Schedule 2 clause 62(2).

APPLICANT DETAILS (if different from owner)

Name: Ecograf Limited

Address: 18 Richardson Street

West Perth WA Postcode 6005

Phone: Work: 08 6424 9000 Home: -- Mobile 0428 112 815

Fax: _____ Email: soneill@ecograf.com.au

Contact person for correspondence: Shaun O'Neill

The information and plans provided with this application may be made available by the City of Rockingham for public viewing in connection with the application. Yes ☑ No ☐

Signature: _____ Date: 25/1/22

PROPERTY DETAILS

Lot No. 2 House/ Street No. _____ Street Name Zirconia Drive

Suburb East Rockingham Nearest Street Intersection Zirconia Dt / Alumina Rd.

Title Encumbrances (eg. Easements, Restrictive Covenants) N/A

Certificate of Title Vol. No: -- Folio -- Diagram/Plan No: 404186

PROPOSED DEVELOPMENT

Nature of development: Works ☐

Use ☐

Works and Use ☑

Is an exemption from development claimed for part of the development? Yes ☐ No ☑

If Yes, is the exemption for: Works ☐

Use ☐

Description of proposed works and/or land use: Industrial - General (licensed)

Development of an industrial graphite processing plant, inclusive of process buildings, machinery and equipment, site services infrastructure, administration offices, staff amenities, training and meeting rooms, roads, secure staff carpark, visitor carpark, site fencing and landscaping.

Description of exemption claimed (if relevant) N/A

Nature of any existing buildings and/or land use: Industrial processing & staff accommodation

Approximate cost of proposed development (exclusive of GST): $ 50.0M

Estimated time of completion: December 2022

OFFICE USE ONLY

Acceptance Officer's Initials: _____ Date Received: _____

Application Reference No. _____

Parcel No. _____ File No. _____

Application Fee $_____ Date Sought _____ Date Received _____

Receipt No. _____ Planning Account No. 711 (Application Planning Fee)

FEE STRUCTURE FOR DEVELOPMENT APPLICATIONS

ITEM	APPLICATION TYPE	FEE
1	Determination of an Application for Development Approval (other than an Extractive Industry) where the estimated cost of the development is:-	
	(a) not more than $50,000	$147
	(b) more than $50,000 but not more than $500,000	0.32% of the estimated cost of the development
	(c) more than $500,000 but not more than $2.5M	$1,700 + 0.257% for every $1 in excess of $500,000
	(d) more than $2.5M but not more than $5M	$7,161 + 0.206% for every $1 in excess of $2.5M
	(e) more than $5M but not more than $21.5M	$12,633 + 0.123% for every $1 in excess of $5M
	(f) more than $21.5M	$34,196
2	Determining a Development Application (other than for an Extractive Industry) where the development has commenced or been carried out	The fee in Item 1 plus, by way of a penalty, twice that fee.
3	Determining an application to amend or cancel Development Approval	$295
4	Determining a Development Application for an Extractive Industry, where the development has not commenced or has not been carried out.	$739
5	Determining a Development Application for an Extractive Industry, where the development has commenced or has been carried out.	The fee in Item 4 plus, by way of a penalty, twice that fee.
6	Determining an application for approval of a **Home Occupation** or **Home Business** where the home occupation or home business has not commenced	$222
7	Determining an initial application for approval of a **Home Occupation** or **Home Business** where the home occupation or home business has commenced	The fee in Item 6 plus, by way of a penalty, twice that fee.
8	Determining an application for renewal of a Home Occupation or Home Business where the application is made before the approval expires	$73
9	Determining an Application for a **change of use** or for an **alteration or extension or change of a non-conforming use** to which Item 1 does not apply, where the change or the alteration, extension or change has not commenced or been carried out	$295
10	Determining an Application for a **change of use** or for an **alteration or extension or change of a non-conforming use** to which Item 1 does not apply, where the change or the alteration, extension or change has commenced or been carried out	The fee in Item 9 plus, by way of a penalty, twice that fee.
11	Building Envelope Variation	$500

GENERAL INFORMATION REQUIRED FOR DEVELOPMENT APPLICATIONS

1. A completed **Application for Development Approval** (copy attached), signed by the landowner or party acting under written authority from the landowner.

2. The relevant **Development Application Fee**, as detailed above.

3. A **written explanation** of the proposal that expands on the information in the Application for Development Approval, including for example the proposed hours of operation, numbers of employees and clients at any one time.

4. Two (2) hard copies and one (1) electronic copy (PDF format) of plans at a scale of 1:100 or 1:200 including:

   (i) **Site Plan**, which shows the following:

      (a) street names, lot number(s), north point and the dimensions of the site;

(b) the existing and proposed ground levels over the whole of the land the subject of the application and the location, height and type of all existing structures, as well as any structures and vegetation to be removed;

(c) the existing and proposed use of the site;

(d) dimensioned position of proposed buildings and structures to be erected on the site;

(e) the existing and proposed means of access for pedestrians and vehicles to and from the site;

(f) the location, number, dimensions and layout of all car parking spaces intended to be provided in accordance with Australian/ New Zealand Standard AS/NZS 2890.1:2004, *Parking facilities, Part 1: Off-street car parking* and Australia/ New Zealand Standard AS/NZS 2890.6:2009, *Parking facilities, Part 6: Of-street parking for people with disabilities*;

(g) the location and dimensions of any area proposed to be provided for the loading and unloading of vehicles carrying goods or commodities to and from the site and the means of access to and from those areas;

(h) the location, dimensions and design of any open storage or trade display area and particulars of the manner in which it is proposed to develop the same;

(i) the nature and extent of any open space and landscaping proposed for the site;

(j) existing and proposed walls and fences;

(k) existing and proposed sealed areas;

(l) stormwater drainage and method of on-site disposal;

(m) existing and proposed levels, embankments and retaining walls (where the proposed development involves alterations to the natural level of the ground); and

(ii) **Floor Plans, and Sections** of any building proposed to be erected or altered and any building that is intended to be retained which must also show dimensions of the buildings and setbacks from boundaries.

(iii) **Elevation Plans**, which show natural ground levels, proposed ground levels, finished floor levels, finished ceiling levels and ridge heights.

(iv) **Streetscape Elevation Plan**

(v) **Landscape Plan**

(vi) **Report** on any specialist studies in respect of the development that the City requires the applicant to undertake, such as a Bushfire Management Plan, Transport Impact Statement and Transport Impact Assessment, Heritage Impact Statement, Signage Strategy, site survey, environmental, engineering or urban design study; and

(vii) **Heritage** – Where the application relates to a place entered onto the City's Heritage List other information may be required as set out in the Planning and Development (Local Planning Schemes) Regulations 2015 (Regulation 63(3).

(viii) Written justification where any variations to the R Codes 'Deemed to Comply' criteria are proposed.

6. Any other information that the City reasonably requires to enable the application to be determined.

PRE LODGMENT CONSULTATION (Optional)

If you have had any pre-lodgment discussions with a City Planning Officer prior to the submission of this Development Application, please confirm the following:

Planning Officer: _____ Date (if known) _____

Matters Discussed _____

_____

Form of communication: Email ☐ Phone ☐ Meeting ☐ Letter ☐

Should you require further assistance, please call the City's Planning Services on 9527 0748.

GOVERNMENT OF WESTERN AUSTRALIA

Western Australian Planning Commission

MRS | Form 1 Application for Planning Approval

Owner/s details

Registered proprietor/s (landowner/s) or the authorised agent's details **must** be provided in this section. If there are more than two landowners please provide all relevant information on a separate page. Signature/s must be provided by all registered proprietors or by an authorised agent.

Alternatively, a letter of consent, which is signed by all registered proprietors or by the authorised agent, can be provided.

Full name	WESTERN AUSTRALIAN LAND AUTHORITY
Company/agency (if applicable)	T/AS DEVELOPMENTWA
ACN/ABN (if applicable)	34 868 192 835
Postal address	LOCKED BAG 5
Town/suburb	PERTH BC Postcode 6849
Signature	The landowner/s or authorised agent consents to the applicant submitting this application Date 4/2/22
Print name and position (if signing on behalf of a company or agency)	VAUGHAN BRAZIER - MANAGER STRATEGIC INDUSTRIAL & ASSET MGMT

Applicant details

Name/company	Ecograf Limited
Contact person	Shaun O'Neill
Postal address	18 Richardson Street
Town/suburb	West Perth Postcode 6005
Phone	0428112815 Email soneill@ecpgraf.com.au
Applicant signature	
Print name and position (if signing on behalf of a company or agency)	Shaun O'Neill Executive Manager Project Development Date 25/1/22

Property details

Certificate of title description of land:	Lot No	2	Location No	--
Plan or diagram 404186	Vol	2868	Folio	292
Certificate of title description of land:	Lot No		Location No	
Plan or diagram	Vol		Folio	

Title encumbrances (e.g. easements, restrictive covenants)	N/A
Locality of development (house no., street name, suburb, etc)	City of Rockingham
Nearest street intersection	Zirconia Drive / Alumina Road
Existing building/land use	vacant land - zoned special industrial
Description of proposed development and/or use	Development of an industrial graphite processing plant inclusive of all buildings and site infrastructure
Nature of any existing buildings and/or use	Industrial use
Approximate cost of proposed development (excl. gst) $	$50.0M
Estimated time of completion	December 2022

Office use only

Acceptance officer's initials		Date received	
Local government reference No.		Commission reference No.	

The information and plans provided with this application may be made available by the WAPC for public viewing in connection with the application.

Version: 9.2 (December 2018)

Additional Information to be provided on the MRS Form 1

Is the development within a designated Bushfire Prone Area?	Yes	No
If 'yes', have bushfire hazard issues been identified and addressed (e.g.by providing a BAL Assessment(s) or BAL Contour Map and a Bushfire Management Plan with the application)?	Yes N/A	No
If NA is selected and the development is in a designated bushfire prone area then a short statement justifying why SPP 3.7 does not apply should be included.		
Does your application require determination by a Development Assessment Panel? (DAP)	Yes	No

Please refer to the following website for DAP requirements: www.dplh.wa.gov.au/daps

If yes, please complete DAP Application Form as per DAP requirements.

Checklist (supporting information)

Please complete the checklist below and ensure that all the relevant information is provided with the application.

1. Completed Metropolitan Region Scheme (MRS) Form 1
2. Plans at a scale not less than 1:500 (A3) showing:-
   - (i) the location of the site including street names, lot number(s), north point and the dimensions of the site;
   - (ii) the existing and proposed ground and floor levels over the whole of the land that is the subject of the application, including details of proposed cut and fill, and retaining walls;
   - (iii) the location, metric dimensions, materials, finishes and type of all existing and proposed structures, including services, on the land that is the subject of the subject of the application and all existing structures and vegetation proposed to be removed;
   - (iv) the existing and proposed use of the site, including proposed hours of operation and buildings to be erected on the site;
   - (v) the existing and proposed means of access and egress for pedestrians and vehicles to and from the site;
   - (vi) the location, number, dimensions and layout of all car parking spaces intended to be provided, including provision for the disabled;
   - (vii) the location and dimensions of any area proposed to be provided for the loading and unloading of vehicles carrying goods or commodities to and from the site and the means of access to and from those areas;
   - (viii) the location, dimensions and design of any open storage or trade display area and particulars of the manner in which it is proposed to develop those areas;
   - (ix) the nature and extent of any open space and landscaping proposed for the site; and
   - (x) proposed external lighting and signage.
3. Plans, elevations and sections, as appropriate, of any building or structure proposed to be erected or altered and of any building or structure it is intended to retain;
4. Any specialist studies that the responsible authority may require the applicant to undertake in support of the application such as traffic, heritage, environmental, engineering or urban design studies;
5. Any management plans the responsible authority may require to support or implement the application; and
6. Any other plan or information that the responsible authority may require to enable the application to be determined. This may include scale models or information in digital formats.

For additional information please refer to Development Control Policy 1.2
www.dplh.wa.gov.au/getmedia/37533b97-e0ad-4947-9d00-c4d62fa92746/DCP_1-2_general_principles

Development application checklist - lodgement requirements

Application signatures	The MRS Form is to be signed by the registered proprietor/s as shown on the certificate/s of title. Where the landowner/s cannot sign, an authorised agent can sign and attach evidence of the authority. If the subject land is owned by a company, you must confirm whether it is a sole proprietorship company and state the full name/s and position/s of the company signatory/ies. Appropriate company signatory/ies include one director and the company seal, two directors, or one director and one secretary. Eg: _____ _____ John F. Smith - Director, Smith Pty Ltd Peter S James - Director, Smith Pty Ltd Or _____ John F. Smith - Sole Director, Smith Pty Ltd If the subject land is owned by a strata company, consent can be signed by the strata company secretary or by an elected person of the strata company providing proof of authority either by letter of delegated authority, signed by all strata owners or minutes showing delegated authority.
Certificate of Title	Ensure the Certificate of Title/s is/are current (within 6 months) and provide copy/s.
Change of name	Applications made by either private owners or companies who have changed names to that depicted on the Certificate of Title, must provide supporting documentation showing the change of name such as: • a transfer of land document that incorporates a lodgement receipt, • a company search from the Australian Securities and Investment Commission, • a marriage certificate or • a change of name certificate.
Contacts	A contact name, phone and email address is essential, in the event more information is required and for issuing correspondence relating to the Department's decision.
Contracts of sale	Where the land is subject to a contract of sale or offer and acceptance, evidence of landowner's consent must be provided. Relevant evidence may include; • an express provision of consent by the vendor on the contract of sale or offer and acceptance, • a letter of consent from the registered proprietor/s giving prospective purchaser/s consent to lodge the application or • a copy of the transfer of land document that incorporates a lodgement receipt.
Crown land	Where the land is registered in the name of the Crown, the application form must be signed by an authorised officer of the Department of Lands, stating the name and position. Alternatively, a letter of consent from the authorised Crown land officer.
Deceased estates	Where the land is registered in joint tenants, a copy of the death certificate of the deceased landowner must be provided. Where the land is registered in tenants in common, a copy of the grant of probate or endorsed enduring power of attorney must be provided.
Designated Bushfire Prone Area	If the proposed development is located within a Bushfire Prone Area according to the Map of Bush Fire Prone Areas, then bushfire hazard issues should be identified and addressed (e.g. by providing a BAL assessment(s) or BAL Contour Map and a Bushfire Management Plan with the application). If NA is selected and the development is in a designated bushfire prone area then a short statement justifying why SPP 3.7 does not apply should be included.
Emailed documents	Emailed applications or documents are acceptable, however the application must be signed by the registered proprietor/s.
Government agencies	Where the land is registered in the name of a government authority, the application form must be signed by an authorised officer of the relevant authority, stating the name and position of the signatory/s. Alternatively, a letter of consent signed by an authorised officer.

Ecograf Battery Anode Material Facility

Stage 1
East Rockingham Industrial Park

Development Application Report

Revision C
Issued For Development Approval
28th January 2022

HUNT ARCHITECTS

EcoGraf™

Contents

I. Executive Summary

This Report will summarize the proposed industrial facility located at the corner of Zirconia Drive and Alumina Road in the East Rockingham Industrial Park. The project proposes to construct an industrial graphite processing (battery anode material) facility for Ecograf Limited. This will be a world's first facility of this type, producing spherical graphite used in lithium batteries which support the global transition to clean energy. The development has the potential to be staged across lots 1 & 2, Zirconia Drive. This development application is for the stage 1 project and only pertains to the industrial development on Lot 2 Zirconia Drive. Any subsequent development on Lot 1 will be the subject of a future development application process.

About Ecograf Limited

EcoGraf Limited is a publicly listed company on the Australian Stock Exchange, trading as ASX: EGR. It is a vertically integrated battery anode material business is supporting the global transition to clean energy for the rapidly expanding electric vehicle and lithium-ion battery manufacturers. Ecograf supports battery production through its provision of the anode material, which is 100% graphite and represents almost half of the total minerals in a lithium-ion battery. This graphite is a plus 99.95% pure spherical graphite product which is refined to meet stringent chemical and physical specifications capable of withstanding the intense operating conditions of a battery in an electric vehicle.

Along with electric vehicles and growth in battery manufacturing, demand for this specialised spherical graphite product is growing exponentially. Coupled with this there is increasing growth in demand for natural flake graphite, which is the feedstock. EcoGraf Limited is focused on becoming a long-term partner in supplying eco-friendly natural flake and battery (spherical) anode material to customers in both established (refractory, recarburiser, lubricant) and emerging (lithium-ion battery) global markets.

To cater to this new demand for quality graphite EcoGraf has developed an integrated graphite business. To produce spherical graphite in Western Australia for export directly to major anode manufacturers while at the same time developing an upstream mining business to produce natural flake graphite as feedstock and for other traditional industrial markets. Currently all global supply of spherical battery graphite is produced in China with a very toxic purification process using hydrofluoric acid.

There is strong demand by anode manufacturers outside China for an alternative supply that is environmentally friendly. This is the market demand that EcoGraf is targeting. The company has refined its process over 3 years and many millions of dollars in R&D to fine tune the eco-friendly purification process. The Western Australian Government is providing strong support and has allocated EcoGraf land in the City of Rockingham. The graphite produced at this plant will be exported to customers in Asia, Europe and America.

The Project

This application is to proceed with the first stage of the Ecograf battery anode material facility. The proposal includes all necessary infrastructure to implement the demonstration phase of the graphite processing to prove the capability of the technology and enable Ecograf to commence its manufacturing and export business. The second stage of the development will be subject to its own development application and thus this proposal is seeking approval for stage 1 only.

The proposed development includes all the required industrial facilities to commence operation from the proposed site in the East Rockingham Industrial Park. The proposal is for an industrial use, consistent with the site's zoning under TPS2 and the adopted Structure Plan.

The proposed development includes the following facilities; cross-overs, access roads, carparks, infrastructure and services, site enclosure fencing and gates, site identification signage, process infrastructure (P.I.) buildings, non-process infrastructure (N.P.I.) buildings, site drainage works and landscaping.

The proposed development is in compliance with the provisions of the planning scheme and the site zoning under the scheme. The East Rockingham Industrial Park Design Guidelines have been addressed through various aspects of the design and appropriate justification has been included.

II. Report Appendices

A number of specialist consultants have prepared the following reports in support of the proposal and application for development approval. This information is included in the appendix to this report and includes the following subject matter.

Appendix	Report Topic	Author / Firm	Summary Comment
A	Planning overview	GHD	An overview of the statutory planning context and compliance of the proposal with the scheme text. The report provides further justification for the definition of the primary and secondary street frontages and the approach to these interfaces as proposed in the development.
B	Landscape Architecture Design and schedule	Plan E	The landscape design has been prepared to express the bushland character of the site, the edges of the site will be planted to illustrate the native species endemic to the area and the scheme will utilize transplanted and relocated grass trees from within the site. A number of the larger mature trees have also been retained in the design to further enhance the bushland character of the site. Landscape site plan illustrating the areas of landscape planting and proposed species has been included.
C*	Traffic Impact Statement	i3 Consultants	The Traffic Impact Statement has been written in the context of the fully realized processing plant including stages 1 & 2. This illustrates the site's capacity to cater for the anticipated vehicle movements and the impact on the surrounding road network. We note the impact of stage 1 which is the subject of this proposal will represent a reduced impact from that which has been identified in the report and therefore does not materially alter the findings or information included in that report.
D	Stormwater Management Plan	GR Engineering	The stormwater management plan has been developed n the basis of the initial stage 1 works and includes the necessary drainage systems to collect, transfer and retain all surface water in accordance with CoR PP1.8. The report also includes standard details for retention pits to deal with oily water runoff which may exist on the site.
E	Environmental Analysis Report	GHD	The report outlines the environmental aspects of the proposal in accordance with the City of Rockingham Planning Procedure No. 1.23 – Environmental Assessment. The report supports the proposed developments compliance with he requirements and outlines the specific response to the criteria listed in the policy.
F	Domestic Waste management Report	Encycle Consulting	The report has been prepared to outline the domestic waste generation and handling requirements for the general office and administration areas utilizing the City's waste collection services. The industrial and process waste is not included in this report.

G	Bushfire Management Plan	Bushfire Prone	Bushfire contour mapping has been developed on the basis of stage 1 only, and the corresponding site masterplan illustrates no major infrastructure within the BAL FZ/40 zones.
H	Noise Impact Statement	SLR Consulting	The report undertook noise measurements, modelling and assessment of the proposed equipment and facilities associated with he stage 1 development. The noise modeling was correlated against baseline noise data and predicts impacts on the nearest residents. The report illustrates the proposed development is expected to comply with environmental noise management regulations and criteria.
I	Site Feature Survey	Horizon Surveys	Drawing Included
J	Architectural Drawings – NPI Buildings	Hunt Architects	Drawings of cluster 1, 2, 3 plans, elevations, section and site masterplan included. A 3-D image of the cluster 1 building which sits on the primary street frontage has been included for visual reference.
K	Engineering Drawings – PI Buildings	GR Engineering	Drawings of the industrial processing buildings included.

III. Site Context

The subject site is located at Lot 2 Zirconia Drive, on Deposited Plan 404186 and encompasses a land area of 3.7711 hectares. The site is located within the East Rockingham Industrial Park and is subject to the East Rockingham Industrial Park Design Guidelines, in addition to the provisions of TPS2. The land is zoned "Special Industry" under the TPS2 and "Environmentally Acceptable Heavy Industry" under the structure plan.

Figure 1 – Map 1 City of Rockingham TPS2

Figure 2 – TPS2 Map1 w/ legend

Figure 3 – East Rockingham Industrial Park Structure Plan

The proposed site is located with Precinct 2 and has been designated as – Environmentally Acceptable Heavy Industry. The Ecograf Limited processing facility is a permitted industrial use and complies with the precinct zoning of the structure plan.

The site has varied boundary conditions as follows:

North Boundary	Land zoned for public purposes
East Boundary	Alumina Road
South Boundary	Zirconia Drive
West Boundary	Lot 1, 2.9843ha of land zoned, special industry

The site is located in proximity of Patterson Road which is a primary artery and entry into the City of Rockingham, however the site has no frontage to Patterson Road as illustrated by the below image. The subject site is separated from Patterson road by Lot 1, Zirconia Drive.

Figure 4 – Aerial Image indicating site location and surrounding streets

The below series of images taken from Google Street view illustrates the existing character of the surrounding road network and adjacent industrial development.

View east on Zirconia Drive – Proposed site on left *(Image courtesy Google)*

View east on Zirconia Drive – Proposed site on left *(Image courtesy Google)*

View east on Zirconia Drive at intersection of Alumina Road *(Image courtesy Google)*

View North on Alumina Road – Proposed site on left *(Image courtesy Google)*

View West on Zirconia Drive – adjacent development on the left. *(Image courtesy Google)*

Existing Site Conditions

The proposed site is currently vacant land consisting predominantly of scrub vegetation, having been cleared during the creation of the industrial park. The site has been identified as a proposed location for industry and is not subject to any clearing permit requirements. The Environmental report and BAL Assessment included in the appendices will provide further detail on the site and its surrounds.

The site contains a small number of larger trees and a number of native xanthorrhoea (grass trees). The site masterplan illustrates that the larger trees in proximity to the site boundary will be retained. The landscape

report has outlined a strategy for the retention and preservation of a number of the xanthorrhoea which are found on site. The landscape design proposes to transplant, relocate and re-use as many of these from the site as can be accommodated, thus ensuring the bushland characteristics of the site are retained in the proposed development. Further detail can be found in the Landscape report appended to this document.

A site feature survey of the current site configuration and condition has been undertaken by Horizon Surveys and is included in the Appendix. The survey identifies the site features which currently exist and the nature of the existing vegetation found on the site.

Currently no geotechnical investigations have been undertaken on the site, this will occur in the next phase of work.

Planning Context and Response

The Site is located within the East Rockingham Industrial Park as identified in the City of Rockingham Town Planning Scheme No.2, Gazetted 19th November 2004 and updated 11th June 2021. Additional relevant documents include:

- Planning Policy No. 3.3.8 – East Rockingham Development Guidelines

The East Rockingham Industrial Park is subject to the provision of the planning scheme text and the relevant design guidelines included within the TPS2. The below table summarises a number of the key criteria from these documents as they relate to the proposal and includes a summary of the proposals response.

Planning Requirement	Proposed Development Response
TPS2 - Zoning – Special Industrial	➢ The proposed use for graphite processing would be classified as industrial use and therefore is in compliance with this requirement.
TPS2 - Clause 4.8.5 *(a) The facades of all buildings visible from the primary road or open space area shall be of masonry construction or any other material approved by the Local Government in respect of the ground floor level, provided that if concrete panels are used, such panels must have an exposed aggregate or textured finish. The second-floor level, or its equivalent, may be constructed of other material in accordance with the Building Code of Australia and to the satisfaction of the Local Government;*	➢ The main administration building has been set back a minimum of 25 meters from the primary street and 15m from the secondary street. ➢ The administration building is the main public interface for the site, all staff and visitors are required to check in at this location. ➢ The building form has been oriented to address the street corner and intersection of the 2 street frontages of the development. ➢ The building form has been suitably articulated with glazing and transparency including the main entry and the staff workspaces fronting the primary street. ➢ The building form has been further articulated with the addition of an architectural perforated screen to create layering, light, shadow and mitigate glare in the workspaces. ➢ The screen is a bespoke architectural element creating a distinctive architectural character to the primary street and the main public interface of the proposed development.
TPS2 - Clause 4.10.6 (b)(i) *to achieve an attractive and unified development which acknowledges the goal of conserving and enhancing the natural*	➢ Site masterplan will illustrate the retention of a number of the mature trees within the site and adjacent to the site boundaries.

environment by emphasising the retention of natural vegetation and the introduction of complementary quality landscaping and well designed buildings;	➢ The site landscape plan will utilize retained, relocated and preserved native vegetation, inclusive of a large number of xanthorea (grass trees) currently found on site.
TPS2 - Clause 4.10.6 (b)(ii) *to achieve a degree of consistency and compatibility in the built form and landscaping, whilst allowing for individuality and a well presented corporate or market image; and*	➢ The site setbacks are proposed to include considerable landscape treatment consistent with the native vegetation found on site. ➢ The buildings which present to the street have been suitably designed as to provide a distinctive architectural character to the public realm. ➢ The dialogue between buildings, landscape and site identification signage has been considered to create a distinctive development which expresses the unique character of East Rockingham Industrial Park setting.
* Primary Street – Alumina Road	➢ The proposed site has been planned with Alumina Rd. acting as the main site access point for vehicles, pedestrians and industrial traffic. ➢ The administration building public entry addresses this as the primary street. ➢ The site identification signage addresses this as the primary street. ➢ Due to the shape, dimensions and proportion of the site, the proposed industrial use the required setbacks from the primary street Alumina Road enables the site to be optimized and efficient within the available land area of Lot 2. ➢ The industrial buildings visible from the primary street have been set further back from the street, screened appropriately, and include a landscape buffer zone to the minimum setback line. ➢ The site landscape plan indicates a considered landscape response to the setback zone.
Secondary Street – Zirconia Drive	➢ The proposed site has been planned with Zirconia Drive as the secondary street. ➢ There are no public entry points planned to occur along this boundary, only an emergency egress from the processing plant has been located along this frontage.
TPS2 – Clause 4.10.10 - Setbacks	➢ Primary Street – Alumina Road – Proposed 25m setback to main administration building (NPI). Proposed 40m setback to industrial workshop building. ➢ Secondary Street – Zirconia Drive – Proposed 15m to the administration building (NPI) and 20m setback to industrial processing facility (PI). ➢ Landscape – 1 minimum 10m landscape buffer is provided to all street frontages. ➢ The proposed landscape buffer to the primary frontage of Alumina Road is in excess of 30m.

**TPS2 – Clause 4.15 - Carparking	➢ In accordance with the traffic report, staffing numbers and shift overlap the proposal includes 26 carbays for staff. ➢ The proposal includes 1 ACROD bay for visitors ➢ The proposal includes 2 visitors bays
TPS2 - Clause 4.8.5 - Fencing *(b) No fence visible from a road or open space reserve shall be constructed of materials/colours which in the opinion of Local Government are unsightly or detract from the amenity of the locality, or be used for signage where the approval of the Local Government has not been granted. Any industrial (eg. Chain wire) fencing forward of the street building setback line shall be landscaped to the satisfaction of the Local Government.*	➢ In accordance with the ERIP design guideline requirements the proposed development will include 2.4m high chain mesh fencing with black PVC coating to the mesh and black posts. ➢ The fence line will sit on the property boundary on Zirconia Drive. ➢ Along the primary frontage the fencing is set back to the 25m setback, with the exception of the staff carpark which will be setback 7.0m from the boundary with a landscape buffer to the fence set-back area. ➢ The majority of the primary street frontage is open landscape buffer and carparking with the fencing setback 25m to all areas with he noted exception of the staff secure carpark.
Design Guideline 5.3.2 - Airconditioning plant and equipment	➢ All air conditioning plant to the main administration building and workshop structures which is visible to the primary street frontage will be suitable screened with the proposed articulated perforated metal screen.
Design Guideline 5.3.4 - Signage	➢ The proposal includes the design for the site identification signage and has been located within the setback zone as indicated on the submitted plans.

**Please refer to the report appendices for additional justification of the primary and secondary street allocation.*

***Please refer to the appended traffic report for further justification of parking calculations in accordance with TPS2.*

IV. Background & Brief

The proposal is a distinctive and innovative industrial use, providing a niche product for the growing battery industry using a refined and environmentally friendly process. The facility will include non-process infrastructure (NPI) and process infrastructure (PI). These 2 elements are distinct from one another in the following aspect:

NPI – refers to non-industrial workspace environments, desk work, laboratory, IT and desk work, inclusive of meeting spaces, crib rooms and training rooms.

PI – refers to industrial working environments. These buildings house the processing machinery for the industrial processing of the graphite.

Design Brief

The design brief is to create the first stage of the Ecograf Limited battery anode material facility. This facility will provide direct employment for 37 FTE in stage 1. Below is the organizational chart indicating FTE for stage 1 and the future stage 2 development. Please note this proposal is only regarding stage 1, 37 FTE.

KWINANA SPG FACILITY	5,000tpa Plant		20,000tpa Plant	
Manning	Number	Roster	Number	Roster
Position				
Processing				
Management and Technical				
Processing Plant Manager	1	5/2	1	5/2
Metallurgists	2	5/2	2	5/2
Production - Shift				
Shift Supervisor	2	3/1	4	3/1
Process Operator (Spheronisation/Micronisation)	2	3/1	4	3/1
Process Operator (Purification & Reagent Mixing)	4	3/1	4	3/1
Process Operator (Bagging/Loading)	2	3/1	4	3/1
Forklift Operator	2	3/1	6	3/1
Labourers	4	3/1	8	3/1
Laboratory				
Chemist	1	5/2	1	5/2
Laboratory Supervisor	2	3/1	2	3/1
Laboratory Technician	2	3/1	2	3/1
Maintenance				
Maintenance Superintendent	1	4/1	1	4/1
Mechanical Supervisor	1	4/1	1	4/1
Electrical Supervisor	1	4/1	1	4/1
Fitter	2	4/1	4	4/1
Welder / Boilermaker	2	4/1	4	4/1
Electrician/Instrument Technician	2	4/1	4	4/1
Labourers	4	4/1	8	4/1
TOTAL	37		61	

To support the plant operations a number of distinctive facilities are required to manage the administration and the processing, as noted above NPI and PI facilities.

A high level summary of the functional building areas (NLA) for the non-process infrastructure (NPI) buildings is as follows:

Level	Function / Description	Area (m2 of NLA)
Cluster 1 - Administration		
	Office / Security / training / meeting / comms / first aid / crib room / amenities	400
Cluster 2 – Control room		
	Control room / lab / meeting / crib / amenities	192
Cluster 3 - Workshop		
	Office / amenities / store	71

A high level summary of the functional building areas (NLA) for the process infrastructure (PI) buildings is as follows:

A high level summary of the functional building areas (NLA) for the process infrastructure (PI) buildings is as follows:

Level	Function / Description	Area (m2 of NLA)
Micronising and Spheronising Mill Building		
	Micronising Feed Bin & Bag Splitter - Train 1 & 2 Micronising and Spheronising Mills - Train 1 & 2 MCC -01 & MCC-02 Train 1 & 2	2,758
Kiln Shed		
	Alkaline Bake Kiln / Dust Collector / Scrubber	239.2
Purification Plant Building		
	Pressure Filters / Feeders / Tanks / Pumps	785
Dryer Shed		
	Graphite Flash Dryer / Cooler / Baghouse	266
Bagging Plant Building		
	Product Bagging Plant / Load Out / Storage	235
Services Plant Shed		
	Steam Boiler / Air Compressors / Nitrogen Plant	248
Motor Control Centre 3		
	MCC 03 – Purification Plant	60

Building Planning – Non-Process Infrastructure (NPI)

The NPI buildings will employ a modular construction methodology. These buildings will consist of a series of pre-fabricated modules constructed off-site. These modules will be brought to site and assembled in accordance with the cluster 1, 2 & 3 plans included with this Development Application.

Building Planning – Process Infrastructure (PI)

The PI buildings by the nature of the scale and volume will be in-situ construction. Constructed on site using a conventional building approach with materials arriving on-site and assembled by a contracting team.

V. Design Proposal – Non-Process Infrastructure (NPI)

Site Master Planning

The masterplan has been developed to facilitate the efficient and orderly operation of the industrial operation for machining and production of battery anode graphite material. The first stage of the plant which is the subject of this proposal has been developed on Lot 2 with capability for expansion within Lot 2 and potentially a future stage which expands the operation to Lot 1 for additional plant capacity.

The key principals of the masterplan are as follows:

- Create a public interface and street front presence at the main intersection of Zirconia Drive and Alumina Road.
- Orient the large industrial processing buildings to align with he long axis of the site running east-west to optimize site utilization.
- Create the main public and vehicular access points on the Alumina Road frontage.
- Create a generous landscape setback to the Alumina Road frontage, with the NPI building setback 25m and the PI industrial building set-back 40m from the site boundary.
- Secure staff parking and entry from the primary frontage on Alumina Road.
- Roads and infrastructure located to retain a number of large mature trees on the site.

Vehicular and Pedestrian Access

All vehicular and pedestrian access has been focused on Alumina Road. This frontage will be the main arrival for staff, visitors and heavy vehicles via a separate secure entry point. Access to the site will be strictly controlled via a security checkpoint within the main administration building (NPI Cluster 1), card swipe gates and turnstiles and a boom gate for heavy vehicle movement.

The secure staff carpark and visitors carpark are accessed direct from Alumina Road via a single crossover. Pedestrian access will be direct from the footpath on Alumina Road and lead to the main administration building (NPI Cluster 1) for security check in and clearance.

An emergency egress point for heavy vehicles has been provided along Zirconia Drive, which will be closed with a sliding gate and only opened when required to be used.

Car Parking

The development proposes to include all required off-street carparking at grade with a combination of parking located around the site to suit the various functional requirements and needs of the facility. The following is a summary of car parking by location:

Function	Location	Number of bays
Public	Visitor	2
	ACROD	1
Staff	Secure	26
	Ambulance (undercover within secure area – cluster 1)	1
	Total off-street car bays	30

Landscape Philosophy

The following statement has been prepared by the landscape architect commissioned to undertake the design of the project, Plan E, the corresponding drawing and planting schedule has been included in the Appendix.

Key features of the landscape philosophy to be adopted for the Ecograf Battery Anode Material Facility project include:

1. Enhance Biodiversity
   - Retain existing trees / vegetation where possible;
   - Utilise high diversity of endemic WA plantings;
   - Showcase WA endemic species, particularly as this facility is likely to attract International visitors, and;
   - Maximise tree plantings throughout to mitigate the 'heat-island effect', including large 'habitat' trees such as Tuarts as well as bird & insect-attracting species such as Banksias, Melaleucas etc.

2. Waterwise Strategy
   - Utilise endemic plantings throughout with low irrigation demand that can be reduced and ultimately switched off after a 3-5 year establishment period;
   - Potential introduction of on-site drainage treatment in collection basins as a means to filter run-ff prior to entering the groundwater system, and;
   - Maximise garden bed areas / permeable paving to increase infiltration across the site.
   -
3. Sustainability
   - Introduce low-maintenance garden bed areas with endemic plantings;
   - Maximise tree canopy to reduce heat island effect + carbon offsets;
   - Use local materials such as natural limestone, gravels, sands & concrete aggregates to minimise transport costs;
   - Consider using local industries and suppliers for furniture, landscape materials and plants, and;
   - Consider recycled and recyclable materials throughout.

Design Approach – N.P.I. Buildings

The NPI building designs have been developed in response to and as an outcome of:

- The functional brief requirements;
- The required site planning to suit the industrial nature of the development; and
- The modular construction methodology, transport requirements and standard module sizes as determined by the nominated supplier.

The NPI buildings will utilize modular construction and comprise of a series of standardized modules linked together to create the spaces required for the administration and workspace for the staff on site. The staff amenities, toilets, meeting spaces and other ancillary uses commensurate with office based activities will also be developed as modular units. The modules will come in standard widths of 3.2m, 3.4, 3.5 and 4.0m and lengths from 6.0m up to 14.4m. The design has utilized a range of standard sizes to create the spaces required for the various activities envisaged on site. The modules will provide a standard internal ceiling height of 2.7m and will vary in height depending on the size and slope of the roof, the standard height will be less than 3.5m floor to top of roof, however due to their nature as modules will be positioned on stumps which will range in height between 250mm and 600mm above finished ground level. This will provide an overall maximum height of approximately 4.1m above ground level for all modular buildings. A number of

the modules will have insitu verandahs and roof structures added for shade, shelter and glare control of the internal spaces.

The main focus of the development proposal from an NPI perspective is cluster 1, this building is positioned on the primary street frontage and addresses both the Alumina Road frontage as well as the Zirconia Drive frontage. This building will be the main arrival point for all staff and visitors to the site. Whilst it will be constructed as a modular structure the proposal includes the addition of an external screening element to create a visually united structure which has a distinctive presence on this important corner. The screen will utilize an angular geometry to enhance the distinctive character of the design and will act as a 'veil' to the public faces of cluster 1 to shroud the modules and unify the building. The 'veil' will be constructed using a folded perforated metal on an independent steel frame which will be fixed to the modules. The perforated material will be approximately 50% open area which will enable transparency and views through the screen allowing natural light to illuminate the internal workspaces.

The veiling screen will also be used along the street frontage of cluster 3 and the workshop facility to create a similar character facing the primary street and shroud the more industrial nature of the workshop as it presents to the primary street frontage of Alumina Road, this veil will sit in dialogue with the cluster 1 screen albeit in a different configuration due to the scale and nature of the building(s) behind.

All air conditioning plant located on NPI buildings with exposure to the street will be suitably screened with either the veil, or located under verandahs behind timber battens, to ensure they are obscured from street views.

Environmentally Sustainable Design

The following sustainability initiatives are envisaged as part of the proposal:

- The use of modular, off-site construction will minimize construction waste generated on site,
- The application of verandahs to the north, east and west facades of the habitable workspaces will control heat gain and glare in the workspaces,
- The provision of a landscape courtyard for cluster 1 and 2 will provide a microclimate to assist with cooling the building, provide access to cross ventilation and create amenity for staff,
- The use of light coloured sheeting for the main bodies of the modules will mitigate solar heat gain through the walls,
- The modules will be constructed in accordance with the requirements of NCC 2019 and the energy efficiency provisions included in Section J.

NPI Building Materials

The NPI buildings have been developed with a palette which is complimentary to the colour and tones of the proposed landscape and the character of the bushland surrounds of the East Rockingham Industrial Park.

The NPI buildings will utilize the following materials and colours:

Building element	Proposed material	Proposed Colour	Sample
Module / Building Facades	Steel sheet – panel rib or similar profile	Colorbond Shale Grey	
Module / verandah Roof	Metal Deck – Trimdek or similar profile	Colorbond Surfmist	
Module glazed window/door frames	Anodised aluminum	Natural Anodised	
Screen / Veil to Primary Frontage and A/C plant screening	Metal Deck – perforated to 50% open area Spandek profile or similar	Colorbond Basalt	
Verandah column, rafter, balustrade and handrails	Steel hollow sections and tubes as appropriate for structure and function.	Paint finish to match Colorbond Basalt	

VI. Design Proposal – Process Infrastructure (PI)

Micronising and Spheronising Mill Building

Concentrate receival

Concentrate will be received in bulk bags, packaged in containers. The bags will be carried by forklift to the bag filling station located within the Mill building. The bag will be split and the concentrate will be fed and stored in the Feed Silo(s).

Concentrate will be withdrawn from the Feed Silo by the Feed Silo Rotary Feeder and fed via the Micronising Train Feeder into the first Micronising Mill.

Mechanical Shaping

Concentrate from the first Micronising Mill will report to the second Micronising Mill, and from there to the Micronising Cyclone. Cyclone overflow will report to the Fines Baghouse while Cyclone underflow will report to the next two Micronising Mills in series. This sequence will be repeated for the required number of units to achieve the particle size desired for the particular product line being produced. Once sizing is complete the cyclone underflow will report to the first Spheronising Mill. Spheronising Mill product will report to an External Air Separator, with overflow from the separator reporting to a Spheronising Cyclone and underflow to the next Spheronising Mill in sequence. Overflow from the separator will report to a Spheronising Cyclone, with overflow from this cyclone reporting to a Fines Baghouse and underflow reporting as By-Product 1 to the By-Product 1 Silo, where it will be stored ahead of additional processing.

The sequence of Spheronising Mill, External Air Separator, Spheronising Cyclone and Fines Baghouse will be repeated as required to achieve the desired product.

Dependent upon the product specification desired underflow from the final External Air Separator will report either to the SPG10 or SPG16 Product Silo, where it will be stored prior to purification.

Additional Spheronising

By-product 1 will be stored in the By-Product 1 Silo, from where it can be directed back into the Mechanical Shaping circuit, diverted directly to the Fines Bagging Plant or sent for further treatment to the Additional (SPG10) Grinding circuit.

In the latter circuit further stages of Spheronising Mills with External Air Classifiers and Spheronising Cyclones will produce a Fines Product, which will join the fines produced in the other mechanical shaping trains in the Fines Silo, and an SPG10 product which will be stored in the Additional Product (SPG10) Silo.

Kiln Shed

Alkaline Bake and Leach

Product will be fed from the relevant silo into the Spherical Graphite Mixer, where it will be combined with sodium hydroxide. The resulting mixture will be fed into the Alkaline Bake Kiln, where it will be heated to a temperature determined by testwork for a specified period of time. Hot product will be discharged directly into the Alkaline Bake Quench Tank. The kiln will be heated using natural gas, with off gases scrubbed prior to release to atmosphere.

Purification Plant Building

Purification

Quenched material will then be pumped to the Filter 1 Feed tank, and subsequently to the Alkaline Water Leach Product Filter, where it will be filtered and washed. Filtrate will report to the Water Treatment Plant, while the filter cake will report to the Acid Wash Tank.

Filter cake from the Alkaline Water Leach Product Filter will be repulped with demineralised water and mixed with sulphuric acid. The resulting slurry will be held in the Acid Wash Tank at an elevated temperature for a period of time before being pumped to the Acid Wash Filter, where it will be filtered and washed with demineralised water. Filtrate will report to the Water Treatment Plant, while the filter cake will report to the Water Bath Tank.

Filter cake from the Acid Wash Filter will be repulped with demineralised water. The resulting slurry will be held in one of two Water Bath Tanks for a period of time before being pumped to the Water Bath Filter, where it will be filtered and washed. Filtrate will report to the Water Treatment Plant, while the filter cake will report to the Final Product Filter 4 Surge Hopper.

Dryer Shed

Drying and bagging

Final product will be fed into a flash dryer, with dried product transferred to the SPG Bagging Plant. The flash dryer will be heated by natural gas with product pneumatically conveyed and cooled to the bagging plant feed silo with off gases sent to a dust collector prior to release to the environment.

Bagging Plant Building

Product Bagging

Final product will be transferred to the SPG Bagging Plant. Here product will be bagged and placed into containers ready for shipment.

Fines Bagging

Fines generated in the mechanical shaping process will be collected and stored in the Fines Silo. Material from the silo will be withdrawn by the Fines Rotary Valve and fed into the dual purpose SPG Bagging Plant by the Fines Bagging Plant Feeder. Bagged fines will be loaded into containers for shipping.

Services Plant Shed

Steam Generation

Demineralised water and recycled condensate will be fed into a steam boiler powered by natural gas to produce steam for various heat exchange processes required within the process plant. Off gases from the boiler will be vented to atmosphere.

Air Compressors

Compressed air will be generated for services required within the process plant. Air receivers located throughout the plant will hold service air, while dedicated receivers will hold compressed air for drying product in the various filtering processes.

Nitrogen Plant

Compressed Nitrogen will be manufactured onsite via the Nitrogen Plant. A Nitrogen receiver located in the services area will supply a nitrogen blanket atmosphere for Alkaline Bake kiln's operation.

Appendix A – Planning Overview

999 Hay Street, Level 10
Perth, Western Australia 6000
Australia
www.ghd.com

Our ref: 12561940

28 January 2022

Chie Executive Officer
City of Rockingham
PO Box 2142
Rockingham WA 6967

EcoGraf Battery Anode Material Facility: Lot 2 on Plan 404186, corner Patterson Road and Zirconia Drive, East Rockingham – Application for Planning Approval (Development Assessment Panel)

Dear Sir / Madam,

EcoGraf Limited has engaged GHD to coordinate and submit an application for planning approval for the proposed battery anode material facility located at Lot 2 on Plan 404186, corner Patterson Road and Zirconia Drive, East Rockingham (subject site).

This submission provides an overview of the proposed development against the applicable state and local planning framework and provides detailed justification with regard to departures to the applicable development requirements; specifically with regard to street setback and landscaping.

This submission should be read in conjunction with the following assessments / documentation which forms part of this application for planning approval:

– Development application report by Hunt Architects
– Landscape design report and plan by Plan E Landscape Architects
– Traffic impact statement by i3 Consultants
– Stormwater management plan by GR Engineering
– Environmental impact report by GHD
– Waste management report by Encycle Consulting
– Bushfire management plan by Bushfire Prone Planning
– Noise impact statement by SLR Consulting

Background

The subject site is located within the Rockingham-Kwinana Industrial Area which is an area that has been earmarked by the State Government for industrial development associated with port facilities since the 1950's. The 1955 Stephenson and Hepburn Report, the 1961 "Premiers Committee for the Development of Cockburn Sound and Kwinana" and the 1963 Metropolitan Region Scheme formulated the broad planning framework.

In light of constraints at the time relating to lack of a structure plan and complicated land ownership and management, a concept plan was prepared which subsequently led to the decision to initiate preparation of an Improvement Plan for the area in 1981. Improvement Plan No. 14 was then endorsed with the main aim of the Plan being to *"…ensure that the area is developed in a manner which has regard to potential industries and their infrastructure needs in addition to their pollution and hazard influences on neighbouring urban areas"*.

Coordination and management of development in the locality is now overseen by the Industrial Lands Authority (ILA) which is a business unit within DevelopmentWA and takes a leading role in driving WA's economic development and jobs growth.

It is understood the subject site is Lot 2 on Plan 404186 which was created as part of WAPC subdivision approval #148030 dated 4 November 2013, which subdivided the former parent lot No. 500 on deposited plan 61891, volume 2733 folio 843.

Description of Proposed Works and Use

EcoGraf Limited (EcoGraf) is a battery anode material business, supporting the global transition to clean energy for the rapidly expanding electric vehicle and lithium-ion battery manufacturing industry. EcoGraf is proposing to expand its production efforts as a response to market demand for graphite, typically for use in lithium-ion batteries.

The project will involve milling of high-quality graphite flakes into battery-grade spherical graphite to be used in lithium batteries which support the global transition to clean energy. Currently all global supply of spherical battery graphite is produced in China with a very toxic purification process using hydrofluoric acid.

The project will include the following facilities and site improvements:

– 4,351.2sqm (nla) Battery anode facility – being the two main buildings where the milling and purification of uncoated spherical graphite products of 16 µm and 10 µm sizes occurs
– 400sqm (nla) Main administrative building for administrative staff and visitors
– 71sqm (nla) Workshop and store
– 192sqm (nla) control room and laboratory
– 60sqm (nla) motor control room
– Water treatment plan
– 2 x drainage swales
– Sealed internal roads throughout, 3 crossovers and, staff and visitor parking.
– Perimeter landscape treatment

The business itself will operate day-to-day based on the following characteristics:

– Operations are on a 24hr / 7 day basis with shift crews operating on three 8-hr shifts.
– The business employees a total of 37 staff full-time equivalent (FTE), the breakdown of this per building area being as follows:
    - 3 persons in the administration building

- 16 persons in the production plants (micronizing and spheronising mill building and purification and bagging plant)
- 5 persons in the control room and laboratory
- 13 persons in the workshop and store

Table 1 below provides a breakdown of staff based on role and roster arrangements.

Table 1 Employment breakdown and roster arrangement

Position	Number of Employees	Roster
Management and Technical		
Processing Plant Manager	1	5/2
Metallurgists	2	5/2
Production – Shift		
Shift Supervisor	2	3/1
Process Operator (Spheronisation / Micronisation)	2	3/1
Process Operator (Purification & Reagent Mixing)	4	3/1
Process Operator (Bagging / Loading)	2	3/1
Forklift Operator	2	3/1
Labourers	4	3/1
Laboratory		
Chemist	1	8/2
Laboratory Supervisor	2	3/1
Laboratory Technician	2	3/1
Maintenance		
Maintenance Superintendent	1	4/1
Mechanical Supervisor	1	4/1
Electrical Supervisor	1	4/1
Fitter	2	4/1
Welder / Boilermaker	2	4/1
Electrician / Instrument Technician	2	4/1
Labourers	4	4/1
Total	**37**	

Further details on the operational aspects of the development can be found in the development application report prepared by Hunt Architects.

Development Plans which form part of this application for planning approval are also contained within the development application report prepared by Hunt Architects.

State and Local Planning Framework Context

An overview of the applicable state and local planning framework provisions is summarised in Table 2 below.

Table 2 - Summary of State and Local planning framework

General	Details
Property Detail	Lot 2 on Plan 404186
Landowner	DevelopmentWA
Local Authority	City of Rockingham
Framework	
Metropolitan Region Scheme	Industrial
City of Rockingham Local Planning Scheme No. 2	Special Industry (majority of lot) General Industry (small strip abutting Zirconia Drive)
Structure Plan / Local Development Plan	N/A
Improvement Plan	Yes – Improvement Plan No. 14 (Feb 1988)
DevelopmentWA Strategic Industrial Area (SIA)	Yes – Rockingham SIA
Redevelopment Scheme / act area	No
Development Guidelines (DevelopmentWA)	Yes – Rockingham Industrial Zone (RIZ) Development Guidelines (East Rockingham Industrial Park) *subject Premises located within Precinct 2 – Environmentally Acceptable Heavy Industry
State Planning Policy 3.7 – Planning in Bushfire Prone Area	Yes
State Planning Policy 4.1 – State Industrial Buffer Policy	Yes
State Planning Policy 5.4 – Road and Rail Noise	Yes – Strategic freight and/or major traffic route
Draft Operational Policy 4.3 – Planning for High Pressure Gas Pipelines	Yes – within Dampier – Bunbury pipeline trigger distance
Government Sewerage Policy	Yes – within habitats of threatened and propriety ecological communities and specially protected water dependent fauna
Local Planning Policies	Planning Policy 3.3.8 – East Rockingham Development Guidelines Planning Policy No. 7.1 – East Rockingham Industrial Park: Environmental Planning Policy
EPA Guidance Statement	EPA Guidance Statement No. 3: Separation Distances Between Industrial and Sensitive Land Uses
Aboriginal Heritage Place (Registered Site)	No
European Heritage	No
Bush Forever area	No
Contaminated Site	No
Native Title	No

Land Use and Permissibility

Based on the description of the proposed works and use stated above, the development is considered to fall within an 'Industry - General (Licenced)' use calls under the provisions of LPS2**.** 'Industry – General (Licenced)' is defined under LPS2 as follows:

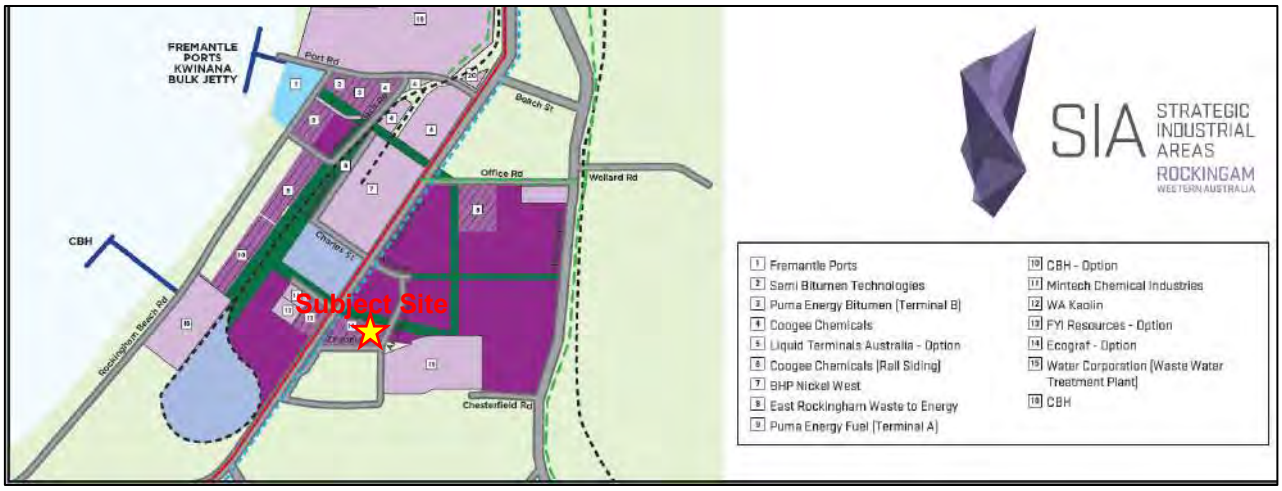
> *means an industry which is a category of Prescribed Premises set out in Schedule 1 of the Environmental Protection Regulations 1987 or premises subject to registration set out in Schedule 2 of the Environmental Protection Regulations 1987, but does not include an abattoir, agriculture—intensive, industry-extractive, industry-hazardous, industry-noxious, industry—rural, landfill (Prescribed Premises Category 63, 64, 65 and 66), livestock holding facility, piggery or stockyards.*

It is noted that the proposed development does constitute a Prescribed Premises as set out in Schedule 1 of the *Environmental Protection Regulations 1987*. A Works approval document seeking approval for a Category 31 premise has been submitted. The proposed development does not include any of the prohibited categories.

A 'Industry – General (Licenced)' use on land zoned 'Special Industry' and 'General Industry' is a 'A' use under Table 1 of LPS2 meaning *"…that the use is not permitted unless the local government has exercised its discretion by granting development approval after giving special notice in accordance with Clause 64 of the deemed provisions"*.

As outlined above, the locality has been designated for significant industrial development since the inception of the Stephenson and Hepburn report. Since then, DevelopmentWA has taken a leading role in the delivery of this area as a strategic industrial hub, its primary mandate being to encourage economic growth and efficiently develop land for strategic, general and light industrial use across Western Australia. As illustrated in Figure 1 below, the subject site is situated within, and surrounded by land designated for industrial purposes, many of which have already been developed or have been allocated / optioned to businesses which are pending approvals. It is noteworthy that Figure 1 already identifies EcoGraf at the subject site.

Figure 1 Extract of Rockingham-Kwinana Strategic Industrial Area plan (Source: DevelopmentWA)



Furthermore, under the provisions of the City of Rockingham Planning Policy No. 7.1 – East Rockingham Development Guidelines, the subject site is located within 'Precinct 2 – Environmentally Acceptable Heavy Industry' of which the planning criteria is:

> *This precinct is designated for heavy industry which can meet stringent environmental and risk criteria. Industries eligible for this precinct ae generally expected to be large scale and involved in*

chemical or mineral processing. The precinct is central to the strategic planning for the estate to enable heavy industry to operate within a buffer of transitional industrial and parkland zones.

Based on the reasons above, the proposed use is considered to warrant favourable consideration in its proposed location. Sections below provide further discussion on the built form outcome, having regard to the applicable development provisions.

Development Considerations

Part 4 of LPS2 outlines the general development requirements applicable to all zones. Cl. 4.10 specifically outlines the development requirements applicable to all industrial zones. The main objective for all development within industrial zones is to:

a) to provide for a range of industrial land uses by establishing guiding principles and policies that are environmentally and socially acceptable;

b) to encourage and facilitate the establishment of attractive and efficient industrial areas ensuring that acceptable levels of safety and high standards of amenity are provided through the application of appropriate land use, design and landscaping controls; and

c) to ensure that industrial areas are developed in a manner which has due regard to potential industries and their infrastructure needs, and that adjacent urban areas are not subjected to pollution and hazards.

Table 3 below provides an assessment of the proposal against the general development requirements contained under cl.4.10 of LPS2. Further assessment of the proposal against relevant supplementary requirements is outlined under the subsequent tables below. Variations have been marked in red.

Table 3 summary of cl. 4.10 of LPS2

Clause	Provision / Requirement	Proposed	Comply Yes / No
4.10.2	Form of Development a) promotion of a high standard of building development, landscaping and working environment; b) protection of the amenity of adjacent residential and open space areas; c) management of drainage systems and land uses to promote groundwater conservation; and d) to ensure safe movement of vehicular and pedestrian traffic in the area.	Refer architectural statement report by Hunt Architects	Yes
4.10.3	Parking As per clause 4.15 and Table No. 2 of LPS2	Refer Table 4 below	-
4.10.5	Improvement Plan No. 14 b) In considering applications for development approval or otherwise planning for development on industrial zoned land in the East Rockingham Industrial Park (IP14 Area), the local government shall have regard to the Industrial Policy.	Refer Table 5 below	-
4.10.5	East Rockingham Development Guidelines c) In considering applications for development approval and otherwise planning for development within the East Rockingham Industrial Park, the	Refer Table 5 below	Yes

Clause	Provision / Requirement	Proposed	Comply Yes / No
	local government shall have due regard to the East Rockingham Development Guidelines.		
4.10.7	Modification of Policy and/or Guidelines a) The local government may modify the Industrial Policy or the East Rockingham Development Guidelines, provided that it is satisfied that such modification is in the interest of orderly and proper planning and will not detract from the amenity of the locality. b) Modifications shall be advertised for public comment in accordance with the provisions of Clause 4 and 5 of the deemed provisions, unless the proposed modification is minor.	Applicable to any variations sought – refer justification section below	-
4.10.9 & 4.10.10	General Industry and Special Industry Zone a) Setbacks: Min front setback of 25 metres for major structures Min front setback of fifteen (15) metres to offices, gatehouses and amenity buildings. Where a lot has frontage to two or more streets, prescribed front setbacks of twenty five (25) metres and fifteen (15) metres shall apply to the primary street and the setback to the secondary street shall be determined by the local government, but shall not be less than the prescribed minimum landscaping setback requirement. b) Landscaping shall be provided on all street frontages for a distance of not less than 10 metres from property boundary.	Primary St = Alumina Road Secondary St = Zirconia Drive <u>Alumina Road</u> Min. 28 m to office / admin. Req. 15m. Min. 43m to workshop. Req. 25m <u>Zirconia Drive</u> Min. 15m to office / admin. Req. 10m 21m to bagging, purification plant. Req. 10m. <u>Landscaping</u> 21m to 35m along Alumina Rd. 5.3m to 10m along Zirconia Drv.	 Yes Yes Yes Yes Yes No

Table 4 Car Parking Assessment as per Table 2 of LPS2

Car parking requirements:	Proposed		Comply Yes / No
Industry, Showroom, Warehouse - 1 bay per 50sqm NLA for factory units and showrooms, plus 1 bay per 100sqm NLA for warehouses or 1 bay per employee, whichever is the greater Floor area (NLA) by primary and ancillary facilities: • **Primary** (milling building, Purification plan, bagging plant) = 4,351.2sqm • **Ancillary** (administration & security, control room, laboratory) = 663sqm	By floor area: (4,351.2+663)÷100= 50.1 bays required By staff: Max of 25 staff on-site at any given time based on shift arrangement = 25 bays required	26 staff bays 2 visitor bays 1 ACROD bay **29 bays Total**	No 21.1 bay shortfall Refer TIS and DA report for justification
Note: for the purposes of parking calculation, administration, security, control room and laboratory areas have been assessed based on the parking requirement applicable to the primary use. These areas are ancillary to the predominant use and as such, should not be assessed as if they are an independent use.			

Table 5 Planning Policy 3.3.8 - East Rockingham Development Guidelines Assessment

Clause	Provision	Proposed	Comply Yes / No
5.2.2	Setback (Front) • 15 metres landscaping • 25 metres setback Setback (side and rear) • Side – 6m for one side only • Rear – 6m Setback (secondary street) • As per LPS2 or Council discretion subject to being no less than required depth of landscaping buffer (10m)	Alumina Road Min. 28 m to office / admin. Req. 15m Min. 43m to workshop. Req. 25m Zirconia Drive Min. 15m to office / admin. Req. 10m 21m to bagging, purification plant. Req. 10m. Landscaping 21m to 35m along Alumina Rd. 5.3m to 10m along Zirconia Drv.	 Yes Yes Yes Yes Yes No
5.2.3	Height Limit Generally no limit subject to high structures best located towards centre of lot	Administration and security building – 5.27m Workshop & store – 7.19m Milling building – 8.96m Purification and bagging plant – XXm	Yes
5.2.4	Site Coverage / Plot Ratio As per LPS2 and guided by setbacks, landscaping, parking and Building Codes	Refer site plan	Yes
5.2.5	Orientation and Shading Development to take into consideration benefits and/or detrimental effects of sun angles, prevailing breezes and vision to and from site	Administration and security building located east of larger milling and plant buildings to circumvent overshadowing. Subject site abuts road to the south thereby reducing any adverse overshadowing impacts to adjoining lots	Yes
5.2.6	Site Levels Minimise extent of earthmoving and 'site interference'.	Minimal siteworks proposed	Yes
5.2.7	Carparking, vehicular and pedestrian movement • Car bays as per LPS2 • Car bay size, manoeuvring areas, driveway widths to suit purpose and vehicle types • Separate service vehicle movement areas from staff and visitor parking areas • Number and location of crossovers to consider traffic safety, ease of vehicle movement and existing and proposed vegetation • Parking areas near buildings • Shade trees at a ratio of 1 per 4 car bays • Clear path for pedestrian movement	• Refer Table 4 for car parking assessment. Refer TIS and DA report for justification • Car bays and manoeuvring areas designed as per AS2890.1 • Staff and visitor car bay and crossover independent to heavy haulage vehicle access / egress. • Refer traffic impact assessment for detailed assessment of traffic movement and safety considerations • Staff and visitor parking located adjacent to administration / main entry • Shade trees for parking areas – refer landscape plan • Direct and legible pedestrian access provided to and from parking area to main building entrance	No Yes Yes Yes Yes Yes Yes

Clause	Provision	Proposed	Comply Yes / No
5.2.8	Fencing • Security fencing permitted alongside and rear boundaries • Fencing to street frontage to be limited. Where required, preferably setback to building line but as a minimum, behind landscape buffer • Min. standard of black PVC coating galvanised linkmesh	• Security fencing along northern side boundary • Fencing along Alumina Rd setback min. 25m from lot boundary • Fencing along Zirconia Drv setback nil from lot boundary • Material – 2.4m black PVC coated chain mesh with black posts	Yes Yes No Yes
5.2.9	Service, storage and display areas • To be setback behind building line and screened	Located centrally within lot and screened via landscape treatment along street setback area	Yes
5.3	5.3.1 architectural 'form' and massing 5.3.2 plant and equipment 5.3.3 outbuildings and other structures 5.3.4 signage and graphics	Refer DA report by Hunt Architects	Yes
5.4	5.4.1 landscape theme 5.4.2 the landscape provision 5.4.3 maintenance 5.4.4 approved plant species	Refer landscape plan by Plan E Landscape Architects	Yes

Justification

Having regard to the departures identified in the assessment tables above, the following justification is provided with regard to the proposed setback and landscaping.

Street Setbacks

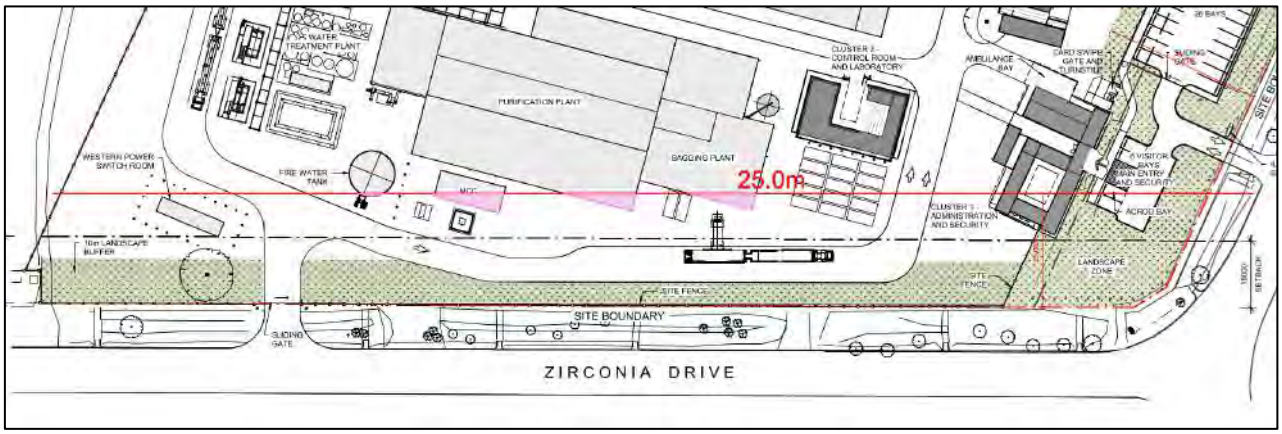
As identified in Table 3 above, assessment of the setbacks has been based on assigning Alumina Road as the primary street and Zirconia Drive as the secondary street. In the absence of any definition under LPS2 or the planning policy of what constitutes the primary and secondary streets, assigning the two roads under this designation and therefore supporting the proposed setback is considered reasonable based on the following reasons:

– Whilst planning policy 3.3.8 fails to recognise site planning considerations for corner lots under Figures 2 to 4, it generally acknowledges that the layout of buildings and circulation areas favour and necessitate designing along the horizontal plane. To this end, it would be logical to assign the narrower frontage of Alumina Road as the primary street.
– In terms of the overall road layout within the industrial estate, it is considered that Alumina Road functions as the higher order road given it gains direct access to Patterson Road at its southern extent and connects to Patterson Road via Alloy Avenue at its northern extent. Meanwhile, Zirconia Drive functions as a 'loop' road merely servicing a total of 6 lots. In light of this, assigning Alumina Road as the primary street and designing the development with a high-quality built form and landscaping outcome along this façade is considered to be preferable.
– The streetscape outcome proposed along Zirconia Drive is considered to be acceptable on the basis that the building set out has been angled so that major buildings achieve a setback in excess of a 25m average. As illustrated in Figure 2 below, there are only minor portions of the purification and bagging plant, MCC building and fire water tank (cumulative area of only 86sqm) that protrude into the 25m

setback line (refer shaded areas). These minor protrusions will have a negligible impact to the overall streetscape outcome as sufficient landscape treatment, including a number of retained trees and vegetation, will circumvent any adverse visual outcome – refer to landscape plan.

The buildings in question will also be finished to a high-quality and architectural standard which assist in achieving a quality streetscape outcome

Figure 2 Street setback analysis (Zirconia Drive)



– Clause 4.10.7 of the planning policy provides for modification of the guidelines where such modification is in the interest of orderly and proper planning and will not detract from the amenity or the locality. The reasons outlined above are considered to warrant a minor departure from the requirements of the planning policy. These reasons are also considered to justify that the variation is in the interests of orderly and proper planning.

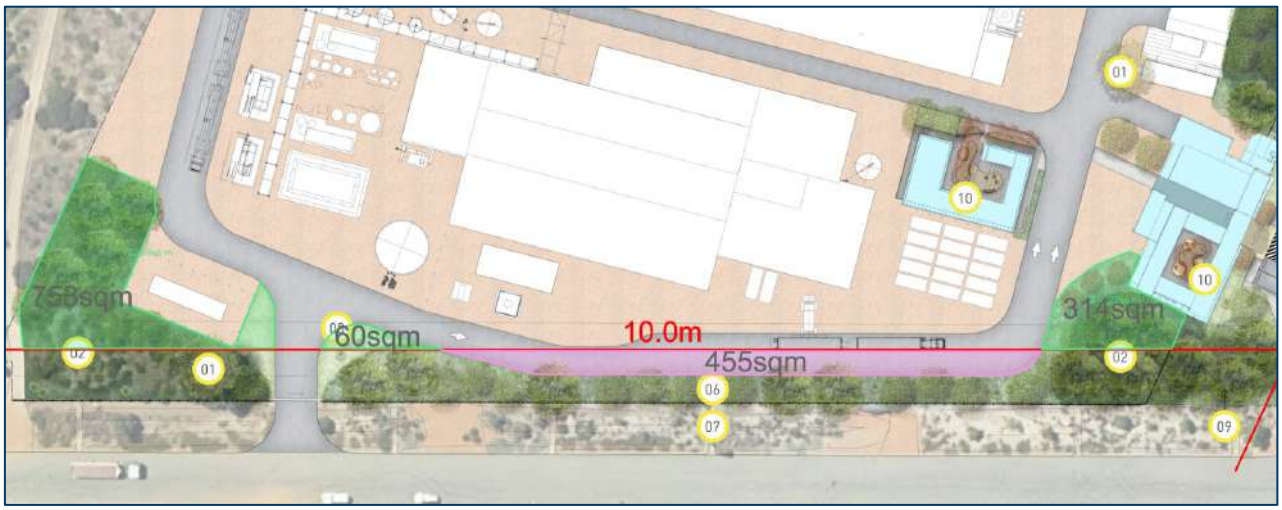
  As identified above, the proposal will need to be advertised in accordance with cl. 64 of the deemed provisions. Should the advertising process resolve no objections that are of a relevant planning basis, the variation is considered to warrant favourable consideration.

Landscaping

As identified in Table 3 above, assessment of the landscaping has identified a minor variation to the provision of landscaping along Zirconia Drive being a minimum of 5.3m in lieu of 10m. In this instance, a variation is considered warranted in accordance with cl. 4.10.7 of the planning policy based on the following reasons:

– The portion of landscaping which reduces down to 5.3m is considered to be offset by additional landscaping that is provided beyond the 10m minimum required. As illustrated in Figure 3 below, the variation as shaded which measures approximately 455sqm in area is offset by additional and contiguous landscape buffer treatment behind the 10m setback line (shaded) which cumulatively exceeds 1,100sqm in area.
– The proposed landscaping treatment along the entire length of Zirconia Drive by way of plant species, type and spacing (refer landscaping plan) is considered to be of high quality which achieves the intended streetscape outcome. It is noted that the landscape plan has been designed having due regard to the intended landscape theme and that forms part of the Landscape Masterplan contained in Appendix B and suggested species list that is Appendix C of the planning policy.
– Several existing / mature trees have been intentionally retained on-site, within the street setback / landscape buffer areas as well as further within the subject site itself to ensure landscape amenity is of a high standard.

Figure 3 Landscape Buffer Treatment along Zirconia Drive



Conclusion

In light of the above, we request favourable consideration of the subject proposal by the City of Rockingham and approval by the JDAP, based on the merits presented in the preceding sections of this submission.

Should you have further queries or seek clarification with regard to the matters raised above, please do not hesitate to contact the undersigned.

Regards

Hide Shigeyoshi
Team Lead – Planning

6222 8289
Hide.Shigeyoshi@ghd.com

Appendix B – Landscape Architectural Design & Schedule

LEGEND

01 EXISTING TREES TO PROTECT AND RETAIN

02 DENSE PATCH OF EXISTING VEGETATION TO RETAIN, WITH ADDITIONAL TREE & SCREENING SHRUB PLANTING

03 GRAVEL DRAINAGE BASINS FOR ON-SITE TREATMENT

04 GRAVEL MULCH TO ALL OTHER AREAS

05 SCREENING BOUNDARY PLANTING WITH MIX OF ENDEMIC TREE SPECIES AND TALL SHRUBS (IE. EUCALYPTUS GOMPHOCEPHALA, ALLOCASUARINA & MELALEUCA SP)

06 BOUNDARY PLANTING TO FENCELINE WITH MIX OF ENDEMIC TREE SPECIES AND MEDIUM SHRUBS TO ENHANCE BIODIVERSITY (IE. EUCALYPTUS GOMPHOCEPHALA, AGONIS & MELALEUCA SP), RETAINING OR TRANSPLANTING EXISTING XANTHORRHOEA SPECIES WHERE POSSIBLE

07 EXISTING VERGE TREATMENT

08 LOW NATIVE SHRUBS/ GROUNDCOVERS & XANTHORRHOEA SPECIES AT ENTRIES TO MAINTAIN SIGHTLINES

09 GROVE OF LARGE HABITAT TREES (IE. EUCALYPTUS GOMPHOCEPHALA)

10 STAFF COURTYARD SPACES WITH SEATING AND SHADE OPPORTUNITY (SEE DRAWING C1.102)

11 MAIN ENTRY WITH FEATURE PAVEMENT

12 NEW CONCRETE PATHWAYS WITH SEATING OPPORTUNITY

13 FEATURE PLANTING AROUND ADMINISTRATION BUILDING WITH SCULPTURAL TREES (IE. BANKSIA SPECIES) AND LOW FLOWERING SHRUBS

14 SHADE TREES TO CARPARK (AGONIS SPECIES)

15 MEDIUM SHRUB PLANTING TO FENCELINE

LOW NATIVE SHRUBS/ GROUNDCOVERS (<0.5M)

MEDIUM NATIVE SHRUBS (1-1.5M)

SCREENING NATIVE SHRUBS (2M+)

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LANDSCAPE CONCEPT - OVERALL SITE

JANUARY 2022

JOB NO. 2113401

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C1.101

REV B

0 5 10 20 30 50m

PLAN E

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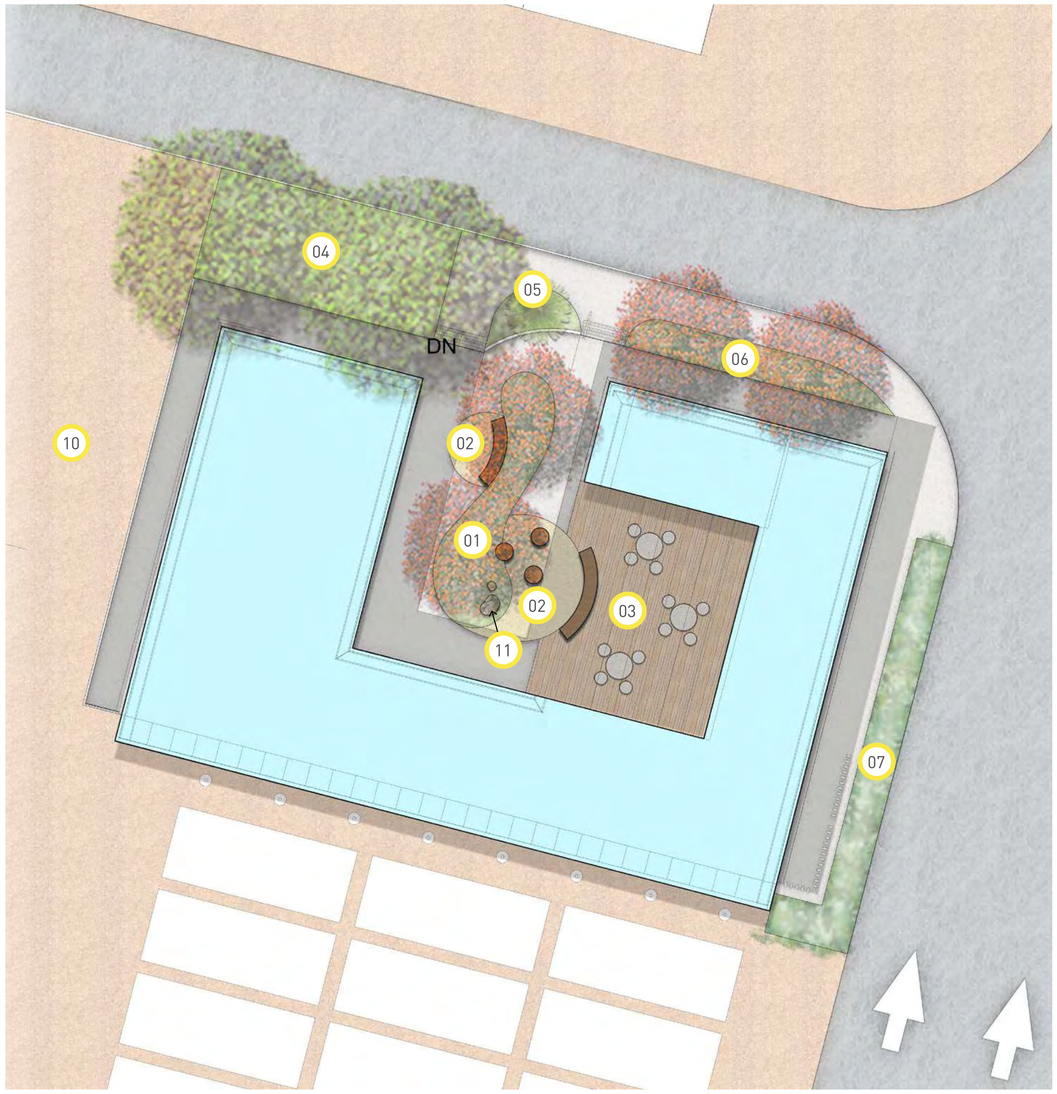
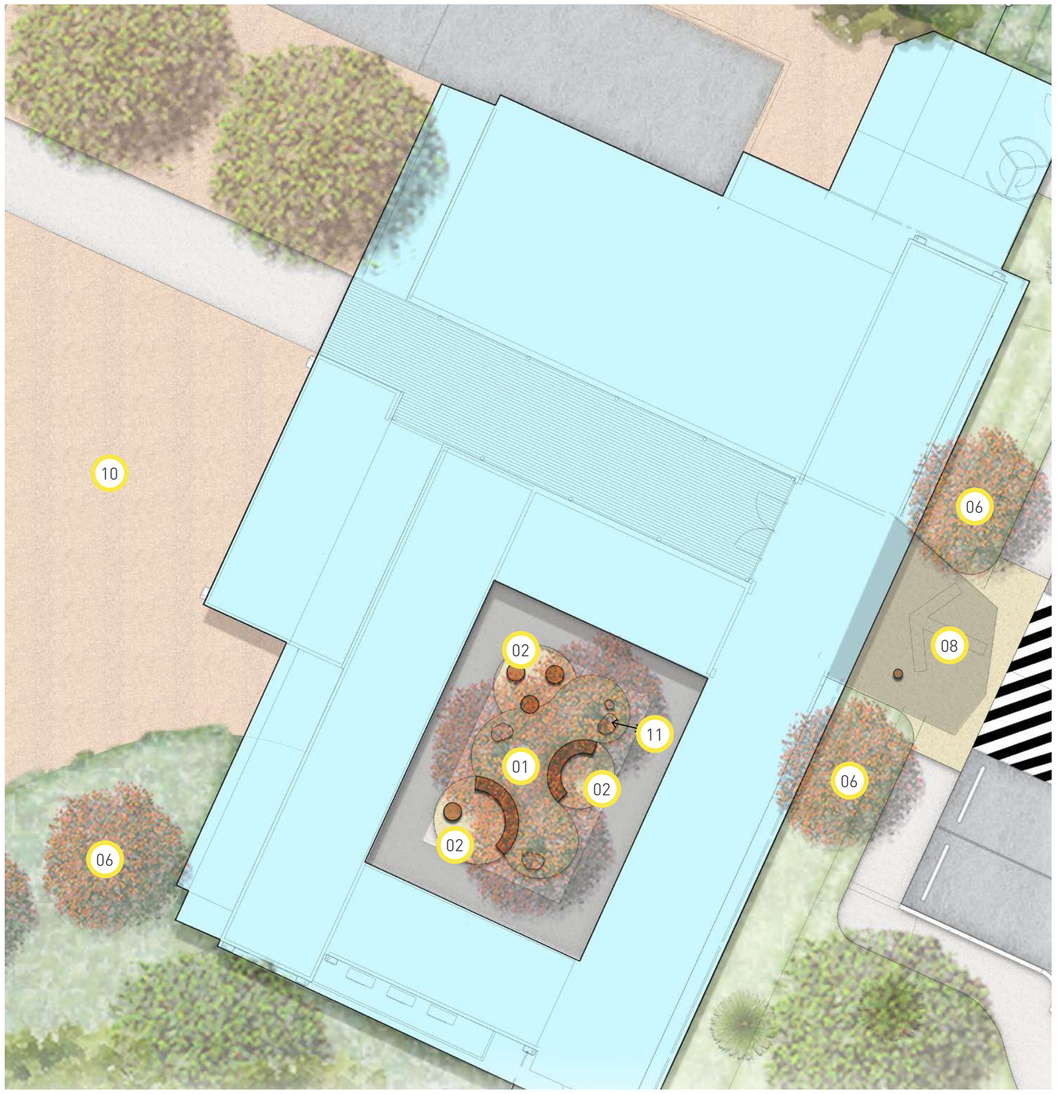
CONTROL ROOM & LABORATORY BUILDING



ADMINISTRATION & SECURITY BUILDING



LEGEND

01 MOUNDED GARDEN BEDS WITH FEATURE COASTAL SHRUB PLANTINGS & SMALL SCULPTURAL TREES (IE. BANKSIA SPECIES)

02 SEATING NICHES OF VARIOUS SIZES FOR INTIMATE & GROUP GATHERINGS, WITH EXPOSED AGG / LIMESTONE PAVEMENT

03 UNDERCOVER DECK AREA FOR OUTDOOR GATEHRING WITH SEATING EDGE TREATMENT

04 SHADE TREES WITH LOW GROUNDCOVER PLANTING (IE. AGONIS SPECIES)

05 TRANSPLANTED XANTHORRHOEA AT STAIR ENTRY

06 SMALL SCULPTURAL TREES WITH LOW GROUNDCOVER PLANTING (IE. BANKSIA SPECIES)

07 MEDIUM SHRUB PLANTING TO BUILDING

08 SHADED ENTRY WITH FEATURE EXPOSED AGG / LIMESTONE PAVEMENT & ARTWORK OPPORTUNITY

09 CONCRETE FOOTPATH

10 GRAVEL MULCH TO ALL OTHER AREAS

11 FEATURE LIMESTONE BOULDERS

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LANDSCAPE CONCEPT - STAFF COURTYARDS

JANUARY 2022

JOB NO. 2113401

1:100 @ A1

C1.102

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0 1 2 4 6 10m

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TREE SPECIES


EUCALYPTUS GOMPHOCEPHALA


AGONIS FLEXUOSA


ALLOCASUARINA FRASERIANA


CALLITRIS PRESEII


MELALEUCA LANCEOLATA


MELALEUCA VIRIDIFOLIA


BANKSIA ATTENUATA

TALL SHRUBS / SCREENERS


CALOTHAMNUS QUADRIFIDUS


MELALEUCA HUEGELII


DODONAE HACKETTIANA


HAKEA PROSTRATA


JACKSONIA STERNBERGIANA

MEDIUM SHRUBS


WESTRINGIA DAMPIERI


TEMPLETONIA RETUSA


OLEARIA AXILLARIS


MYOPORUM INSULARE


GUICHENOTIA LEDIFOLIA


LEPIDOSPERMA GLADIATUM


MELALEUCA SYSTENA

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PLANTING PALETTE
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LOW SHRUBS/ GROUNDCOVERS


HEMIANDRA PUNGENS


EREMOPHILA GLABRA


SCAEVOLA CRASSIFOLIA


GREVILLEA CRITHMIFOLIA


LEUCOPHYTA BROWNII


RHAGODIA BACCATA


BANKSIA DALLENYI


ACACIA LASIOCARPA


DIANELLA REVOLUTA


FICINIA NODOSA

FEATURE PLANTING


XANTHORHHOEA PRESEII


TRACHYMENE COERULA


ACACIA PULCHELLA


PIMELEA FERRUGINEA


CONOSTYLIS CANDICANS


LEUCOPHYTA BROWNII


KENNEDIA PROSTRATA

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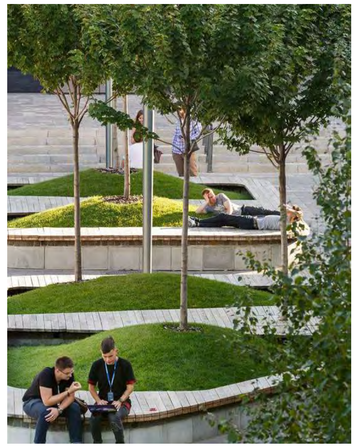















MAXMISE SUSTAINABILIY
WITH HIGH BIODIVERSITY
OF ENDEMIC, WATERWISE
PLANTINGS AS WELL
AS LOCAL SOURCE OF
MATERIALS

ECOGRAF HQ, ROCKINGHAM

PLANTING PALETTE
JANUARY 2022

JOB NO. 2113401 C3.101 REV A

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Appendix C – Traffic Engineering Report

PROPOSED BATTERY ANODE GRAPHITE PROCESSING FACILITY

LOTS 1 & 2 ZIRCONIA DR, EAST ROCKINGHAM

TRANSPORT IMPACT STATEMENT

Final 1-0

Prepared by i3 consultants WA for

EcoGraf

Project details

Project	Proposed Battery Anode Graphite Processing Facility
Location	Lots 1 & 2 Zirconia Dr, East Rockingham
Project ID	32301
Client	EcoGraf
Description	A Transport Impact Statement for a proposed Battery Anode Graphite Processing Facility on Lots 1 and 2 Zirconia Drive in the City of Rockingham suburb of East Rockingham prepared in accordance with the 2016 WAPC Transport Impact Assessment Guidelines.

Document control

Author	David Wilkins
Status	Final 1-0
File name	32301 Lots 1_2 Zirconia Dr TIS (F1-0)

Distribution & Publication Record	Draft			Final				
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	☐	☐	☐	☐	☐	☐	☐	☐
	☐	☐	☐	☐	☐	☐	☐	☐

Revision status comments: D1-0 issued as a draft to client for confirmation of background data. F1-0 issued as final report.
This is not an approved document unless certified here.

CONTENTS

ABOUT THE AUTHOR

David Wilkins has over 40 years of practical experience in traffic engineering, road safety and transport planning in both the UK and Australia and is an RTA NSW Certified Level 3 Lead Auditor (RSA-08-0178) and Main Roads Western Australia (MRWA) accredited Senior Road Safety Auditor (SRSA 0101). In addition to this, David is an MRWA accredited Crash Investigation Team Leader and Roadworks Traffic Manager (MRWA-RTM-10-RTM20). David has undertaken 164 road safety audits in the last five years and 320 road safety audits since 2011 across the full range of stages from feasibility through to pre-opening, including roadworks, existing roads, schools, and mine sites.

David's specialist skills are in the management and development of transport infrastructure and planning, particularly with respect to road safety engineering, roadworks traffic management, traffic engineering, crash investigation, road safety audits, alternative transport systems (TravelSmart, shared paths, cycle facilities), transport statements, transport assessments, parking demand management, local area traffic management, speed management, accessible environments and innovation.

David specialises in undertaking and preparing traffic impact assessments in accordance with either the WAPC document *Transport Impact Assessment Guidelines* (1) or Austroads *Guide to Traffic Management Part 12: Traffic Impacts of Developments* (2). In the last 10 years, David has personally prepared over 200 traffic and transport impact reports in accordance with these guidelines, or previous versions of them.

1 INTRODUCTION

This Transport Impact Assessment report has been prepared in accordance with the WAPC publication *Transport Impact Assessment Guidelines* (1). These guidelines indicate that a *Transport Impact Statement* (TIS) "is required for those developments that would be likely to generate moderate volumes of traffic and therefore would have a moderate overall impact on the surrounding land uses and transport networks, (in accordance with Table 1.)"

LAND USE	MODERATE IMPACT	HIGH IMPACT
	Transport Impact Statement required	Transport Impact Assessment required
	10 – 100 vehicle trips in the peak hour	> 100 vehicle trips in the peak hour
Residential	10–100 dwellings	>100 dwellings
Schools	10–100 students	>100 students
Entertainment venues, restaurants, etc.	100–1000 persons (seats) OR 200–2000 m² gross floor area	>1000 persons (seats) OR >2000 m² gross floor area
Fast food restaurants	50–500 m² gross floor area	>500 m² gross floor area
Food retail /Shopping centres with a significant food retail content	100–1000 m² gross floor area	>1000 m² gross floor area
Non-food retail	250–2500 m² gross floor area	>2500 m² gross floor area
Offices	500–5000 m² gross floor area	>5000 m² gross floor area
Service Station	1–7 refuelling positions	>7 refuelling positions
Industrial/Warehouse	1000–10,000 m² gross floor area	>10,000 m² gross floor area
Other Uses	Discuss with approving authority	Discuss with approving authority

Table 1 - Level of TIA required by land use and size

The proposed development comprises of a processing plant that is not included as a land use in Table 1, other than as 'Other Uses'. The proponent has discussed the proposed development with the approving authority, i.e. City of Rockingham, and the City has requested that a Transport Impact Statement is prepared on the basis that peak hour traffic volumes will be between 10 -100. Refer **Section 8** for an assessment of the forecast peak hour volumes.

2 EXISTING DEVELOPMENT

The existing development site is vacant land within the 'Patterson Road Precinct' of the 'Rockingham Industry Zone' (RIZ), as shown in Photograph 1 and Photograph 2 below and Photograph 3 on the following page.

Photograph 1 – Aerial photograph dated 16 July 2019 showing existing development site conditions

Photograph 2 – Looking west on Zirconia Drive

Photograph 3 – Annotated Aerial Photograph (17 Feb 2020) showing existing and future access to Patterson Rd

3 PROPOSED DEVELOPMENT

It is proposed to construct a processing facility on Lots 1 & 2 Zirconia Drive to produce battery anode grade purified spherical graphite (BAM).

Initially the graphite concentrate feed material will be sourced from third-party producers.

This material will be delivered in containers to the Fremantle Container Terminal (FCT) and trucked to site.

The development will occur in two stages:

- Stage I – construction and production of 5,000 tonnes per annum (tpa) purified spherical graphite plant, requiring 10,920 tpa graphite concentrate at a nominal 94-96%C delivered per annum, and
- Stage II – construction and production of an additional 15,000 tpa purified spherical graphite plant which will require an additional 32,800 tpa graphite concentrate at a nominal 94-96%C per annum.

The construction schedule for Stage I is 49 weeks and Stage II 62weeks. There will be a short "ramp up" period to ensure product quality and to achieve nameplate capacity as well as to identify possible improvements to be incorporated into the second stage plant.

The Department of Water and Environmental Regulation (DWER) and Environmental Protection Authority (EPA) have indicated that this development will be a "prescribed premise" under Schedule 1 of the Environmental Protection Regulations 1987 and will fall within Category 31 "Chemical Manufacturing".

A concept layout is provided as Figure 1 below. This may change to suit access to Alumina Road – refer **Section 5**).

Figure 1 – Concept Plan showing Processing Facility (may change to suit access – refer **Section 5**)

Shift crews will operate three 8-hour shifts on a rotation basis 24/7. Each shift will be controlled by a Production Supervisor.

The organisational chart and staff breakdown are shown in Figure 2 and Table 2 below.

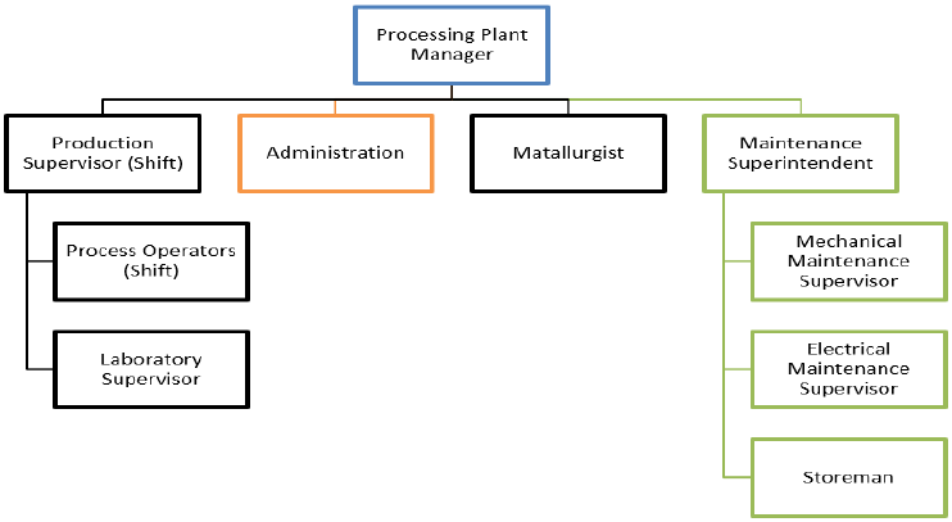


Figure 2 – Operations Organisation Chart

KWINANA SPG FACILITY	5,000tpa Plant		20,000tpa Plant	
Manning	Number	Roster	Number	Roster
Position				
Processing				
Management and Technical				
Processing Plant Manager	1	5/2	1	5/2
Metallurgists	2	5/2	2	5/2
Production - Shift				
Shift Supervisor	2	3/1	4	3/1
Process Operator (Spheronisation/Micronisation)	2	3/1	4	3/1
Process Operator (Purification & Reagent Mixing)	4	3/1	4	3/1
Process Operator (Bagging/Loading)	2	3/1	4	3/1
Forklift Operator	2	3/1	6	3/1
Labourers	4	3/1	8	3/1
Laboratory				
Chemist	1	5/2	1	5/2
Laboratory Supervisor	2	3/1	2	3/1
Laboratory Technician	2	3/1	2	3/1
Maintenance				
Maintenance Superintendent	1	4/1	1	4/1
Mechanical Supervisor	1	4/1	1	4/1
Electrical Supervisor	1	4/1	1	4/1
Fitter	2	4/1	4	4/1
Welder / Boilermaker	2	4/1	4	4/1
Electrician/Instrument Technician	2	4/1	4	4/1
Labourers	4	4/1	8	4/1
TOTAL	37		61	

Table 2 – Direct Employment at Subject Site – Stages 1 and 2

4 CONTEXT WITH SURROUNDS

The development site is located within the 'Patterson Road Precinct' of the 'Rockingham Industry Zone' (RIZ), within the City of Rockingham local government area, as shown in Figure 3 below and Figure 4 on the following page.

Figure 3 – Location of development site showing context with surrounding transport infrastructure & links (3)

The development sited is zoned special industry. Development guidelines exist for this Precinct (refer to *East Rockingham Industrial Park – Element Precinct – Development Guidelines* (2), Appendix 3 of *City of Rockingham's Policy 3.3.8* (3)).

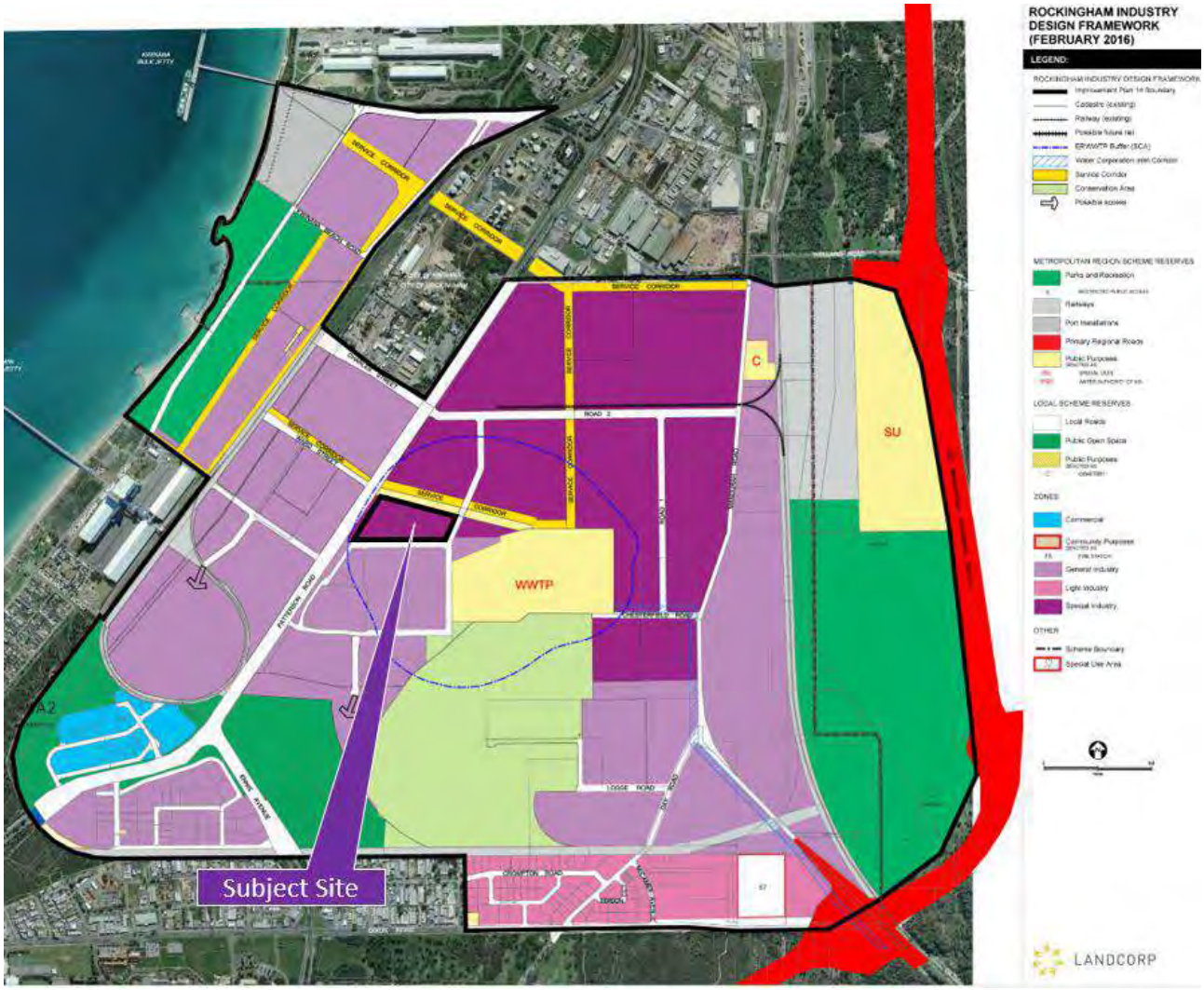


Figure 4 – Annotated extract from *Rockingham Industry Design Framework* (4) showing zoning under *City of Rockingham TPS2* (6)

It is preferable that traffic generating developments are located on or close to distributor roads as this reduces the impact of these developments on local roads. The development site is located on the northwest corner of Alumina Rd and Zirconia Dr, local industrial roads that currently connect to the distributor road network via the Alumina Rd/ Patterson Rd intersection but will shortly also connect to Patterson Rd via the extension of Alumina Rd to Alloy Ave, a new road east of Patterson Rd opposite Charles St with a new signalised intersection, as shown in Figure 5 below. The Alumina Rd extension and Alloy Ave are currently under construction.

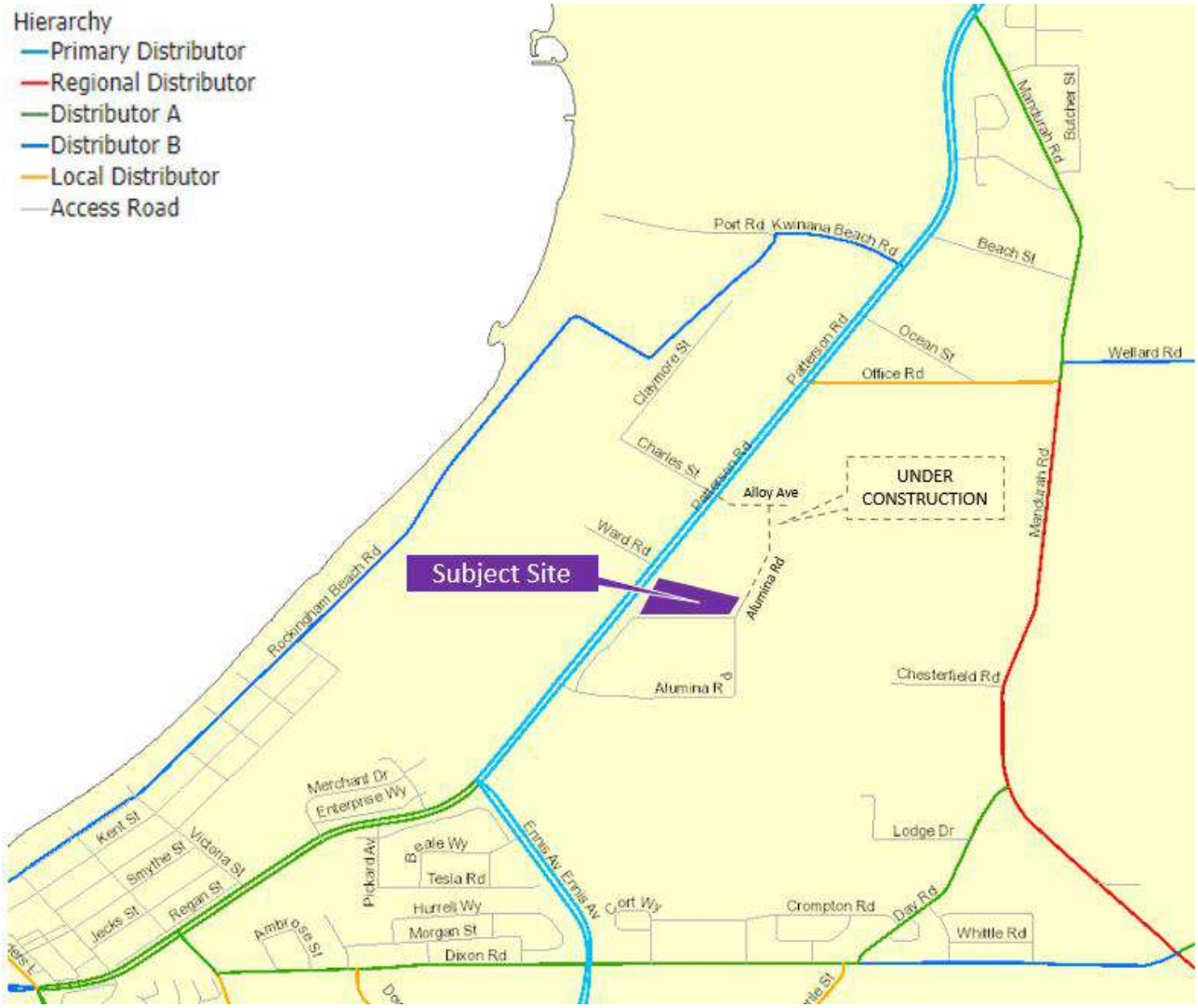


Figure 5 – Road hierarchy showing nearest distributor roads (*MRWA Functional Road Hierarchy* (7))

Alumina Road (1070976) and Zirconia Drive (1071362) are both local industrial roads that come under the care and control of the City of Rockingham. Patterson Rd is the common usage name for the Melville Mandurah Hwy (H002) and is designated as a 'Primary Distributor' road. It comes under the care and control of Main Roads WA. It is assumed that Alloy Ave and the Alumina Rd extension will be local industrial roads under the care and control of the City of Rockingham. Typical layouts of each of these roads are shown in the photographs on the following pages.

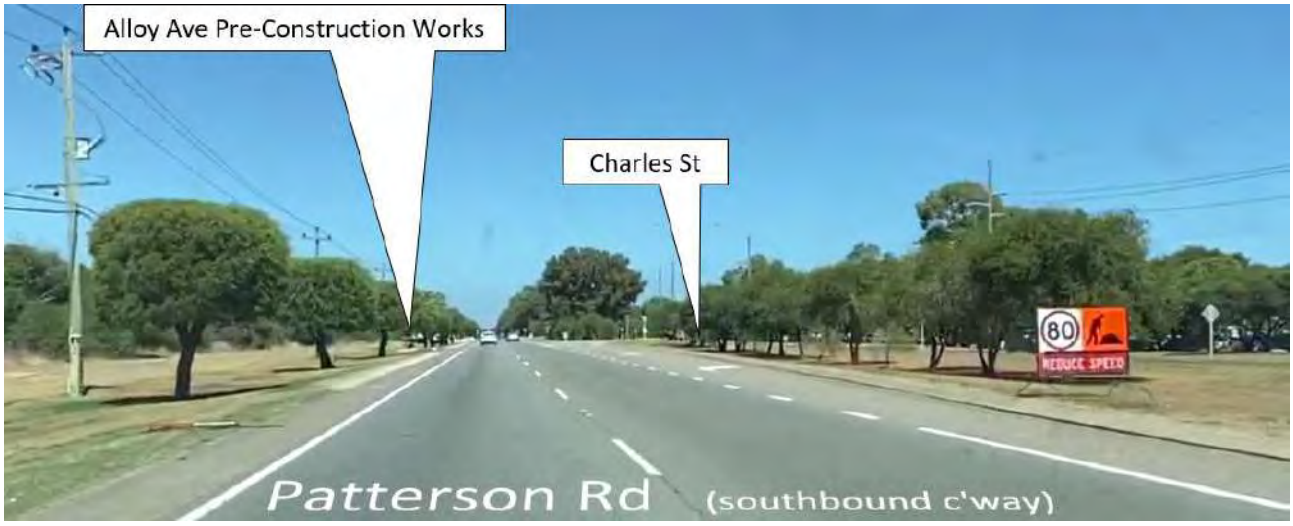
Photograph 4 – Looking south on Alumina Rd south of Zirconia Dr

Photograph 5 – Looking east on Zirconia Dr towards Alumina Rd (subject site on left)

Photograph 6 – Looking north at construction works on Alumina Dr extension north of Zirconia Dr (subject site on left)

Photograph 7 – Looking west on Alumina Rd approach to Patterson Rd intersection

Photograph 8 – Looking south on Patterson Rd approach to Alumina Rd intersection



Photograph 9 – Looking south on Patterson Rd approach to Charles St (future traffic signals and Alloy Ave)

5 VEHICLE ACCESS AND PARKING

As stated previously, the nearest distributor road to the development site is Patterson Rd (Melville Mandurah Hwy). Patterson Rd can be accessed within 800 m of the subject site via Alumina Road under the current road network as well as via Alloy Ave with the future road network, i.e. traffic signals at Alloy Ave/ Charles St/ Patterson Rd, as shown in Figure 6 below.

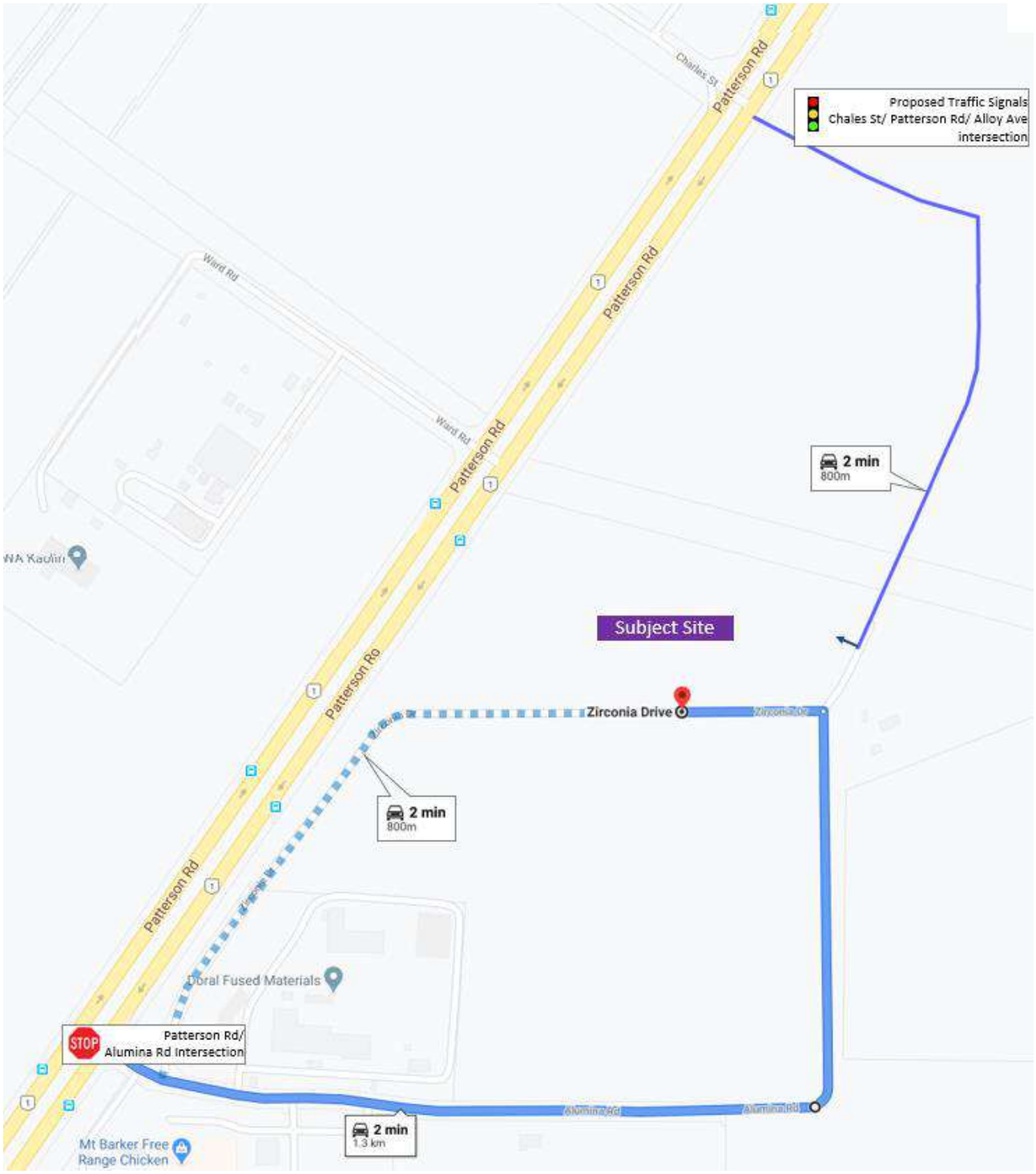


Figure 6 – Existing and future access routes and times between subject site and Patterson Rd

The assessed routes to and from the development site and locations north, south, east and west, using the designated distributor roads is shown in Figure 7 below along with the type of control at relevant intersections. The diagram on the right shows the existing Restricted Access Vehicle 3 (RAV3) routes and assumed future RAV3 access routes for the proposed haulage of materials and product using pocket road trains, as described in **Section 6**. This shows excellent transport connectivity, consistent with the objectives of the Rockingham Industrial Zone.

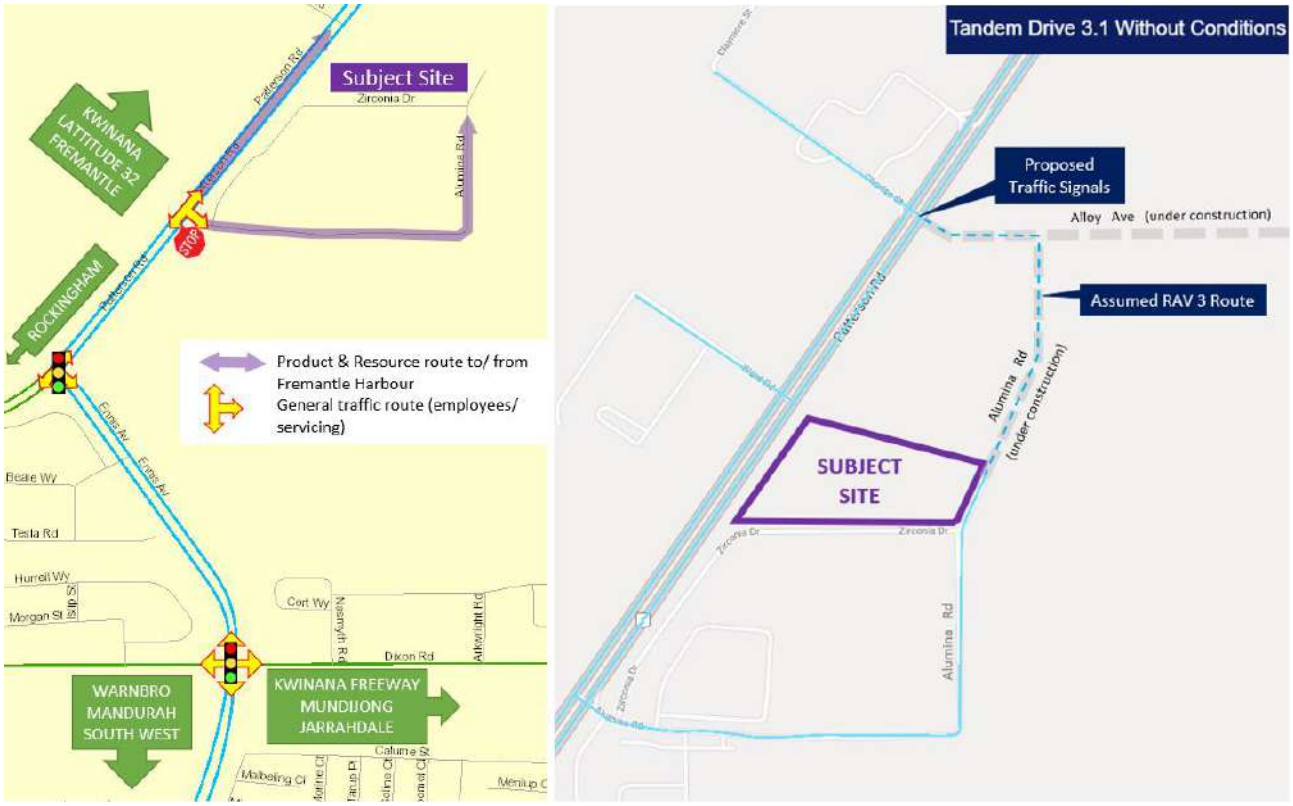


Figure 7 – Assessed routes between development site locations north, south, east, and west

The development drawing (Figure 1on page 8) is conceptual at this time and does not show parking areas or the proposed number of on-site parking bays.

The assessed classification of parking in *AS/ NZS 2890.1* (8) for the subject site is User Class 1, i.e. Employee and commuter parking (generally, all day parking). The required dimensions for the regular bays, based on 90° bays are 2.4 m wide and 5.4 m long. The required dimension for the required disabled bay is 2.4 m wide and 5.4 m long with an adjacent shared space of 2.4 m (9).

Clause 4.10.3 (Industrial Zones: Parking) of the *City of Rockingham Town Planning Scheme No.2 (TPS2)* (6) states: "*Provision shall be made for the on-site parking of motor vehicles for all development on industrial zoned land in accordance with the provisions of clause 4.15 and Table No.2.*"

Clause 4.15.1.3 of *TPS2* states: "*Where land is proposed to be developed in any zone other than the Primary Centre City Centre Zone, the Primary Centre Waterfront Village Zone, the Primary Centre Urban Village Zone, the Primary Centre City Living Zone or the District Town Centre Zone, for a purpose specified in Table No.2,*

the minimum number of car parking bays required for the development is to be determined in accordance with Table No.2".

An extract from Table 2 within *TPS2* with respect to the proposed development's land use is provided as Table 3 below.

USE CLASS	MINIMUM CARPARKING REQUIREMENT
Industry, Showroom, Warehouse	1 bay per 50m^2 NLA for factory units and showrooms, plus 1 bay per 100m^2 NLA for warehouses or 1 bay per employee, whichever is the greater

Table 3 – Extract from Table 2 (Parking Requirements) from *TPS2*

The employment data in Table 2 in **Section 3** indicates that there will be up to 37 staff with Stage 1 development and up to 61 staff with Stage 2 development.

An assessment of the parking requirements based on 1 bay per employee, as per TPS2, is 37 bays for Stage 1 and 61 bays for Stage 2.

The proponent has indicated that factory workers are operating on 3 x 8 hr shifts and that with professional and administrative staff on site during the day shift, the maximum requirement for parking would be less, i.e. 20 (including 2 visitors) and 26 (including 2 visitors).

The proponent is correct in determining that parking demand rates will be less than that indicated in TPS2 as this assumes one shift, however, it is important to note that parking spaces are required for the staff completing their shift and for those arriving for the next shift. On this basis, the assessed TPS2 rates would be two-thirds of the total employees, resulting in a parking demand for 25 bays for Stage 1 and 41 bays for Stage 2.

Australian Standard *AS/NZS 2890.6* (9) "specifies minimum requirements for the provision of off-street parking facilities for people with disabilities." This indicates that there is a requirement for the provision of 1 off-street parking bay for people with disabilities for every 100 bays, or part thereof, i.e. a Class 8 Building in the *Building Code of Australia* (10).

Class 8	A laboratory, or a building in which a handicraft or process for the production, assembling, altering, repairing, packing, finishing, or cleaning of goods or produce is carried on for trade, sale or gain.

Table 4 – Extract from *Building Code of Australia*

6 PROVISION FOR SERVICE VEHICLES

The proponent has advised the following:

6.1 TRANSPORT AND REAGENT REQUIRMENTS

The final plant layout relative to the site has not been finalised however the main storage locations are shown in Figure 1 on page 8 with the relative position of the plant on Lot 2.

The probable orientation of the buildings will be with the Office and Purification areas facing south to the frontage on Zirconia Drive.

It is assumed that when access from Patterson Rd off Alloy Ave is completed that heavy vehicles will transit via Allow Ave and Alumina Rd extension to the northern side of Lot 2 where they will travel to either the, sulphuric acid or caustic soda isotainers.

The route is anticipated to be ex Fremantle container terminal via Pt Beach Rd - Tydeman Rd - Stirling Highway - High St /Leach Hwy - Stock Rd – Rockingham Rd - Patterson Rd - turn left into Alloy Ave then right into Alumina Rd, right into Zirconia Drive past exit from Plant to entrance to drop off area clockwise to pick up area and then return to Fremantle in reverse.

6.1.1 REAGENTS

Caustic soda, water purification chemicals and sulphuric acid will be transported to site by contractors into 15 m^3 Isotainers in Stage 1. This is expected to increase to 30 m^3 in stage 2.

It is assumed that all these reagents will be sourced from suppliers in the Kwinana Industrial Zone.

6.1.2 DELIVERY OF FEEDSTOCK

The graphite concentrate feedstock will packed in one tonne bulk bags in 20 ft containers. It will be shipped to the Fremantle Container Terminal [FCT] and loaded onto trucks for transport to the plant site where the containers will be destuffed and the bulk bags stored.

In Stage 1, 10,950 tpa concentrate (-100mesh 94-95% carbon) will be delivered to site.

In Stage 2, 43,800 tpa concentrate will be delivered to site.

6.1.3 EXPORT OF PRODUCT

STAGE 1

After processing, the purified spherical battery grade (BAM) graphite will be bagged and containerised for delivery to Fremantle. 5,000 tpa of BAM (16µ, 99.97% carbon) will be trucked to FCT annually. Several other products of up to 5,000 tpa will also be trucked and exported via FCT.

STAGE 2

After processing the purified spherical Battery grade (BAM) graphite will be bagged and containerised for delivery to Fremantle. 20,000 tpa of BAM will be trucked to FCT. Several other products of up to 20,000 tpa will also be trucked and exported via FCT.

It is assumed that each container holds 20 tonne of both graphite concentrate and product.

6.1.4 TRUCKING

Qube have indicated that 2 x 20' containers each weighing approximately 20 t will be delivered to site on "pocket" road trains with a length of <27.5m. They will be off loaded using a side loader / SKEL configuration. Containers of product (SPG) will be bagged and stuffed into 20' containers for transport to Fremantle Container Facility for export to Asia and Europe.

Figure 8 – Example of 'pocket road train' provided by the proponent

An assessment of the number and type of vehicle movements associated with the delivery (import) of Reagents and Feedstock and Export of BAM Graphite and other products to and from the site annually, weekly and daily, has been undertaken by the author based on the preceding information and is provided as Table 5 on the following page.

IMPORTED	Packaging	Units	Stage 1	Stage 2	From	Truck Type	Comment	Trucks per annum		Trucks per week		Max trucks per day	
								Stage 1	Stage 2	Stage 1	Stage 2	Stage 1	Stage 2
Reagents (Caustic Soda, Water Purification Chemicals & Sulphuric Acid)	15 m^3 Isotainers	kg	2,975		KIZ	Pocket Roat Train or Semi Trailer or HRV	Trucks assumed to carry 2 containers	99		2		1	
	30 m^3 Isotainers	kg		11,901					199		4		1
Feedstock (Graphite Concentrate)	1 Tonne Bulk Bags in 20' Intermodal Containers	tpa	10,950	43,800	FCT	Pocket Road Train	Each container holds 20 t of graphite concentrate	548	2,190	11	42	2	6
												3	**7**

EXPORTED	Packaging	Units	Stage 1	Stage 2	From	Truck Type	Comment	Trucks per annum		Trucks per week		Max trucks per day	
								Stage 1	Stage 2	Stage 1	Stage 2	Stage 1	Stage 2
Purified spherical battery grade (BAM) graphite	1 Tonne Bulk Bags in 20' Intermodal Containers	tpa	5,000	20,000	FCT	Pocket Road Train	Each container holds 20 t of BAM graphite	250	1,000	5	19	1	3
Several other products	1 Tonne Bulk Bags in 20' Intermodal Containers	tpa	5,000	20,000	FCT	Pocket Road Train	Each container holds 20 t of other products	250	1,000	5	19	3	3
												3	**5**

Table 5 – Assessed truck movements/ type for import and export of materials, annually, weekly, and daily

Table 5 shows that it is unlikely that there will be more than 12 truck trips per day for Stage 1 development and no more than 24 truck trips per day for Stage 2 development, based on each trip doubled to account for the truck leaving empty after importing material and arriving empty prior to exporting material. It also shows that the largest trucks to be used are 'Pocket Road Trains'. These vehicles are classified as Level 1 RAVs by Main Roads WA as shown in the following extracts from the MRWA Restricted Access Vehicle publications.

Standard Restricted Access Vehicle Route Assessment Guidelines

1 INTRODUCTION

1.1 General

These guidelines have been prepared by Main Roads Western Australia to assist local government, Main Roads' staff and transport operators or consultants in assessing the suitability of routes proposed for the operation of "standard" Restricted Access Vehicles (RAVs) on roads within the State of Western Australia.

For the purpose of these guidelines, "standard" RAVs are those vehicle combinations specified as Category 1 to 10 vehicle combinations under the *Prime Mover, Trailers Combinations Order 2017* and *Truck, Trailer Combinations Order 2017*.

- The RAV Categories have been grouped into four (4) assessment levels, as follows:
- Level 1 - RAVs Categories 2-4 (e.g. pocket road train, B-Double, and other RAVs with a maximum length of either 25.0 m or 27.5 m);
- Level 2 - RAVs Categories 5-6 (e.g. RAVs with a maximum length of 36.5 m and a maximum mass of 87.5T);
- Level 3 - RAVs Categories 7-8 (e.g. RAVs with a maximum length of 36.5 m and a maximum mass of 107.5T); and
- Level 4 - RAVs Categories 9-10 (e.g. RAVs with a maximum length of 53.5 m).

Category & RAV Network	Vehicle Description and Configuration	Length (m)	Max Mass (T)	Axle
	(A) PRIME MOVER, SEMI TRAILER TOWING A DOG TRAILER	≤27.5	84	5

Figure 9 – Pocket Road Train details form Main Roads WA Restricted Access Vehicle publications

Pocket Road Trains are permitted to use the Restricted Access Vehicle (RAV) Network 3 routes. These routes are shown in Figure 10 below, along with the proposed route between the subject site and the FCT.

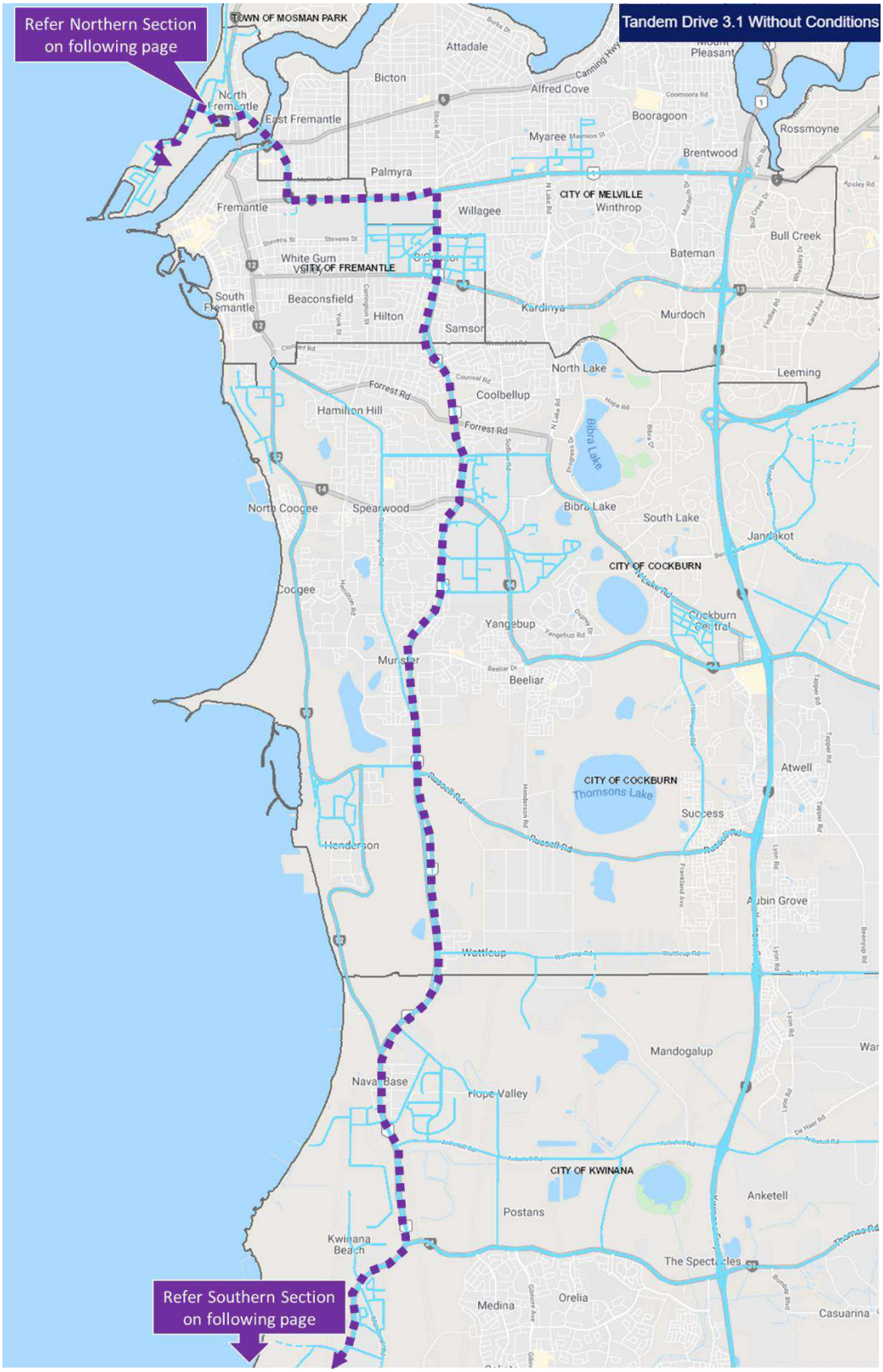


Figure 10 – RAV 3 Network and Assessed Route between Subject Site and Fremantle Container Terminal

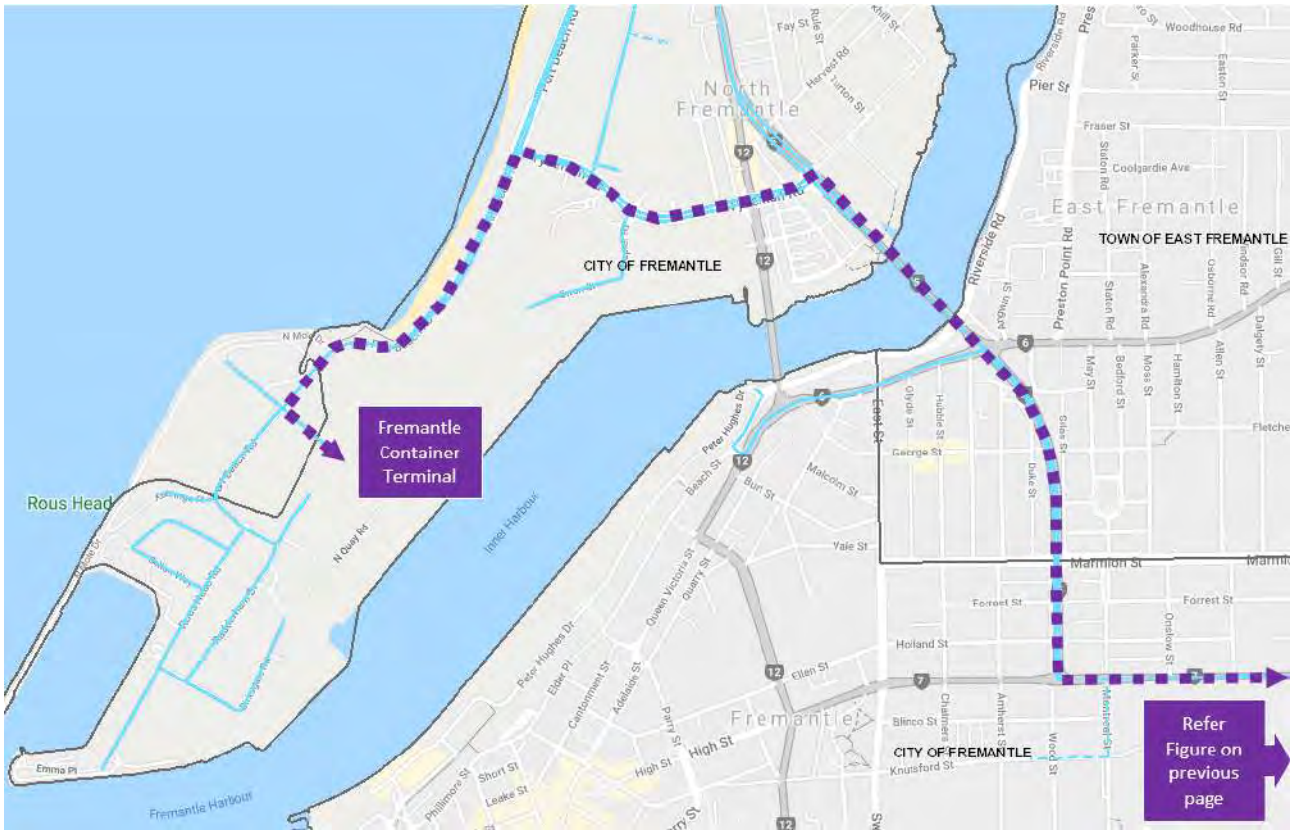


Figure 11 – RAV 3 network and assessed route in the vicinity of Fremantle

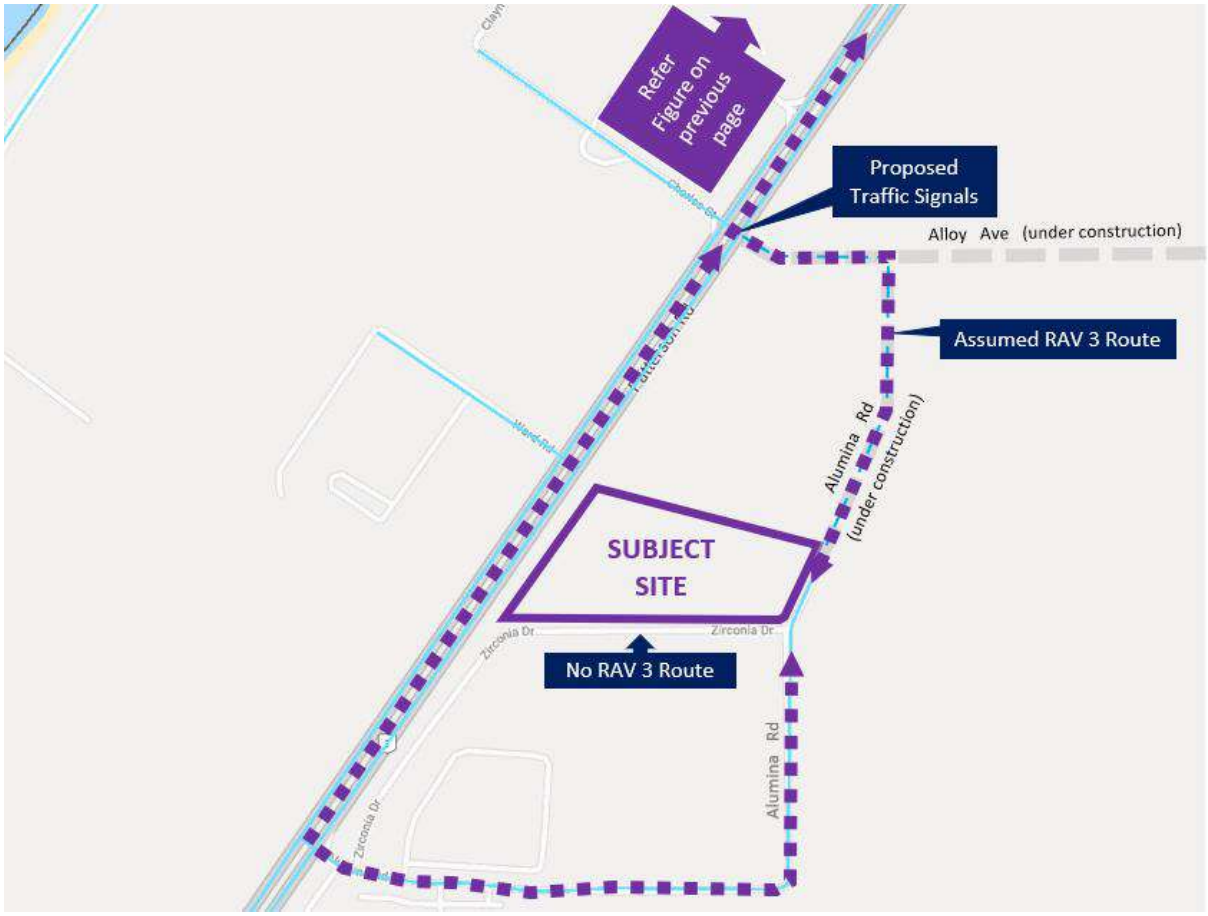


Figure 12 – RAV 3 network and assessed route in the vicinity of the subject site

Figure 12 on the previous page shows that Zirconia Drive is not included in the RAV 3 network and hence cannot be used by Pocket Road Trains to access the site at this time.

Options for addressing the RAV 3 network incompatibilities are for the proponent to:

1. Request that the section of Zirconia Drive between Alumina Rd to the east and the proposed vehicular accesses to the subject site is classified as a RAV 3 route:
2. Change the development site so that all Pocket Road Trains access it from Alumina Rd: or
3. Change the development site so that all accesses are off Alumina Rd.

In addition to the above, it is recommended that the proponent confirm with Main Roads WA and/ or the City of Rockingham that the Alumina Rd extension and Alloy Ave currently under construction will be included as RAV 3 routes when opened to traffic.

More information regarding classifying roads as RAV routes, including the application process, can be found here.

7 OPERATING HOURS

Shift crews will operate three 8-hour shifts on a rotation basis 24 hours per day every day of the year.

8 TRAFFIC VOLUMES AND VEHICLE TYPES

As indicated in Table 5 in **Section 6.4**, Heavy Vehicle movements are unlikely to be more than 3 in any one hour, i.e. no more than 12 truck trips per day for Stage 1 development and no more than 24 truck trips per day for Stage 2 development.

Based on a maximum of 61 staff and three shifts, staff trips are expected to be result in a peak of 30 trips during the hour of the shift change, i.e. 1/3 arriving and 1/3 leaving in the same hour with an average occupancy rate of 1.3 employees per car and no employees using public transport, cycling or walking to or from the site.

There is no known traffic data for Zirconia Dr or Alumina Rd. The latest available traffic data for Patterson Road south of Charles St indicates that peak hour volumes in any one direction do not exceed 2,000 vehicles, as shown in Figure 13 on the following page.

The functional one-way mid-block capacity of Patterson Rd based on two lanes in each direction with a dual carriageway is 1,900 vehicles per hour. Figure 13 on the following page shows that one-way traffic volumes on Patterson Rd exceed 1,900 vehicles per hour between 16:00 and 17:00 for southbound traffic. On this basis, **it is recommended that the shift hours for the site are set to avoid generating traffic between 4 PM and 5 PM on weekdays.**

mainroads WESTERN AUSTRALIA

SITE 1858

Hourly Volume

Patterson Rd (H002)

South of Charles St (SLK 24.93)

2019/20
Monday to Friday

	All Vehicles			Heavy Vehicles			
	NB	SB	Both	NB	SB	Both	%
00:00	38	64	102	4	2	6	5.9
01:00	28	37	65	3	3	6	9.2
02:00	31	27	58	1	2	3	5.2
03:00	126	46	172	9	3	12	7.0
04:00	428	123	551	21	13	34	6.2
05:00	1745	365	2110	78	35	113	5.4
06:00	1624	690	2314	90	74	164	7.1
07:00	1413	1061	2474	78	87	165	6.7
08:00	1137	1110	2247	70	87	157	7.0
09:00	886	810	1696	72	93	165	9.7
10:00	803	801	1604	79	101	180	11.2
11:00	849	841	1690	83	102	185	10.9
12:00	926	893	1819	90	104	194	10.7
13:00	889	892	1781	86	101	187	10.5
14:00	960	1343	2303	80	96	176	7.6
15:00	1181	1748	2929	65	106	171	5.8
16:00	1185	1942	3127	49	103	152	4.9
17:00	967	1631	2598	31	74	105	4.0
18:00	510	826	1336	18	41	59	4.4
19:00	336	390	726	11	19	30	4.1
20:00	270	287	557	9	13	22	3.9
21:00	207	229	436	5	8	13	3.0
22:00	111	181	292	4	5	9	3.1
23:00	55	110	165	3	5	8	4.8
TOTAL	16685	16467	33152	1039	1277	2316	7.0

Peak Statistics

AM	TIME	05:15	07:30	07:15	11:30	10:45	11:30
	VOL	1843	3198	2510	94	109	194
PM	TIME	15:45	15:45	15:45	12:00	15:45	12:00
	VOL	1211	1955	3166	90	108	194

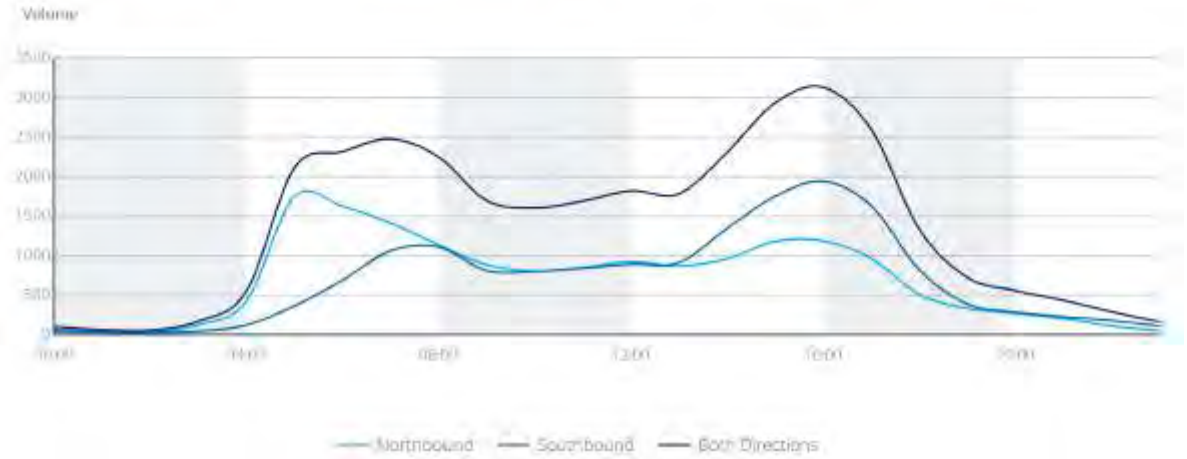


Figure 13 – Average Annual Weekday traffic volumes on Patterson Rd south of Charles St (2019/20)

9 TRAFFIC MANAGEMENT ON FRONTAGE STREETS

There is no traffic management, e.g. lines, pavement markings or signs on either Zirconia Dr or Alumina Rd, as shown in the photographs in **Section 4**. There is no identified warrant for traffic management on these frontage roads. Refers **Section 13** and **14** for details of traffic control at the intersections of Alumina Rd/ Patterson Rd and Alloy Ave/ Charles St/ Patterson Rd.

10 PUBLIC TRANSPORT ACCESS

Nearest bus routes	548 Mandurah Train Station – Mandurah Tce/ Tindale St – Madora Beach Rd/ Sabina Dr – via Patterson Rd.
Nearest train route	Mandurah Line.
Nearest bus stops	Patterson Rd (southbound), after Lithia Rd (200 m/ 2 ½ min walk) Patterson Rd (northbound), after Alumina (200 m/ 2 ½ min walk).
Nearest train station	Rockingham, 3.9 kms (50-minute walk/ 13-minute cycle). Wellard, 7.8 kms (29-minute cycle).
Pedestrian/ cycle link to bus stops	Path on south side of Zirconia Dr opposite development site. No Formal path links to nearest bus stops on Patterson Rd – peds currently walk through landscaping between Zirconia Dr and Patterson Rd.
Pedestrian/ cycle link to train station	No designated cycle routes between subject site and train stations.

11 PEDESTRIAN ACCESS/ FACILITIES

Existing pedestrian facilities within the development	Not applicable (vacant industrial blocks).
Proposed pedestrian facilities within the development	To be included in detailed development plans.
Existing pedestrian facilities on surrounding roads	Path on at least one side of all roads in the industrial estate. No paths on Patterson Rd.
Proposals to improve pedestrian access	It is recommended that a formal path link is provided between the bus stops on Patterson Rd and Zirconia Dr.

12 CYCLE ACCESS/ FACILITIES

Existing cycle facilities within the development	Not applicable (vacant industrial blocks)
Proposed cycle facilities within the development	To be included in detailed development plans.
Existing cycle facilities on surrounding roads	Path on at least one side of all roads in the industrial estate. No paths on Patterson Rd.
Proposals to improve cycling access	It is recommended that a formal path link is provided between the bus stops on Patterson Rd and Zirconia Dr.

13 SITE SPECIFIC ISSUES

The site is considered to be very suitable for the proposed development as it is consistent with the indicated land use within the Rockingham Industrial Zone and is forecast to generate moderate volumes of traffic.

The only identified concern is the ability of the pocket road train to safely negotiate the STOP controlled 'T' intersection at Alumina Rd/ Patterson Rd. As indicated in **Section 6.1.4**, a pocket road train is up to 27.5 m long (Figure 9 on page 20). The 'seagull' intersection layout allows for a vehicle up to 18.5 m to wait in the median island when turning right out of Alumina Rd without impeding other turning movements, as shown in Figure 14 and Figure 15 below. This indicates that the use of any multi-vehicle combination that exceeds 18 m in length should be discouraged until such time as the new access via Alloy Ave has been constructed and opened for use. This discouragement should apply to all vehicles using the Patterson Road Precinct.

Figure 14 – Existing STOP controlled seagull 'T' intersection of Alumina Rd with Patterson Rd

Figure 15 – Overlay of 27.5 m Pocket Road Train turning right out of Alumina Rd into Patterson Rd

14 SAFETY ISSUES

A review of the five-year crash record for the period ending 31st December 2018 has revealed that there have not been any reported crashes on either Zirconia Dr or Alumina Rd, or the intersection of Patterson Road with Alumina Rd, as shown in Figure 16 below.

There are no assessed vehicular safety issues with the existing site as sight lines are good along Zirconia Ave and Alumina Rd frontages and the crash record does not indicate a problem with any of these roads.

Figure 16 – 5-year crash location plot in vicinity of the subject site

Whilst there have not been any reported crashes at the intersection of Alumina Rd with Patterson Rd, there is a concern that multi-combination vehicles longer than 18 m in length are not able to wait within the median when turning right out of Alumina Rd without extending back into the southbound carriageway of Patterson Rd, as discussed and shown in Section 13 and Figure 15 on page 28.

As indicated in **Section 5**, construction works are currently underway to extend Alumina Rd north to connect with a new road (Alloy Ave) and then Patterson Rd via Alloy Ave and a new traffic signal-controlled intersection with Patterson Rd at Charles St. The proposed traffic signal-controlled intersection is shown in an extract from Main Roads WA Design Drawing CW1055400 003, provided as Figure 17 below.

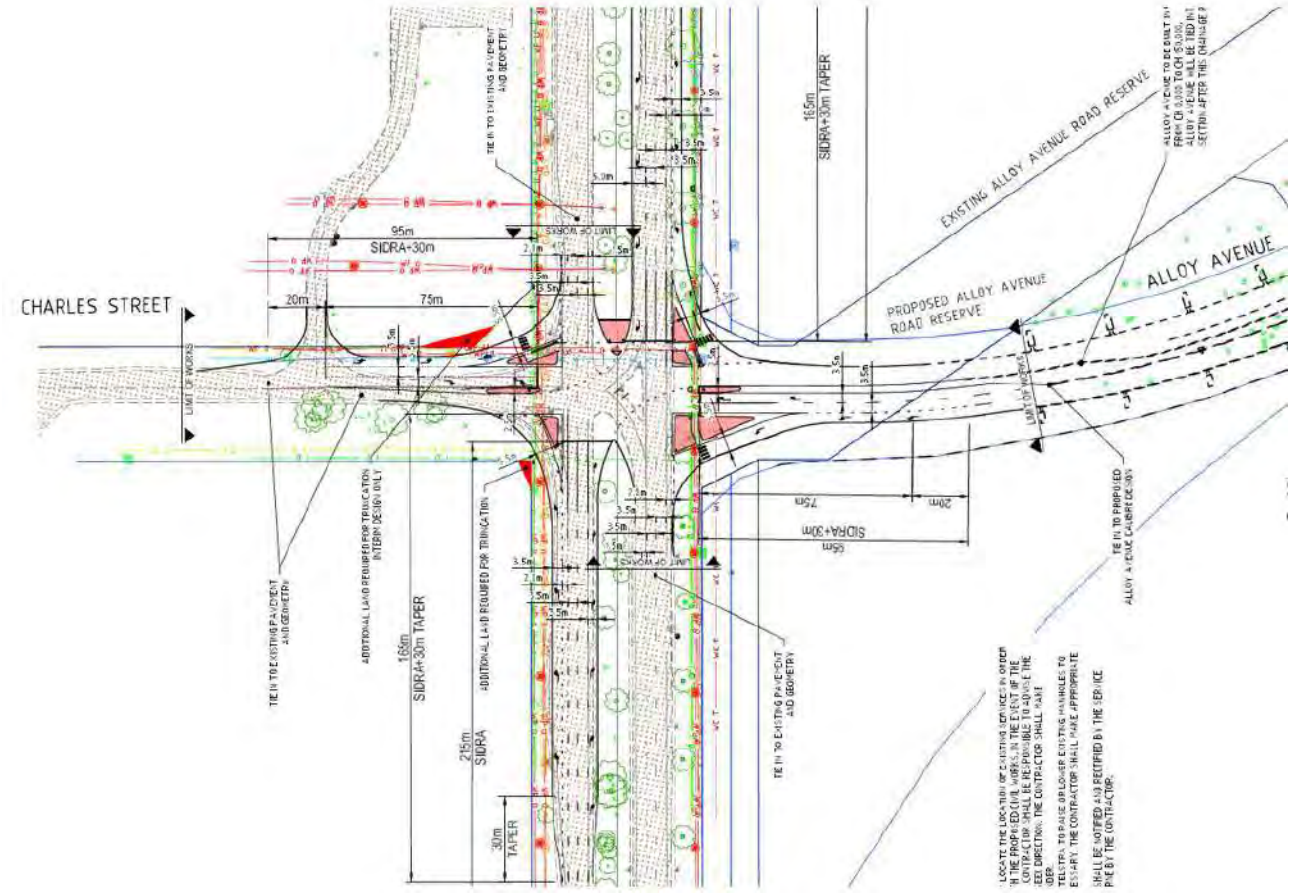


Figure 17 – Proposed Alloy Ave/ Charles St/ Patterson Rd traffic signal-controlled intersection

The above intersection will accommodate the RAV3 network vehicles better than the current Alumina Rd/ Patterson Rd intersection and address the identified concerns regarding the Alumina Rd intersection.

REFERENCES

1. **Western Australian Planning Commission.** *Transport Impact Assessment Guidelines.* Department of Planning, Government of Western Australia. Perth, Western Australia : Western Australian Planning Commission, August 2016. p. 182, Revised August 2016. The current version of the TIA guidelines (August 2016) has been endorsed by the WAPC.

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3. **Landcorp.** Rockingham Industry Zone. *Industrial Land Opportunity.* Perth, WA, Australia : Landcorp, August 2018. p. 8. LAND6633 08/18.

4. —. *RIZ Development Guidelines East Rockingham Industrial Park.* Perth : Landcorp, 2015. p. 350, Version 4 Final Lodgement. Applicable to Precincts 1-4.

5. **City of Rockingham.** *Planning Policy 3.3.8 East Rockingham Development Guidelines.* Rockingham : City of Rockingham, 2008. p. 2, Policy.

6. —. *Town Planning Scheme No.2.* Rockingham : s.n., 2014. p. 237, Gazetted 19 Nov 2004 Updated 3 July 2014.

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8. **Standards Australia.** *AS/NZS 2890.1 - 2004 Parking facilities Part 1: Off-street car parking.* Sydney : Standards Australia/ Standards New Zealand, 2004. p. 77. (Incorporating Amendment No 1). ISBN 0 7337 5742 1.

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10. **Australian Building Codes Board (ABCB).** *The Building Code of Australia.* Canberra : Australian Building Codes Board (ABCB), 2010. The Building Code of Australia (BCA) is Volumes One and Two of the National Construction Code (NCC). The BCA is produced and maintained by the Australian Building Codes Board (ABCB) on behalf of the Australian Government and State & Territory Governments..

11. **Austroads.** *Austroads Design Vehicles and Turning Path Templates Guide.* Sydney : Austroads Ltd, 2013. p. 26, April 2013 Edition. ISBN 978-1-921991-84-4.

12. **Roads and Traffic Authority NSW.** *Guide to Traffic Generating Developments.* Transport Planning Section. Sydney : Roads and Traffic Authority NSW, October 2002. p. 174. Version 2.2. ISBN 0 7305 9080 1.

13. **Standards Australia.** *AS 2890.2-2002 Parking facilities Part 2: Off-street commercial vehicle facilities.* Second. Sydney : Standards Australia International, 2002. p. 49. Vol. 2. ISBN 0 7337 4870 8.

APPENDIX A DEVELOPMENT DRAWINGS

Figure 18 - Draft plant layout and proposed northern extension of Alumina Rd to Patterson Rd (currently under construction)

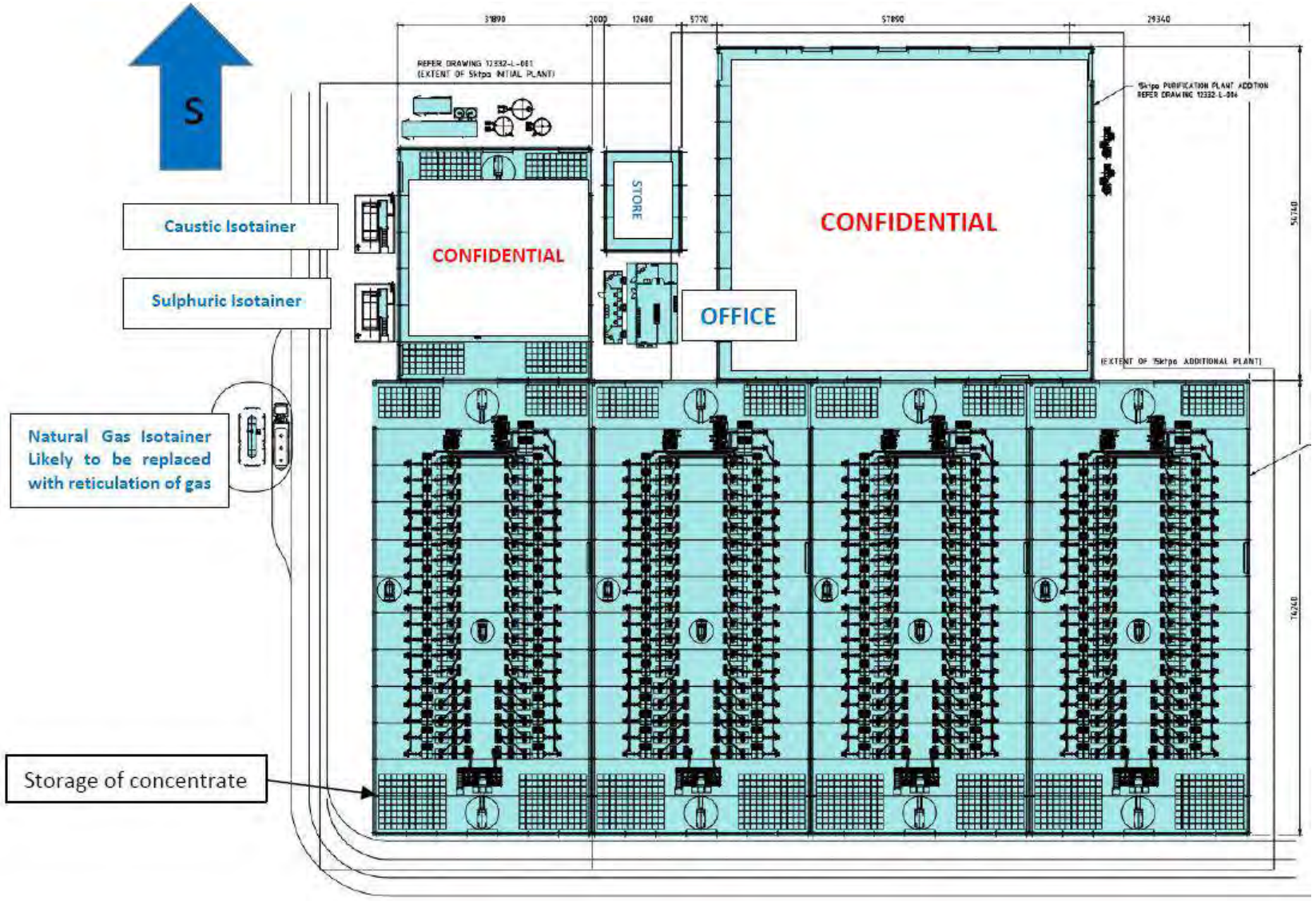

Figure 19 - 20,000 tpa Plant Layout with Reagent Storage Highlighted

APPENDIX B WAPC TRANSPORT IMPACT STATEMENT CHECKLIST

Checklist for a transport impact statement for individual development

- Tick the provided column for items for which information is provided.
- Enter N/A in the provided column if the item is not appropriate and enter reason in comment column.
- Provide brief comments on any relevant issues.
- Provide brief description of any proposed transport improvements, for example, new bus routes or signalisation of an existing intersection.

ITEM	PROVIDED	COMMENTS/PROPOSALS
Proposed development		
existing land uses	✓	Section 2
proposed land use	✓	Section 3
context with surrounds	✓	Section 4
Vehicular access and parking		
access arrangements	✓	Section 5
public, private, disabled parking set down/pick up	✓	Section 5
Service vehicles (non-residential)		
access arrangements	✓	Section 6
on/off-site loading facilities	✓	Appendix A
Service vehicles (residential)	NA	
rubbish collection and emergency vehicle access		
Hours of operation (non-residential only)	✓	
Traffic volumes		
daily or peak traffic volumes	✓	Section 8
type of vehicles (for example, cars, trucks)	✓	Section 8
Traffic management on frontage streets	✓	Section 9
Public transport access		
nearest bus/train routes	✓	Section 10
nearest bus stops/train stations	✓	Section 10
pedestrian/cycle links to bus stops/ train station	✓	Section 10

ITEM		
Pedestrian access/ facilities		
existing pedestrian facilities within the development (if any)	✓	Section 11
proposed pedestrian facilities within development	✓	Section 11
existing pedestrian facilities on surrounding roads	✓	Section 11
proposals to improve pedestrian access	✓	Section 11
Cycle access/facilities		
existing cycle facilities within the development (if any)	✓	Section 12
proposed cycle facilities within development	✓	Section 12
existing cycle facilities on surrounding roads	✓	Section 12
proposals to improve cycle access	✓	Section 12
Site specific issues	✓	Section 13
Safety issues		
identify issues	✓	Section 14
remedial measures	✓	Section 6.1.4: It is recommended that the proponent confirm with Main Roads WA and/ or the City of Rockingham that the Alumina Rd extension and Alloy Ave currently under construction will be included as RAV 3 routes when opened to traffic.

Proponent's name .....

Company EcoGraf **Date** .....

Transport assessor's name David Wilkins **Company** i3 consultants WA **Date** 11 May 2020

Appendix D – Stormwater Management Plan

GR ENGINEERING SERVICES
ENGINEERING CONSULTANTS AND CONTRACTORS

Providing global mineral processing solutions

ECOGRAF LIMITED

EcoGraf Processing Facility

Surface Water Management Strategy - Lot 2

Document History and Status

Revision	Date issued	Reviewed by	Approved by	Date approved	Revision type
A	17-Dec-2021	RS	GR	16-Dec-2021	Issued for review

Distribution of Copies

Revision	Issued to name	Issued to company
A	Shaun O'Neill	EcoGraf Limited

Document Information

File name:	3246017_4
Report author:	Rob Sceresini
Project manager:	Greg Rix
Client name:	EcoGraf Limited
Project name:	EcoGraf Processing Facility
Document title:	Surface Water Management Strategy - Lot 2
Revision:	A
Project number:	12332J

TABLE OF CONTENTS

1. INTRODUCTION

EcoGraf Limited (EcoGraf) is developing the new EcoGraf Processing Facility to produce high purity graphite for the lithium-ion battery market. The new EcoGraf Processing Facility, with associated infrastructure, will be located in the Kwinana-Rockingham Strategic Industrial Area of Western Australia (WA). The EcoGraf Processing Facility will be developed in two construction stages:

1. Construction of Stage 1: Installation of an initial purified spherical graphite product capacity of 5,000 tonnes per annum.
2. Construction of Stage 2: Expansion to achieve a spherical graphite product capacity of 20,000 tonnes per annum.

This report summarises the review of the site drainage system(s) necessary to collect, transfer and retain surface water in accordance with the City of Rockingham's Planning Procedure No. 1.8 Urban Water Management (CoR PP1.8).

At the direction of EcoGraf, the surface drainage systems have been revised to include an initial construction phase focussing on works confined to Lot 2 (rather than the entire area of Lots 1 and 2) which is a smaller project footprint. It has been prepared as an alternative, and standalone, drainage solution to those presented under GR Engineering Services' (GRES) report titled *Surface Water Management Strategy* dated October 2021 (reference: 3153014_2.docx).

2. PLANNING PROCEDURE REQUIREMENTS

2.1 Modelling Considerations

2.1.1 Storm Frequency Design Criteria

Hydrologic and hydraulic modelling undertaken for the design of all stormwater management systems based on a small, minor and major rainfall event basis as outlined in Australian Rainfall & Runoff (AR&R) (Geoscience Australia, 2016) and presented below.

Frequency Descriptor	AEP	EY	Land Use Design Criteria
Frequent/Small	63%	1 (Annually)	Applicable to all
(Annually)	20%	-	Residential and Rural Residential
Frequent/Minor*	10%	-	Commercial and Industrial
Rare/Minor*	1%	-	Residential, Rural Residential, Commercial and Industrial
Very Rare/Major	0.2%	-	Hospitals, Emergency Services, Flood Evacuation

* *All modelling for the project site considered an AEP of 63.2%, 20% (for comparison), 10% and 1% as per the land use design criteria.*

Table 1 AR&R (2019) Design Criteria

2.1.2 Modelling Parameters

In accordance with Section 4.2.2 of CoR PP1.8, the following parameters were adopted:

1. Intensity Frequency Duration (IFD) based on the site coordinates and using the Bureau of Meteorology's (BoM) online data hub.
2. Infiltration value based on geotechnical evaluation by Douglas Partners (Reference Report on Geotechnical Investigation, Lot 2 Rockingham Industrial Zone – Stage 1 East Rockingham, Western Australia dated March 2014) – 2.6 x 10-4 m/s.
3. Depth to Maximum Groundwater Level (MGL) based on a design detention basin level of 2 m AHD gives a 1.0 m depth of the basin to the MGL (based on Groundwater Atlas level of 1.0 m AHD for the site). Where the depth to MGL is less than 5.0 m from the base of the drainage infrastructure (in this case a detention pond), an infiltration model capable of accounting for the influence of a shallow water table on the calculated peak water levels is required.
4. Runoff assumptions considered for paved (including building infrastructure), unpaved and basin areas with calculation of initial and continuing loss values. Areas are as follows:
   a) Paved Areas – 2.04 Ha.
   b) Unpaved Areas – 1.49 Ha.
   c) Basin Area 0.22 Ha.
5. Runoff coefficients for above areas:
   a) Paved Areas – 0.9.
   b) Unpaved Areas – 0.
   c) Basin Area – 1.0.

2.2 Design Considerations

2.2.1 Frequent/Small Event Management

Frequent and small event management considered the following:

1. Commercial and industrial lots must integrate Water Sensitive Urban Design (WSUD) into the development to provide treatment of the first 15 mm of rainfall runoff from trafficable areas. Use of bio retention systems to treat the following:
   a) Trafficable Areas: 0.63 Ha.
   b) Volume of rainfall for 63.2% (1EY) AEP = 378 m^3.

2. All frequent event storages must be designed to completely empty, following the cessation of rainfall, within 12 hours. For the project site the following outcomes were achieved:
   a) 63.2% AEP – the basin contains and infiltrates events for a time of concentration within 3 hours.

2.2.2 Minor Event Management

Minor event management considered the following:

1. Group housing, commercial and industrial lots must manage minor and major rainfall event runoff within the lot boundary. Underground or above ground storage shall be provided and sized to contain the volume generated by the critical 10% AEP event as a minimum. The design solution consists of dual detention basins and are sized for the 1% AEP (Tc of 24 hours) with a volume 4,100 m^3 however, based on the 10% AEP Event:
   a) The basin contains all events for a Tc of 10 minutes to 72 hours (without draining).

2. Retention/detention storages must be sized to appropriately contain the minor flood event within a designated area without impacting POS useability or any adjacent road reserve. The following parameters meet the requirements of Table 5 – Stormwater Management Controls and Design Criteria as per the Planning Procedure and based on the geometry of combined basins:
   a) Area (at surface) – 7,400 m^2.
   b) Basin Floor Area – 1,000 m^2.
   c) Basin Area (at surface) – 90 m x 83.
   d) Maximum batter (length) – 1 in 6.
   e) Maximum batter (width) – 1 in 4.
   f) Depth of Basin – 2 m.

3. All minor event retention/detention storages must be sized to completely empty, following the cessation of rainfall, consistent with the criteria specified in Engineers Australia (2006). For the critical 20% and 10% AEPs the criteria is 36 hours and 48 hours, respectively. The outcomes for the detention basin are:
   a) 20% AEP duration of 36 hours infiltrates completely after 9 hours.
   b) 10% AEP duration of 48 hours infiltrates completely after 12 hours.

2.2.3 Major Event Management

Major event management considered the following:

1. Underground and/or above ground storage shall be provided and sized to contain the volume generated by the critical 1% AEP event. Outcome:
   a) The basin contains all events, without discharge (or considering draining), for a Tc of 10 minutes to 24 hours.

2. Minimum habitable floor levels must be consistent with the criteria specified in the Local Government Guidelines for Sub-divisional Development (WAPC, 2017) and Decision Process for Stormwater Management in WA (DWER, 2017), and should be set at least set at 0.3 m above the adjacent 1% AEP flood level of the urban drainage system (roads, drainage basins):
   a) Basin TWL set at RL4.0 with earthworks pads set at a minimum RL 4.3 m AHD.

3. All major event retention/detention storages must be sized to completely empty, following the cessation of rainfall, within 84 hours:
   a) 1% AEP duration of 84 hours the basin storage infiltrates completely after 24 hours.

4. For disease vector and nuisance insect management, to reduce the health risks associated with mosquito breeding, all stormwater must be fully infiltrated within 96 hours in accordance with BUWM:
   a) 1% AEP duration of 96 hours the basin storage infiltrates completely after 27 hours.

2.2.4 Other Infrastructure

Incorporate various surface water collection and transfer structures as follows:

1. Overall site gradient to be set at approximately 1% and falling from east to west across the site.
2. Gutters to collection points for each building.
3. Three (3) major drainage collection channels (east-west) receiving collected water and transferring to rock-lined soakage swales.
4. Three (3) rock-lined swales, with planted vegetation, receiving site drainage and discharging to the detention basin located along the extreme western perimeter of the site.

Refer to Section 3 for further detail covering the above.

3. SURFACE WATER STRUCTURES

3.1 Modelling Considerations

3.1.1 Storm Frequency Design Criteria

All modelling for surface water capture and project site considered Annual Exceedance Probabilities (AEPs) of 63.2%, 20% (for comparison), 10% and 1%.

3.1.2 Modelling Parameters

Refer to Section 2.1.2 for the modelling parameters applied to surface water structures.

3.2 Design Considerations

3.2.1 Surface Water Modelling

Time of Concentration (Tc) of 5 minutes applied to the following AEPs and discharges based on Peak Flow Estimation Using Rational Equation of Q = CiA.

Area (m^2)	AEPs (%)					
	63.2	20	10	5	2	1
10,000	0.20	0.29	0.3	0.38	0.44	0.49
20,000	0.41	0.57	0.66	0.75	0.87	0.97

Table 2 Peak Flow Estimation

The maximum area reporting to any drainage channel = 20,000 m^2.

The drainage channels are sized to deal with frequent/small events (63.2% AEP) with suitable freeboard (300 mm) and rare/minor events (1% AEP) with diminished freeboard (200 mm).

3.2.2 Surface Water Drainage Structures

The site generally grades towards the west and the intention is for the bulk earthworks design will emulate this natural drainage, which is fundamental to the drainage requirements for this site. The cut and fill volumes are balanced to mitigate the requirement to import/export large volumes of material. A summary of the volumes is presented below.

Summary of Bulk Earthworks Quantities (m^3)			
Cut to Fill Volume	Haul & Place from Stockpile	Haul to Stockpile*	Import from Offsite*
6,980	504	560	1,107

* *Surplus Material to be used for construction of building pads and balance imported from offsite.*

Table 3 Summary of Key Earthworks Quantities

Based on the location of key infrastructure, the site has been evenly divided into three (3) x main watersheds falling into three (3) main surface water drainage gutters. The fall across the site will be maintained within 0.5% to 1.0% positive fall.

Key drainage parameters include:

1. Three (3) "parabolic" 4,000 mm wide (at surface) and 500 mm deep drainage channels.

   Note: To facilitate ease of construction the channels are sized for the largest applicable design event.

2. These channels run the length of the site and receive overland run-off from paved areas. The channels discharge into the Detention Pond, located at the western boundary of the site, via rock lined swales.
3. The drainage channels will include a bituminous liner (or similar) to mitigate scour and erosion of the road embankments.
4. Given the shallow gradients across the site and the requirement for a Detention Pond at the western most (and lowest RLs) boundary, there is insufficient depth to adopt a traditional piped stormwater solution. As a result, water transfer will be via graded paved areas falling to the drainage channels. Transfer across internal roads will be via shallow "floodways" with shallow (1V:10H) entry and departure gradients to allow trafficking by light and heavy vehicles under normal operating conditions and in a low speed environment.
5. All road surfaces will be kerbed to direct runoff to the various floodways. Entries into the drainage channels will be via nominated kerb openings.
6. Upon approach to the electrical switchyard, the drainage channels will enter a set of low profile box culverts, two (2) off 450 to ensure controlled flow through this area. The use of low profile culverts will limit the earthworks required for cover requirements.
7. Given the staged approach to construction of the site, it is recommended that topsoil is stripped and stockpiled along the western perimeter of Lot 2 to form a protection bund to the western perimeter of Lot 2.

The above surface water management strategy ensures surface water runoff is contained within the site and complies with CoR PP1.8.

3.2.3 Other Infrastructure

The Administration Area will include gutters and downpipes to all buildings. Rainfall will be collected from downpipes and transferred via gutters to belowground soak wells via a series of PVC pipes.

The soak wells (four (4) in total) are designed for the following:

1. Contain the 1EY (63.2% AEP).
2. Contain the 50% AEP events.
3. Contain the 20% AEP events.
4. Contain the 10% AEP events.
5. Contain the 5% AEP for durations up to 45 minutes, then controlled overflow to designated surface water drainage structures for event durations of 60 minutes to 2 hours.
6. Contain the 1% AEP for durations up to 15 minutes, then controlled overflow to designated surface water drainage structures for event durations of 20 minutes to 6 hours (likely gutters would overflow during these rare/minor events and infiltrate to surrounding sandy soil).

The above strategy enables frequent/small and up to longer less frequency events to be stored and infiltrate within soak wells. Longer and less frequency events beyond the 10% AEP will overflow and transfer, via surface drainage, to the site detention ponds.

4. SUMMARY

4.1 Drawings

Relevant drawings and the outcomes of this surface water management and drainage strategy are depicted in the following drawings:

- 12332-C-001 Rev B Stormwater Drainage General Arrangement Plan;
- 12332-C-002 Rev C Earthworks Isopach Plan.

4.2 Summary of Compliance with the Planning Procedure

Based on the above evaluation, the current proposal of a detention basis with incoming drainage, meets the various criteria applicable to a commercial site.

Further evaluation, by way of an infiltration model, is required to determine the influence of a shallow water table on the calculated peak water levels. The current design considers a detention basin with base approximately 1 m to 1.5 m above the GWL (depending on final pad levels incorporating cut to fill and detention basin excavated material).

The outcomes may prompt an increase in basin area to decrease the depth of excavation to achieve required storage volumes.

4.3 Summary of Surface Water Management Structures

Based on the preceding evaluation, the site surface water drainage structures are suitably sized to deal with frequent/small events (63.2% AEP) with suitable freeboard (300 mm) and rare/minor events (1% AEP) with diminished freeboard (200 mm).

Soak wells are suitable for frequent/small events up to longer more rare events (up to 10% AEP). The use of soak wells, in combination with the surface water channels (to receive residual overflow after overland infiltration within sandy soil), are suitable for rare/minor events.

The surface water management drainage strategy works in collaboration with the current proposal of a detention basin, which meets the various City of Rockingham criteria that are applicable to a commercial site.

Based on the location of the detention basins (to the west and northern area of the site), and the need to balance the bulk earthworks to promote surface water drainage, the bulk earthworks and drainage strategy are constrained to this first stage of Lot 2. Future earthworks will require a surface water drainage strategy that is likely to differ from that presented under GRES' report titled Surface Water Management Strategy dated October 2021 (reference: 3153014_2.docx).

A possible solution may involve expansion of the current western detention basin and design site gradients on the expansion site (Lot 1) such that they fall from the South West to the North East (into the expanded pond) and removal of the northern secondary detention basin by backfilling. This would maintain the requirements contained within CoR PP1.8 such that a detention basin is maintained within the catchment low point.

5. REFERENCES

1. DWER Stormwater Management Manual for Western Australia.
2. City of Rockingham's Planning Procedure No. 1.8 Urban Water Management.
3. Douglas Partners Report on Geotechnical Investigation, Lot 2 Rockingham Industrial Zone – Stage 1 East Rockingham, Western Australia dated March 2014.

APPENDIX A CITY OF ROCKINGHAM PLANNING PROCEDURE NO. 1.8 URBAN WATER MANAGEMENT

1. Introduction

Urban development within the City of Rockingham (the City) has traditionally taken advantage of elevated land with sandy soils, limited surface water drains or watercourses, as well as generous clearance to groundwater. As the more suitable land has now largely been urbanised the focus has moved to areas which are more difficult to develop due to the presence of seasonal surface water inundation and/or geological complexity.

With a view to obtaining the best possible outcomes for the City, it is important that the City has a procedure which is supported at the higher level by a Council approved Local Planning Policy, which ensures that all development occurs with a focus on total water cycle management, and not just traditional 'end of pipe' drainage solutions.

2. Statement of Intent

This Planning Procedure supports the implementation of the objectives specified in *Planning Policy 3.4.3 - Urban Water Management* and applies specific rigor to strategic and statutory proposals for residential, commercial, industrial or rural-residential development by:

(a) Applying the objectives and requirements of Liveable Neighbourhoods (WAPC, 2009), WA State Government policies and guidelines;

(b) Ensuring that the objectives and intent of the approved Structure Plan and Subdivision Applications are appropriately implemented; and

(c) Ensuring that infrastructure is designed and constructed in accordance with adopted drainage standards consistent with best management practice.

The purpose of this Planning Procedure is to provide technical information on Urban Water Management for those proposing to develop land within the City and is applicable to all activities, works, services and programs conducted by the City, its contractors and consultants.

This Planning Procedure should also be read in conjunction with the following:

- Planning Procedure 3.4.1 - Public Open Space
- Planning Policy 3.3.15 - Bulk Earthworks
- Greening Plan (CoR, 2017)
- Engineering Policy PE1 - Street Verge Development
- Water Efficiency Action Plan (CoR, 2016)
- Planning Procedure No.1.24 - Landscape Assessment
- Planning Procedure No.1.25 - Engineering Assessment.

3. Planning Procedure

3.1 Urban Water Management Planning

Integrated land use and water planning is based on the principle of total water cycle management which holistically considers all aspects of water including drinking water, groundwater, stormwater runoff, wastewater, waterway health and water reuse. This informs sustainable urban planning and development decisions, and results in Water Sensitive Urban Design (WSUD).

3.1.1 Better Urban Water Management (BUWM)

Consistent with *Planning Policy 3.4.3 - Urban Water Management*, Table 1 outlines how land planning processes align with BUWM (WAPC, 2008) reporting to ensure WSUD is achieved.

Table 1 – Integrated Water Planning and Land Use Planning Process

Planning Trigger	Document Required	WSUD Context
District Structure Plan	District Water Management Strategy (DWMS)	Integrated Water Cycle Management (Regional/Catchment Scale, long-term water resource management and planning)
Local Structure Plan	Local Water Management Strategy (LWMS)	Water Sensitive Urban Design (local responses, built environment focus)
Subdivision Application	Urban Water Management Plan (UWMP)	Water Sensitive Urban Design (local responses, built environment focus)
Development Application (DA)	Stormwater Management Plan – Engineering Design – Landscape Design	Water Sensitive Urban Development (development scale, built environment focus)
Post-Development	Monitoring Report	Water Sensitive Urban Development (compliance)

3.1.2 Regional Context

The City can generally be classified into two separate catchment areas, each with their own unique characteristics; the Peel-Harvey Estuary catchment, and the Coastal Catchment (DWER, 2018) as shown in Appendix 1.

The Peel-Harvey Estuary catchment contains the Peel Main Drain, as well as a number of shallow rural subdrains, and the Serpentine River. The soils in this area are characterised by Bassendean Sands and Guildford Clays. The catchment experiences flooding from groundwater inundation during the winter months as well as riverine and localised rainfall flooding. There are a number of Conservation and Resource Enhancement Wetlands.

The Coastal catchment does not contain any natural drainage lines and is largely characterised by freely draining sandy soils associated with Safety Bay Sands and Tamala Limestone. There are a number of Conservation and Resource Enhancement Wetlands e.g. Lake Richmond.

4. Stormwater Management Principles

Stormwater management is dependent on a number of hydrological and geological factors. The following section outlines the requirements for stormwater management to be applied at each level of reporting (Table 1) with specific guidance for individual catchment areas where applicable.

4.2 Modelling Considerations

All stormwater management system designs shall be carried out by a suitably qualified person experienced in hydrologic and hydraulic modelling and design.

4.2.1 Storm Frequency Design Criteria

Hydrologic and hydraulic modelling shall be undertaken for the design of all stormwater management systems based on a small, minor and major rainfall event basis as outlined in *Australian Rainfall & Runoff (AR&R)* (Geoscience Australia, 2016) and presented in Table 2.

Table 2 – AR&R (2019) Design Criteria

Frequency Descriptor	AEP	EY	Land Use Design Criteria
Frequent/Small	63%	1 (Annually)	Applicable to all
Frequent/Minor	20%	-	Residential and Rural Residential
Rare/Minor	10%	-	Commercial and Industrial
Very Rare/Major	1%	-	Residential, Rural Residential, Commercial and Industrial
	0.2%	-	Hospitals, Emergency Services, Flood Evacuation Buildings and Civil Defence

4.2.2 Modelling Parameters

The City does not wish to prescribe fixed stormwater modelling parameters or standardised modelling methodology. It is essential, however, that applicants provide sufficient information to demonstrate the appropriateness of modelling parameters and assumptions to enable a proper consideration of the legitimacy of the modelling approach.

(a) Rainfall

(i) The Intensity Frequency Duration (IFD) design rainfall depths, should be created on a site by site basis using the BoM's online Design Rainfall Data System (2016).

(ii) The design rainfall temporal patterns for each frequency descriptor (Table 2) should be created on a site by site basis using AR&R's online datahub.

(b) Infiltration

(i) As infiltration properties vary depending on the lithology of in situ soils, site specific site investigations and modelling are necessary to determine stormwater storage volumes and drainage basin sizing. Field measurements of saturated hydraulic conductivity (infiltration tests) shall be undertaken by a suitably qualified person, e.g. Geotechnical Engineer, in accordance with recognised Australian Standards.

(ii) Appropriate soil moderation factors (DoW, 2004 - 2007) and long term clogging rates (John Argue, 2004) should be applied to the field measured infiltration tests to determine design hydraulic conductivity rates (m/day).

(iii) Where the depth to Maximum Groundwater Level (MGL) is less than 5.0m from the base of drainage infrastructure (e.g. drainage basin, underground storage), an infiltration model (e.g. MODRET, PONDS and PCSUMP – shallow water table) capable of accounting for the influence of a shallow water table on the calculated peak water levels is required. Where the depth to MGL is greater than 5.0m the use of a more simplistic model is considered appropriate.

(c) Runoff Assumptions

(i) Runoff assumptions should utilise latest methodology shown in Australian Rainfall and Runoff, Book 9 – Runoff in Urban Areas, Chapter 6: Modelling Approaches. This includes the use of impervious vs pervious areas in conjunction with Initial Loss (IL), Continuing Loss (CL) and Proportional Loss (PL) values.

(ii) Site specific fraction impervious runoff coefficients are to be calculated on a case by case basis with demonstration of their appropriateness to be provided.

(d) Other Parameters

(i) Appropriate stormwater and drainage design parameters shall be applied, where applicable, including but not limited to; depression storage, roughness coefficients (Horton's, Manning's 'n'), inlet and outlet losses and downstream conditions. Appropriate values must be determined on a site by site basis using existing and proposed site conditions.

(iii) Conveyance systems (open drainage channels, living streams, swales) must be designed using an integrated hydrologic and hydraulic stormwater and floodplain model (e.g. XP-Storm).

4.3 Design Considerations

4.3.1 Frequent/ Small Event Management

(i) Residential lots must manage small rainfall event runoff from constructed impervious surfaces within the lot boundary. Soakwells or other approved retention devices must be provided, where appropriate, and sized to contain the volume generated by the first 15mm of rainfall runoff as a minimum.

(ii) The use of soakwells and/or underground storage devices may be limited in areas with shallow depth to MGL, poor draining clayey soils and small lot areas (<300m^2). In these instances, a partial or direct lot connection to the road drainage system should instead be provided. This is to be assessed on a case by case basis.

(iii) In addition to the above, commercial and industrial lots must integrate Water Sensitive Urban Design (WSUD) into the development to provide treatment of the first 15mm of rainfall runoff from trafficable areas. WSUD can include elements such as bio-retention swales, rain gardens and tree pits.

(iv) Large developments must also integrate WSUD elements into the overarching stormwater and landscape design to capture and treat runoff from connected trafficable areas.

(v) All frequent event storages must be designed to completely emply, following the cessation of rainfall, within 12 hrs. This is consistent with the criteria specified in Engineers Australia (2006).

4.3.2 Minor Event Management

(i) Group housing, commercial and industrial lots must manage minor and major rainfall event runoff within the lot boundary. Underground or above ground storage shall be provided and sized to contain the volume generated by the critical 10% AEP event as a minimum. In circumstances where site conditions are constrained, it must be demonstrated that:

- Stormwater runoff is managed as much as practical within the lot; and
- The City's drainage infrastructure has sufficient capacity to cater for any off-site discharge via piped drainage or overland flow.

(ii) Municipal roads must maintain serviceability, amenity and road safety during rainfall events:

- The road reserve pit and pipe network must be designed for the critical 20% AEP event, as a minimum.
- Trapped pits are supported, where site conditions allow and expected contaminant runoff is minimal, promoting infiltration at source. Where trapped pits are not appropriate, e.g due to the presence of a shallow controlled groundwater level, benched pits are instead to be provided.
- The City is supportive of the DWER's approach to minimise piped drainage systems. Where roads abut Public Open Space (POS) or other landscaped areas, flush kerbing or kerb breaks shall be considered.

(iii) Retention/ detention storages must be sized to appropriately contain the minor flood event within a designated area without impacting POS useability or any adjacent road reserve. Storage sizing must be cognisant of existing and proposed site conditions and any downstream constraints.

(iv) All minor event retention/ detention storages must be sized to completely emply, following the cessation of rainfall, consistent with the criteria specified in Engineers Australia (2006). For the critical 20% and 10% AEPs the criteria is 36 and 48 hours, respectively.

4.3.3 Major Event Management

(i) Group housing, commercial and industrial lots may be required to manage the major rainfall event runoff within the lot boundary. Underground and/or above ground storage shall be provided and sized to contain the volume generated by the critical 1% AEP event. In circumstances where site conditions are constrained, it must be demonstrated that:

- Stormwater runoff is managed as much as practical within the lot; and
- The City's drainage infrastructure has sufficient capacity to cater for any off-site discharge via piped drainage or overland flow.

(ii) Flooding of the road pavement within the municipal road reserve is permitted, provided minimum safety requirements are met.

(iii) Minimum habitable floor levels must be consistent with the criteria specified in the Local Government Guidelines for Subdivisional Development (WAPC, 2017) and Decision Process for Stormwater Management in WA (DWER, 2017), and should be set:

- At least set at 0.3m above the adjacent 1% AEP flood level of the urban drainage system (roads, drainage basins); or
- At least 0.5m above the 1% AEP flood level of natural waterways, living streams or open drainage channels.

(iv) In major events, flooding within retention/ detention storages can overflow into useable POS and any adjacent road reserve, provided minimum public safety measures are met. Storage sizing must be cognisant of existing and proposed site conditions and any downstream constraints.

(v) All major event retention/detention storages must be sized to completely empty, following the cessation of rainfall, within 84hrs. This is consistent with the criteria specified in Engineers Australia (2006). For disease vector and nuisance insect management, to reduce the health risks associated with mosquito breeding, all stormwater must be fully infiltrated within 96 hours in accordance with BUWM.

4.3.4 Stormwater Infrastructure Design Criteria

Stormwater management system controls shall be cognisant of the City's design criteria as shown in Table 5.

The City does not support the use of fenced sumps as a permanent urban water management solution. The City will, however, consider sumps for temporary flood storage areas providing the following criteria are met:

(i) Where the sump is not at the catchment low point, storage capacity should be cognisant of the volume generated by the critical 20% AEP event in residential areas and critical 10% AEP event in industrial and commercial areas.

(ii) Where the sump is located at the catchment low point, storage capacity should reflect the volume generated by 1% AEP.

Table 5 - Stormwater Management Controls and Design Criteria

Stormwater Management Control	Design Criteria
Detention/Infiltration Basin	Maximum Permissible Batters: 1 in 8 for grassed areas 1 in 6 to 1 in 4 for landscaped area within POS 1 in 2 for terraced landscaped areas with retaining walls Maximum Flood Depths 1EY – 0.5m, 20% AEP – 0.9m, 1% AEP – 1.2m Invert Level To be a minimum 0.5m above the calculated MGL or CGL
Open Channel/Living Stream/Swale	Maximum Permissible Batters: 1 in 8 to 1 in 6 for grassed areas 1 in 6 to 1 in 4 for landscaped area within POS Grades: 0.5% to 4.0% Maximum Flood Depths: 1EY – 0.5m, 20% AEP – 0.9m, 1% AEP – 1.2m Invert Level To be a minimum 0.5m above the calculated MGL or CGL
Sump (Temporary Only)	Maximum Permissible Batters: 1 in 6 to 1 in 1.5 – fenced with no public access. Maximum Flood Depths: 1% AEP – 1.5m Invert Level To be a minimum 0.3m above the calculated MGL or CGL
Underground Storage	Minimum Separation to Constructed Surface: In accordance with manufacturers specifications to the satisfaction of the City. Location: Road Reserve – under verge and foot path areas only. POS – under detention/infiltration basins or turfed recreational space. Invert Level To be a minimum 0.3m above the calculated MGL or CGL

4.4 Peel-Harvey Estuary Catchment

Development within the Peel-Harvey Estuary Catchment (Appendix 1) is bound by criteria specified by both the Water Corporation and the DWER. It is recommended that proponents liaise with both the Water Corporation and DWER as early as possible for site specific guidance and design criteria.

Development proposals located in the Water Corporation's Mundijong Drainage District for the Peel Main Drain has traditionally required stormwater management systems to be designed on the basis of:

(i) A restricted off-site discharge rates of 3 L/s/gross ha for the 10% AEP storm event, and;

(ii) A restricted off-site discharge rates of 4.5 L/s/gross ha for the 1% AEP storm event.

The Water Corporation has published fact sheets to guide urban development within a rural drainage district as well as the design criteria for living streams in their assets.

District level planning in this area is to be informed by the *North East Baldivis Drainage and Water Management Plan (DWMP)* (DWER - in preparation). The DWMP will provide an assessment of catchment-scale water constraints and management opportunities informed by the *North East Baldivis Flood Modelling and Drainage Studies* (DoW, 2015).

Where there is no published criteria, adequate on-site detention and/or retention is required to maintain post development outflows relative to pre-development conditions, consistent with *Better Urban Water Management (BUWM)* (WAPC, 2008).

4.5 Water Dependent Ecosystems (WDEs)

Development proposals should identify any WDEs (e.g wetlands, watercourses, estuaries) and regionally significant vegetation/habitat to be protected. WDEs require specific water regimes to maintain their natural hydrological characteristics referred to as Ecological Water Requirements (EWRs).

(i) EWRs are to be quantified to understand how WDEs will be affected by their relationship to changes in surrounding land uses. Pre-development annual discharge volume and peak flow should be maintained post development, unless otherwise established through determination of EWRs for sensitive environments.

(ii) Appropriate buffers to urban development are to be provided consistent with any identified management and rehabilitation requirements of the WDE. This is to be assessed by both the DWER and the City.

(iii) The City will not accept direct discharge of urban drainage into WDEs. Appropriate water quality treatment measures are to be provided throughout the urban catchment and within vegetated buffers to capture small events.

5. Groundwater Management Principles

Groundwater management systems are required in areas where the MGL is at or within 1.2m of the natural surface that typically exist within the Peel Harvey Estuary Catchment (Appendix 1). The following section outlines the requirements for groundwater management in these areas.

5.1 Controlled Groundwater Levels

Development proposals must consider the existing groundwater regime to determine whether groundwater management is required. This includes installation of site specific observation bores that must be monitored for a minimum 18 month period to include two winters consistent with DWER standard practice.

Where groundwater management requires the establishment of a Controlled Groundwater Level (CGL), the following must be addressed in accordance with *Water Resource Considerations when Controlling Groundwater Levels in Urban Development* (DoW, 2013):

(i) Peel Harvey Estuary Catchment constraints and requirements;

(ii) Adjacent land uses and infrastructure;

(iii) Impacts to local and regional water-dependent ecosystems and water resources;

(iv) Contaminants that may be mobilised with released groundwater associated with historical land uses; and

(v) The system needing to be hydraulically sound and having a free-flowing outlet.

5.2 Subsoil Drainage

Where development proposals require subsoil drainage to control groundwater levels, the City requires the following design and construction standards to be met:

(i) Groundwater management systems to be designed using an appropriate model to predict the performance of the system. The level of detail required to be addressed should be consistent in the broader context of the BUWM planning and design process. Modelling must clearly demonstrate that clearances to groundwater are acceptable depending on the level of risk and amenity for all critical elements of the built form and infrastructure.

(ii) Imported fill must be tested in a NATA accredited laboratory to ensure the groundwater management system design criteria are met e.g. saturated hydraulic conductivity.

(iii) Subsoil outlets are to be free draining with a minimum invert level of 150mm above the base of the system into which it discharges.

(iv) Groundwater quality must be maintained or improved prior to offsite discharge into local and regional watercourses.

6. Water Sensitive Urban Design

The City recognises that there are multiple benefits associated with Water Sensitive Urban Design (WSUD) aside from water quality treatment. WSUD improves biodiversity, microclimate, aesthetics, urban greenery, human health and potentially act as an alternative water supply. WSUD measures are therefore encouraged and must be considered in all development proposals across the City.

6.1 Compliance with Environmental Quality Criteria

Development proposals within the Peel Harvey Estuary Catchment (Appendix 1) are bound by specific environmental water quality criteria. For the Serpentine River, which includes the Peel Main Drain, specific criteria are as follows:

(i) The annual Phosphorus load must not exceed 21 tonnes or concentrations of 0.1 mg/L (EPA, 2008);

(ii) The Phosphorus output target is 70 tonnes or 0.37 kg/ha/year (DoW, 2011);

(iii) The Total Nitrogen output target is 454 tonnes or 2.4 kg/ha/year (DoW, 2011).

WSUD measures must be incorporated in these areas to achieve the mandatory targets. The City requires demonstration of compliance through appropriate computer models, for example the DWER's UNDO tool, to be assessed relevant to the stage of planning and scope of the proposal, as supported by the DWER.

6.2 WSUD Measures

The City requires development proposals, as well retrofit projects, to consider WSUD measures early in the planning and design process. The table in Appendix 2 illustrates the different types of WSUD Best Management Practices (BMPs), adopted from the *Stormwater Management Manual for WA* (DoW, 2004 - 2007), that should be considered at various scales of development.

To achieve the objectives of WSUD, a treatment train approach incorporating a number of the measures in Appendix 2 is to be applied to maximise water quality improvement and overall performance.

The City does not currently have any standard designs or drawings for the BMPs in Appendix 2. It is therefore recommended that proponents engage with the City as early as practical to discuss specific requirements to be assessed on a case by case basis.

6.2.1 Biofiltration

Biofiltration systems must be designed in accordance with latest industry guidance that has been determined based on scientific rigour, in conditions appropriate to those experienced in the City. Biofiltration systems (swales, rain gardens and tree pits) shall be sized to retain the first 15mm of rain in accordance with *Decision Process for Stormwater Management in WA* (DWER, 2017) and must meet the requirements and design specifications outlined in the following:

- *Adoption Guidelines for Stormwater Biofiltration Systems (Version 2)* (CRCWSC, 2015)
- *Vegetation Guidelines for Stormwater Biofilters in the South-West of Western Australia* (Monash University, 2014)

Where amended soils are required to provide an appropriate filter media, the City encourages proponents to test in situ soils against published criteria. Alternatively, a landscape supplier manufactured material must be provided. For both scenarios, a soil sample analysis by a NATA accredited laboratory must be provided to the City to demonstrate compliance.

6.2.2 WSUD Construction and Site Management

Actions must be proposed to address management of construction activities, particularly litter and sediment management as well as vegetation and tree protection.
A Construction and Building Site Management Plan shall be developed to support subdivision and/or Development Application. The management plan should, at a minimum, consider:

(i) Protection of vegetation or wetlands;

(ii) Interim stormwater management measures;

(iii) Location of site entry;

(iv) Location of stockpiled materials;

(v) Control of sediment - fences should be erected around vegetated areas and WSUD infrastructure;

(vi) Erection of safety/construction fences;

(vii) Protection of WSUD infrastructure integrity in the period between civil construction and landscaping.

6.2.3 WSUD Monitoring and Maintenance

Under the BUWM (WAPC, 2008) framework, a monitoring program and maintenance regime must be outlined in an Urban Water Management Plan (UWMP), prepared as a condition of subdivision, to the satisfaction of the City.

The purpose of the monitoring program is to demonstrate the effectiveness of WSUD controls to ensure it is operating in accordance with its intended purpose and design. The post development monitoring program must confirm that there are no detrimental impacts to groundwater and surface water quality and at a minimum shall demonstrate that pre-development conditions are preserved.

Maintenance is required to ensure WSUD systems will function effectively, optimising their life span. Maintenance tasks for WSUD assets are similar to conventional drainage systems and parks. Maintenance should not be reactive e.g. fixing poorly performing assets. Effective maintenance requires time and resources to be allocated to actions that must be scheduled in response to planned inspections. Developers and the City are both responsible for maintenance.

7. Water Conservation and Sustainability

The City has been endorsed as a Waterwise Council under the Water Corporation and DWER's Waterwise Councils program.

The City's *Water Efficiency Action Plan* (2016) specifies a groundwater efficiency goal to reduce groundwater consumption by 10% based on the DWER's standard allowance of 7,500 kL/ha/yr. Development proposals should therefore consider an average irrigation rate of 6,750 kL/ha/yr where groundwater is proposed as a suitable fit-for-purpose water source. Landscape proposals shall be designed using waterwise principles including xeriscaping and hydrozoning.

Where practical, supplement potable and non-potable water supply using alternative sources of water e.g. rainwater tanks, grey water, treated wastewater, harvested stormwater.

At the lot scale, developments are encouraged to implement the Water Corporation's *Guidelines for Waterwise Homes and Gardens Criteria*.

8. Interpretations

8.1 Agency Acronyms

BoM - Bureau of Meteorology

Council - The Council of the City of Rockingham

CRCWSC - Cooperative Research Centre for Water Sensitive Cities

DoW - Department of Water (now the DWER)

DWER - Department of Water and Environmental Regulation (formerly the DoW)

IPWEA - Institute of Public Works Engineering Australasia

NATA - National Association of Testing Authorities

WAPC - West Australian Planning Commission

8.2 Definitions

Annual Exceedance Probability (AEP) - the probability of an event occurring or being exceeded within a year expressed as a percentage.

Best Management Practice (BMP) - Devices, practices or methods for removing, reducing or preventing targeted pollutants from reaching receiving waters and for reducing runoff volumes and velocities. Includes structural and non-structural controls.

Biofilter - (also known as biofiltration basin and rain garden) are excavated basins or trenches filled with porous filter media and planted with vegetation to remove pollutants from stormwater runoff. They use natural and physical processes to treat stormwater.

Controlled Groundwater Level (CGL) - The controlled (ie modified) groundwater level (measured in metres Australian Height Datum) at which drainage inverts are set. This level must maintain the hydrologic regimes of groundwater dependent ecosystems, such as wetlands, that are to be protected.

Ecological Water Requirements (EWRs) - EWRs are the water regimes needed to maintain ecological values of Water Dependent Ecosystems (WDEs) at a low level of risk.

Exceedances per Year (EY) - expresses the probability of how many times in any year that an event will occur.

Intensity Frequency Duration (IFD) - IFDs are Intensity–Frequency–Duration design rainfall intensities (mm/h) or design rainfall depths (mm) corresponding to selected standard probabilities, based on the statistical analysis of historical rainfall.

Maximum Groundwater Level (MGL) - To be determined through on-site measurement, monitoring and/or modelling and compared to the DWER's regional long-term monitoring records (if available).

Structural Practices - Structural stormwater quality and quantity best management practices are permanent, engineered devices implemented to control and improve stormwater quality and restore natural hydrological flows and velocities. Structural controls should be installed at or near the source of run-off/pollutant inputs, to prevent or treat pollution and manage the quantity of stormwater as high in the catchment as possible.

Total Water Cycle Management - water supply, stormwater, groundwater and sewage services are interrelated components of catchment systems, and therefore must be dealt with using an holistic water management approach that reflects the principles of ecological sustainability. Water efficiency, re-use and recycling are integral components of total water cycle management.

Treatment train - application of several types of stormwater best management practices in series or designed to achieve improved stormwater management.

Water Dependent Ecosystem (WDE) - WDEs are parts of the environment in which the composition of species and natural ecological processes are determined by the permanent or temporary presence of flowing or standing surface water or groundwater. The in-stream areas of rivers, riparian vegetation, springs, wetlands, floodplains, estuaries, karst systems and groundwater-dependent terrestrial vegetation are all WDEs.

Water Sensitive Urban Design (WSUD) - The philosophy of achieving better water resource management outcomes in an urban context by using an integrated approach to planning and incorporating total water cycle management objectives into the planning process. The key elements of this design include protection from flooding; management of water quantity and quality to achieve ecological objectives; and water conservation, efficiency and re-use.

9. References

CRC for Water Sensitive Cities (2015) *Adoption Guidelines for Stormwater Biofiltration Systems (Version 2)*

Department of Water (2004-2007) *Stormwater Management Manual for Western Australia*

Department of Water (2011) *Hydrological Nutrient Modelling of the Peel-Harvey Catchment – Water Science Technical Series Report No. WSPT 33*

Department of Water (2013) *Water Resource Considerations when Controlling Groundwater Levels in Urban Development*

Department of Water (2015) *North-east Baldivis Flood Modelling and Drainage Studies – Report No. WST 73*

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WAPC (2008) *Better Urban Water Management*

WAPC (2017) *Local Government Guidelines for Subdivisional Development*

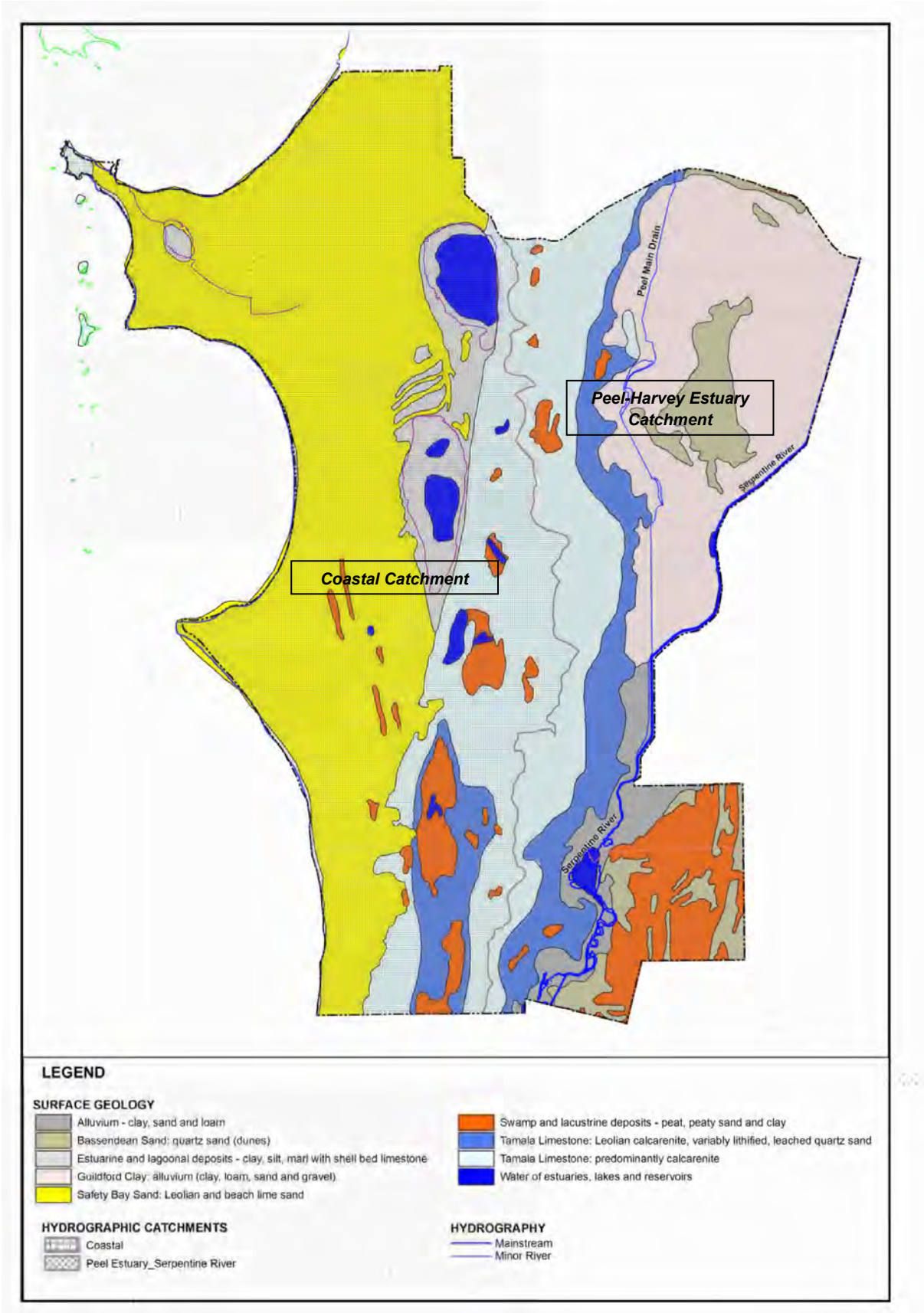
10. Authority

All development proposals shall have due regard to the information presented in this Planning Procedures to ensure compliance with the objectives specified in *Planning Policy 3.4.3 – Urban Water Management.*

11. Adoption

This Planning Procedure was endorsed by the Director, Planning and Development Services on March 2019.

APPENDIX 1: REGIONAL CONTEXT



APPENDIX 2: WSUD BEST MANAGEMENT PRACTICES

BMP	Scale			
	Lot	Street	Subdivision	Regional
Stormwater Storage & Reuse				
Managed Aquifer Recharge			✓	✓
Harvesting	✓	✓		
Rainwater Tanks	✓			
Infiltration Systems				
Soakwells	✓	✓		
Underground Storage		✓	✓	
Pervious Paving	✓	✓		
Trapped Drainage Pits		✓	✓	
Drainage Basins			✓	
Conveyance Systems				
Living Stream			✓	✓
Vegetated Swales	✓	✓	✓	✓
Kerb Treatments (e.g. flush)		✓		
Detention Systems				
Ephemeral Detention Basins			✓	
Green Roofs/Walls	✓			
Pollutant Control				
Gross Pollutant Traps	✓	✓	✓	
Hydrocarbon Management (e.g. Oil-Water Separators)	✓	✓		
Biofiltration				
Basins			✓	
Rain Gardens	✓	✓	✓	
Tree Pits	✓	✓		
Median Swales		✓	✓	

APPENDIX B DOUGLAS PARTNERS REPORT

Douglas Partners
Geotechnics / Environment / Groundwater

Integrated Practical Solutions

Report on
Geotechnical Investigation

Lot 2
Rockingham Industrial Zone - Stage 1
East Rockingham, WA

Prepared for
LandCorp

Project 82089.01
March 2014

Douglas Partners
Geotechnics / Environment / Groundwater

Document History

Document details

Project No.	82089.01	Document No.	1
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Document status and review

Revision	Prepared by	Reviewed by	Date issued
1	M. Williams / D. Jagoe-Banks	M. Thom	28 March 2014

Distribution of copies

Revision	Electronic	Paper	Issued to
1	1	1	LandCorp

The undersigned, on behalf of Douglas Partners Pty Ltd, confirm that this document and all attached drawings, logs and test results have been checked and reviewed for errors, omissions and inaccuracies.

	Signature	Date
Author		28-3-2014
Reviewer		26.03.2014

NCS INTERNATIONAL CERTIFIED QUALITY MANAGEMENT SYSTEM

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Douglas Partners
Geotechnics | Environment | Groundwater

Executive Summary

A geotechnical investigation was carried out for Stages 1 to 3 RIZ and reported in July 2013 (Project 82089). The investigation included over 100 test pits and 14 cone penetration tests. This report uses information from the July 2013 investigation along with additional site specific testing relative to Lot 2, Stage 1. Testing relative to the Lot includes five test pits.

Ground conditions consists of a thin layer of surface topsoil over medium dense sand overlying a layer of very low to medium strength limestone between 0.4 (minimum topside) and 2.2 m (maximum underside) and then deeper sand.

No free groundwater was encountered at the test locations on the fieldwork dates of 6 June 2013 and 23 January 2014.

The following bearing pressures are recommended following site preparation, to limit the estimated total and differential settlements to less than 15 mm:

- 200 kPa for foundation design of strip footings up to 1.5 m wide; and
- 250 kPa for pad footings up to 2 m by 2 m.

A subgrade CBR value of 15% for the natural sand is recommended for design purposes.

A permeability value (k) of 1.0 x 10^{-4} m/s is recommended for the design of soakwells in medium dense sand.

The risk of acid sulphate soils to a depth of 3.0 m below the existing surface level is considered to be low

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Table of Contents

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Report on Geotechnical Investigation
Rockingham Industrial Zone - Stage 1
Lot 2

1. Introduction

This report presents the results of a geotechnical investigation undertaken for Lot 2 of Stage 1 of the Rockingham Industrial Zone (RIZ), Rockingham, WA. The investigation was commissioned in an email dated 15 January 2014 by LandCorp and was undertaken in accordance with Douglas Partners' proposal dated 7 January 2014.

The purpose of this report is to provide site specific geotechnical information for potential purchases of Lot 2 Stage 1 RIZ including comments on:

- Appropriate site classification of the lot in accordance with AS 2870-2011.
- The suitability of the individual lots for industrial development.
- Site preparation, to allow industrial development.
- Appropriate foundation systems for typical structures.
- Parameters for foundation design, including allowable bearing pressures and estimated settlement.
- The depth and strength of limestone, if encountered.

A geotechnical investigation was carried out for Stages 1 to 3 RIZ and reported in July 2013 (Project number 82089). The investigation included over 100 test pits and 14 cone penetration tests. This report uses information from the July 2013 investigation along with additional site specific testing. In total exploratory testing across Lot 2 includes five test pits. The details of the field work are presented in this report, together with comments and recommendations on the issues listed above.

2. Site Characteristics

The site is designated as Lot 2 of Stage 1 of the RIZ development located in Rockingham, WA, approximately 45 km south of Perth. Lot 2 is located in the northern area of Stage 1 and at the time of the investigation was bounded by Lot 1 to the west, future road reserves to the north and south and Lot 3 to the east. Lot 2 was covered in natural vegetation primarily consisting of grass trees, and tall grass with some trees up to 15 m in height (estimate).

Fly tipped materials were observed of several locations across the Stage 1 area, predominantly along the sand tracks. This investigation scope didn't include the assessment of contamination so these materials were not evaluated for remediation or disposal.

The site topography observed during the field work is described as relatively flat with occasional undulations generally less than 1 m and some dune formations.

The Rockingham 1:50,000 Geology Sheet indicates that the site is underlain by Safety Bay Sand approximately 10 m in thickness.

The Perth Groundwater Atlas (2004) indicates that the groundwater level was generally around RL 1.0 m AHD in May 2003, approximately 3 m below existing ground level.

Published acid sulphate soil risk mapping indicates that the site is within an area depicted as “no known risk of acid sulphate soils occurring within 3 m of the natural soil surface”.

3. Field Work Methods

Field work was carried out between 4 and 14 June 2013 and on 23 January 2014. In total, the investigation undertaken across Lot 2 comprises five test pits with adjacent Perth sand penetrometer tests.

3.1 Test Pits

Test pits 39, 40, 41, 42 and 102 were carried out using a 5 tonne excavator with a 0.6 m wide toothed bucket. Ground conditions were logged by a geotechnical engineer from DP, in general accordance with AS1726. Representative soil samples were recovered from test pits for subsequent geotechnical testing.

3.2 Perth Sand Penetrometer Tests

PSP testing was carried out adjacent to test pits to assess the in situ density of the shallow sand. PSP testing was carried out in accordance with AS1289.6.3.3. PSP results are presented on the right hand side of the test pit logs. The results have been used to derive a density description for the soils.

4. Field Work Results

4.1 Ground Conditions

Detailed logs of the subsurface conditions encountered at each test location are provided in Appendix B. Ground conditions consist of a thin layer of surface topsoil over sand overlying a layer of limestone and then deeper sand, as summarised below:

- **Topsoil** – grey and brown sandy topsoil with some rootlets between 0.1 m and 0.25 m thick.
- **Sand** – loose to medium dense, grey and brown fine to medium grained sand underlying the topsoil to depths of between 0.4 m and 1.8 m before reaching limestone.

- **Limestone** – very low to medium strength , light yellow to white limestone underlying the sand and extended to depths of between 1.5 m and 2.2 m.
- **Sand** – to test pit termination depths below the limestone at all locations except for TP102.

4.2 Groundwater

No free groundwater was encountered at the test locations on the fieldwork dates of 6 June 2013 and 23 January 2014.

5. Geotechnical Laboratory Testing

A geotechnical laboratory testing programme was carried out by a NATA registered laboratory and comprised the determination of:

- the particle size distribution on one sample; and
- point load test on one limestone sample.

Results of the testing are summarised in Tables 1 and 2. Test certificates are presented in Appendix C.

Table 1: Geotechnical Laboratory Test Results

Test	Depth (m)	Soil Type	Fines (%)	Sand (%)	Gravel (%)	d_{10} (mm)	d_{60} (mm)
TP102	0.5	Grey fine to medium grained SAND	2	98	0	0.16	0.31

Notes:
- Fines are particles smaller 0.075mm;
- The d_{10} and d_{60} values are the maximum particle size for the smallest 10% and 60% respectively; these values are used in the permeability assessment discussed in Section 7.6.

Table 2: Point Load Strength Test Results

Test	Depth (m)	Testing Location	Point Load Strength Index $I_{s(50)}$ (MPa)	Rock Strength
TP40	0.90	NATA Laboratory	0.16	Low

6. Proposed Development

It is understood that the proposed development will be for industrial use. Given the relatively flat topography and level of surrounding developments and roads, it is anticipated that the finished level will be close to the existing levels with minimal earthworks required to achieve final design surface levels.

7. Comments

7.1 Site Suitability and Site Classification

As detailed in Section 4.1, the subsurface conditions at the site generally comprise loose to medium dense sand and limestone. Due to the occurrence of loose material, the site must be classified Class P in strict accordance with AS 2870-2011. The site classification can be improved to Class A, provided site preparation is undertaken as detailed in Section 7.2.

It should be noted that AS 2870-2011 is applicable to "*single dwelling house, townhouse or similar structure"* and "*other forms of construction including some light industrial, commercial and institutional buildings if they are similar to houses in size, loading and superstructure flexibility*" (AS 2870-2011, Section 1.1). It is therefore recommended that a specific geotechnical investigation is carried out for structures not covered by the above standard.

7.2 Site Preparation

A site classified "A" in accordance with AS 2870-2011, in the Perth area, requires at least 1.8 m of suitably compact sand and/or competent rock. In summary, compaction of the loose material overlying the limestone is required to satisfy Class A conditions. Loose material was encountered to approximately 1 m below existing surface levels, and as such, it is possible that some surface material will require removal to achieve sufficient compaction of the deeper materials.

It is recommended that the site preparation is undertaken under the supervision of a geotechnical engineer.

7.2.1 Site Stripping

Prior to excavation of foundations or the placement of any filling, all deleterious material, including vegetation, topsoil and roots larger than 10 mm in diameter should be stripped and either removed from site or stockpiled for possible re-use as landscaping filling only.

Following stripping, it is recommended that the site is raked through to a depth of around 0.3 m to remove roots larger than 10 mm in diameter including grass tree roots. It is recommended that the geotechnical engineer supervises the early bulk earthworks.

7.2.2 Proof Rolling and Compaction

Dependent on the earthwork plant utilised by the contractor, it anticipated that some surface material will require removal to achieve sufficient compaction of the deeper material. Following excavation to the required level, it is recommended that subgrade is proof rolled with a heavy roller (minimum 10 tonne) under the supervision of a geotechnical engineer to observe the consistency of compaction and to identify additional zones of loose material, if any. Proof rolling across finished earthworks is also recommended, however the need for such work should be assessed by the geotechnical engineer at the time of the earthworks.

Any over excavated material is to be replaced in loose lift layer no greater than 300 mm in height. Each layer should be compacted to not less than 95% Modified Maximum Dry Density (MMDD). Particles greater than 150 mm in size should be removed from the filling.

Compaction control of natural sand at the site could be carried out using a PSP in accordance with test method AS 1289.6.3.3. All areas within the proposed building envelopes should be compacted to achieve a minimum resistance of 10 blows per 300 mm penetration to a depth of not less than 1.0 m below foundation level. In accordance with AS 1289, the use of PSP is limited to granular soils with a maximum particle size not exceeding 2 mm.

During construction, some loosening of the surface materials in foundation excavations is expected. Therefore the base of excavations may need to be re-compacted using a vibratory plate compactor, prior to construction of any footings. Confirmation of adequate compaction should be carried out as suggested above.

7.2.3 Excavation Conditions

Excavation rates are variable due to many factors including the operator ability, quality of equipment, consistency of ground conditions etc. Table 3 presents an estimate of the minimum plant requirements to excavate site conditions, based on DP experience and manufacture's information.

Table 3: Summary of Excavation Plant Requirements

Material	Strength Description	Point Load Strength $I_{s(50)}$ (MPa)	Recommended Plant Requirements
Topsoil	Soil	N/A	Elevator scrapers, graders and excavators.
Sand	Soil	N/A	Elevator scrapers, graders and excavators.
Limestone	Extremely low to very low strength	<0.1	Elevator scrapers, graders and excavators with toothed bucket.
Limestone	Low strength	0.1 to 0.3	Ripping with D9, excavation possible with 30 tonne excavator with toothed bucket.
Limestone	Medium strength	0.3 to 1.0	Heavy ripping with D9, excavation possible with 30 tonne excavator equipped with rock breaker or rock heel.
Limestone	High strength	1.0 to 3.0	Heavy ripping with D10 or D11.

7.2.4 Reuse of In-Situ Material

Topsoil – In general it is recommended that topsoil is reused in landscaped areas only. It may be possible to blend the topsoil with clean sand to generate a suitable filling. Blending is not typically considered for single lots. If blending is considered, a geotechnical engineer will need to carry out a site inspection and collect samples for laboratory testing.

Sand - Based on site observations and laboratory classification testing, excavated sand is considered suitable as a structural filling material.

Limestone – Generally limestone is considered suitable when it forms part of a well graded material with a maximum particle size of 150 mm. Larger particle size could be used in deep filling.

Ripping high strength limestone often results in the extraction of large boulders which are considered unsuitable for structural filling unless crushed down to a size less than 150 mm and mixed with sand to gain a well graded material. AS 3798 states that where ripped rock is used for filling a quantity of material coarser than 37.5 mm may exceed 20%, however testing of dry density relevant to AS 1289 is not applicable and therefore it is common to adopt a method specification. Geotechnical inspections are recommended during the placement and compaction of rocky material following a method specification.

Crushing of low strength rock can be carried out using a pad foot roller following placement. This method has limited success with rock stronger than low strength as larger strong boulders are pushed down into the subgrade instead of broken down, possibly resulting in differential compaction. Crushing under dozer tracks is generally effective for stronger limestone; alternatively a rock crusher can be used. All material greater than 150 mm in size should be removed from the filling.

Testing for compaction of rocky filling can be difficult, thus it is recommended that the geotechnical engineer carries out regular inspections during the placement of well graded rocky material. The aim of the inspections would be to observe the consistency of the works and materials. Inspections would not be a substitute for final testing, but is likely to reduce the quantity required.

7.2.5 Imported Filling

If required, it is recommended that imported filling comprises of free draining cohesionless well graded sand with;

- less than 5 % fines;
- less than 20% of material larger than 37.5 mm;
- containing no particles greater than 150 mm in size; and
- free of organic material and other deleterious material.

Materials from a quarry source should be supplied with laboratory test certificates. It is recommended that test certificates less than 3 months old are reviewed by the geotechnical engineer for approval, prior to importing to site. Materials from non-quarry sources should be stockpiled on site and inspected and approved by the geotechnical engineer before being incorporated into the filling. Laboratory testing may be required.

7.3 Foundation Design

Following suitable site preparation, shallow foundation systems comprising slab, pad and strip footings founded in compacted sand should be suitable to support the typical industrial structures.

As detailed in Section 7.2, AS 2870-2011 applies to single houses, townhouses and the like classified as Class 1 and 10a under the Building Code of Australia.

For buildings not covered by AS2870, a presumptive allowable bearing pressure of:

- 200 kPa is suggested for foundation design of strip footings up to 1.5 m wide; and
- 250 kPa for pad footings up to 2 m by 2 m,

when:

- founding on sand that is medium dense or denser or rock;
- founded at a minimum depth of 0.5 m;
- site preparation is carried out as outlined previously.

Immediate settlement is in the order of 10 mm is anticipated to occur during construction. Further long-term settlements are likely to be less than 5 mm.

Greater maximum allowable bearing pressure may be achievable at some locations and following site specific assessments for the proposed development.

Differential settlement can occur where ground conditions vary, such as compaction of sand, depth to limestone or strength of limestone. To reduce possible differential settlement, it is recommended that the base of footing excavations are scarified to at least 300 mm depth and then re-compacted.

7.4 Design Parameters for Earth Retaining Systems

It is recommended that batter slopes in sand be graded at less than 1.5:1 (H:V) for temporary slopes and 2:1 (H:V) for permanent slopes if not retained and protected against erosion. These batter angles are valid provided no load applies at the top of the slope. Any excavation that is adjacent to existing buildings or below the level of existing footings should be supported or the footings underpinned to a level below the influence of the excavation.

Design of temporary and permanent retaining structures should be based on an average bulk unit weight for the retained sand of 20 kN/m^3. In addition to the soil pressure, wall design should also allow for external loads such as buildings and traffic. Suitable design parameters are presented in Table 4.

Table 4: Summary of Retaining Wall Design Parameters

Ground Condition	Friction Angle (Degrees) Ø	Coefficient of Active Earth Pressure K_a	Coefficient of Earth Pressure at Rest K_0	Coefficient of Passive Pressure K_p
Compacted sand filling	34	0.28	0.45	3.5
Loose to medium dense sand	32	0.31	0.47	3.3

7.5 Pavement Design Parameters

Based on laboratory results from the July 2013 investigation, experience and knowledge of the local soils, it is recommended that a subgrade CBR value of 15% is used for design purposes for the natural and imported sand. This assumes that the sand subgrade is compacted to achieve a dry density ratio of not less than 95% of the MMDD, as determined by AS 1289.5.2.1. Pavement built on imported sand filling (other than sand excavated from site) should be designed for the CBR of the filling. A design CBR of 12% is suggested if the imported filling is Bassendean Sand.

7.6 Stormwater Disposal and Drainage

Estimated permeability values can also be assessed using grading results from the laboratory testing and Hazen's formula which applies to sand in a loose state. Results of the permeability analysis are summarised in Table 5.

Table 5: Summary of the Estimated Permeability Values

Test	Depth (m)	Soil Type	Fines (%)	d_{10} (mm)	d_{60} (mm)	Derived Permeability (m/s) [1]
TP102	0.5	SAND	2	0.16	0.31	2.6×10^{-4}

Notes: [1]: Hazen's method. '-' not tested

Limestone is generally considered impervious at small scale and thus on site stormwater disposal using soakwells might not be suitable in areas of shallow limestone. In many cases soakwells could be extended below the near surface limestone into lower sand deposits. Ground and groundwater conditions would need to be confirmed at the proposed soakwell locations.

A permeability value (k) of 1.0×10^{-4} m/s is recommended for the design of soakwells in medium dense sand. A value of 0.5×10^{-4} m/s is recommended in compacted sand

On-site stormwater disposal using soak wells and sumps is generally considered practical where suitable thickness of sand exists. The infiltration capability often reduces over time due to silt build up at the base of soakwells and therefore should be well maintained.

As a guide, it is recommended that soakwells are positioned at least:

- 5.0 m away from all buildings, retaining walls and boundaries; and
- 0.5 m above the surface or below the underside of limestone; and
- 0.5 m above groundwater.

7.7 Further Investigation

At this stage, the proposed development consists of industrial structures. The nature, geometry and magnitude of the proposed structures or other loads are unknown at this stage. Detailed geotechnical investigations for specific structures will possibly be warranted.

8. Acid Sulphate Soil Evaluation

Previous sampling and laboratory testing across the larger RIZ area which includes Stage 1, indicates that the risk of acid sulphate soils to a depth of 3.0 m below the existing surface level is low. This is consistent with the level of risk as indicated by the published risk mapping and the published geological information which shows ground conditions of Safety Bay Sands.

Further detailed investigation for acid sulphate soils may be required for the following:

- satisfy a development condition in relation to investigation and management of acid sulphate soils;
- excavations of greater than 3.0 m depth; or
- dewatering for construction is proposed.

9. References

1. Australian Standard AS 1289-2000, Methods of Testing Soils for Engineering Purposes.
2. Australian Standard AS 1289.6.3.3-1999, Soil Strength and Consolidation Tests-Determination of the Penetration Resistance of a Soil – Perth Sand Penetrometer Test.
3. Australian Standard AS 1726-1996, Geotechnical Site Investigation.
4. Australian Standard AS 2870-2011, Residential Slabs and Footings
5. Australian Standard AS 798-2007, Guidelines on earthworks for commercial and residential developments.
6. Department of Environment, Perth Groundwater Atlas, Second Edition, December 2004.
7. Department of Environment and Conservation (2013) Identification and Investigation of Acid Sulphate Soils

10. Limitations

Douglas Partners (DP) has prepared this report for Lot 2, Stage 1 of the Rockingham Industrial Zone, in accordance with DP's proposal dated 7 January 2014 and acceptance received from LandCorp on 15 January 2014. The report is provided for the exclusive use of LandCorp and the prospective buyer of Lot 2 and for the purposes described in the report. In preparing this report DP has necessarily relied upon information provided by the client and/or their agents.

The results provided in the report are indicative of the sub-surface conditions only at the specific sampling or testing locations, and then only to the depths investigated and at the time the work was carried out. Sub-surface conditions can change abruptly due to variable geological processes and also as a result of anthropogenic influences. Such changes may occur after DP's field testing has been completed.

DP's advice is based upon the conditions encountered during this investigation. The accuracy of the advice provided by DP in this report may be limited by undetected variations in ground conditions between sampling locations.

This report must be read in conjunction with all of the attached notes and should be kept in its entirety without separation of individual pages or sections. DP cannot be held responsible for interpretations or conclusions made by others unless they are supported by an expressed statement, interpretation, outcome or conclusion given in this report.

This report, or sections from this report, should not be used as part of a specification for a project, without review and agreement by DP. This is because this report has been written as advice and opinion rather than instructions for construction.

The contents of this report do not constitute formal design components such as are required, by the Health and Safety Legislation and Regulations, to be included in a Safety Report specifying the hazards likely to be encountered during construction and the controls required to mitigate risk. This design process requires risk assessment to be undertaken, with such assessment being dependent upon factors relating to likelihood of occurrence and consequences of damage to property and to life. This, in turn, requires project data and analysis presently beyond the knowledge and project role respectively of DP. DP may be able, however, to assist the client in carrying out a risk assessment of potential hazards contained in the Comments section of this report, as an extension to the current scope of works, if so requested, and provided that suitable additional information is made available to DP. Any such risk assessment would, however, be necessarily restricted to the geotechnical components set out in this report and to their application by the project designers to project design, construction, maintenance and demolition.

Douglas Partners Pty Ltd

Appendix A

About this Report
Drawing

About this Report

Douglas Partners

Introduction

These notes have been provided to amplify DP's report in regard to classification methods, field procedures and the comments section. Not all are necessarily relevant to all reports.

DP's reports are based on information gained from limited subsurface excavations and sampling, supplemented by knowledge of local geology and experience. For this reason, they must be regarded as interpretive rather than factual documents, limited to some extent by the scope of information on which they rely.

Copyright

Borehole and Test Pit Logs

The borehole and test pit logs presented in this report are an engineering and/or geological interpretation of the subsurface conditions, and their reliability will depend to some extent on frequency of sampling and the method of drilling or excavation. Ideally, continuous undisturbed sampling or core drilling will provide the most reliable assessment, but this is not always practicable or possible to justify on economic grounds. In any case the boreholes and test pits represent only a very small sample of the total subsurface profile.

Interpretation of the information and its application to design and construction should therefore take into account the spacing of boreholes or pits, the frequency of sampling, and the possibility of other than 'straight line' variations between the test locations.

Groundwater

Where groundwater levels are measured in boreholes there are several potential problems, namely:

- In low permeability soils groundwater may enter the hole very slowly or perhaps not at all during the time the hole is left open;
- A localised, perched water table may lead to an erroneous indication of the true water table;
- Water table levels will vary from time to time with seasons or recent weather changes. They may not be the same at the time of construction as are indicated in the report; and
- The use of water or mud as a drilling fluid will mask any groundwater inflow. Water has to be blown out of the hole and drilling mud must first be washed out of the hole if water measurements are to be made.

More reliable measurements can be made by installing standpipes which are read at intervals over several days, or perhaps weeks for low permeability soils. Piezometers, sealed in a particular stratum, may be advisable in low permeability soils or where there may be interference from a perched water table.

Reports

The report has been prepared by qualified personnel, is based on the information obtained from field and laboratory testing, and has been undertaken to current engineering standards of interpretation and analysis. Where the report has been prepared for a specific design proposal, the information and interpretation may not be relevant if the design proposal is changed. If this happens, DP will be pleased to review the report and the sufficiency of the investigation work.

Every care is taken with the report as it relates to interpretation of subsurface conditions, discussion of geotechnical and environmental aspects, and recommendations or suggestions for design and construction. However, DP cannot always anticipate or assume responsibility for:

- Unexpected variations in ground conditions. The potential for this will depend partly on borehole or pit spacing and sampling frequency;
- Changes in policy or interpretations of policy by statutory authorities; or
- The actions of contractors responding to commercial pressures.

If these occur, DP will be pleased to assist with investigations or advice to resolve the matter.

About this Report

Site Anomalies

In the event that conditions encountered on site during construction appear to vary from those which were expected from the information contained in the report, DP requests that it be immediately notified. Most problems are much more readily resolved when conditions are exposed rather than at some later stage, well after the event.

Information for Contractual Purposes

Where information obtained from this report is provided for tendering purposes, it is recommended that all information, including the written report and discussion, be made available. In circumstances where the discussion or comments section is not relevant to the contractual situation, it may be appropriate to prepare a specially edited document. DP would be pleased to assist in this regard and/or to make additional report copies available for contract purposes at a nominal charge.

Site Inspection

The company will always be pleased to provide engineering inspection services for geotechnical and environmental aspects of work to which this report is related. This could range from a site visit to confirm that conditions exposed are as expected, to full time engineering presence on site.

Rock Descriptions

Douglas Partners

Rock Strength

Rock strength is defined by the Point Load Strength Index ($Is_{(50)}$) and refers to the strength of the rock substance and not the strength of the overall rock mass, which may be considerably weaker due to defects. The test procedure is described by Australian Standard 4133.4.1 - 1993. The terms used to describe rock strength are as follows:

Term	Abbreviation	Point Load Index $Is_{(50)}$ MPa	Approx Unconfined Compressive Strength MPa*
Extremely low	EL	<0.03	<0.6
Very low	VL	0.03 - 0.1	0.6 - 2
Low	L	0.1 - 0.3	2 - 6
Medium	M	0.3 - 1.0	6 - 20
High	H	1 - 3	20 - 60
Very high	VH	3 - 10	60 - 200
Extremely high	EH	>10	>200

* Assumes a ratio of 20:1 for UCS to $Is_{(50)}$

Degree of Weathering

The degree of weathering of rock is classified as follows:

Term	Abbreviation	Description
Extremely weathered	EW	Rock substance has soil properties, i.e. it can be remoulded and classified as a soil but the texture of the original rock is still evident.
Highly weathered	HW	Limonite staining or bleaching affects whole of rock substance and other signs of decomposition are evident. Porosity and strength may be altered as a result of iron leaching or deposition. Colour and strength of original fresh rock is not recognisable
Moderately weathered	MW	Staining and discolouration of rock substance has taken place
Slightly weathered	SW	Rock substance is slightly discoloured but shows little or no change of strength from fresh rock
Fresh stained	Fs	Rock substance unaffected by weathering but staining visible along defects
Fresh	Fr	No signs of decomposition or staining

Degree of Fracturing

The following classification applies to the spacing of natural fractures in diamond drill cores. It includes bedding plane partings, joints and other defects, but excludes drilling breaks.

Term	Description
Fragmented	Fragments of <20 mm
Highly Fractured	Core lengths of 20-40 mm with some fragments
Fractured	Core lengths of 40-200 mm with some shorter and longer sections
Slightly Fractured	Core lengths of 200-1000 mm with some shorter and loner sections
Unbroken	Core lengths mostly > 1000 mm

Rock Descriptions

Rock Quality Designation

The quality of the cored rock can be measured using the Rock Quality Designation (RQD) index, defined as:

$$\text{RQD \%} = \frac{\text{cumulative length of 'sound' core sections} \geq \text{100 mm long}}{\text{total drilled length of section being assessed}}$$

where 'sound' rock is assessed to be rock of low strength or better. The RQD applies only to natural fractures. If the core is broken by drilling or handling (i.e. drilling breaks) then the broken pieces are fitted back together and are not included in the calculation of RQD.

Stratification Spacing

For sedimentary rocks the following terms may be used to describe the spacing of bedding partings:

Term	Separation of Stratification Planes
Thinly laminated	< 6 mm
Laminated	6 mm to 20 mm
Very thinly bedded	20 mm to 60 mm
Thinly bedded	60 mm to 0.2 m
Medium bedded	0.2 m to 0.6 m
Thickly bedded	0.6 m to 2 m
Very thickly bedded	> 2 m

Soil Descriptions

Douglas Partners

Description and Classification Methods

The methods of description and classification of soils and rocks used in this report are based on Australian Standard AS 1726, Geotechnical Site Investigations Code. In general, the descriptions include strength or density, colour, structure, soil or rock type and inclusions.

Soil Types

Soil types are described according to the predominant particle size, qualified by the grading of other particles present:

Type	Particle size (mm)
Boulder	>200
Cobble	63 - 200
Gravel	2.36 - 63
Sand	0.075 - 2.36
Silt	0.002 - 0.075
Clay	<0.002

The sand and gravel sizes can be further subdivided as follows:

Type	Particle size (mm)
Coarse gravel	20 - 63
Medium gravel	6 - 20
Fine gravel	2.36 - 6
Coarse sand	0.6 - 2.36
Medium sand	0.2 - 0.6
Fine sand	0.075 - 0.2

The proportions of secondary constituents of soils are described as:

Term	Proportion	Example
And	Specify	Clay (60%) and Sand (40%)
Adjective	20 - 35%	Sandy Clay
Slightly	12 - 20%	Slightly Sandy Clay
With some	5 - 12%	Clay with some sand
With a trace of	0 - 5%	Clay with a trace of sand

Definitions of grading terms used are:

- Well graded - a good representation of all particle sizes
- Poorly graded - an excess or deficiency of particular sizes within the specified range
- Uniformly graded - an excess of a particular particle size
- Gap graded - a deficiency of a particular particle size with the range

Cohesive Soils

Cohesive soils, such as clays, are classified on the basis of undrained shear strength. The strength may be measured by laboratory testing, or estimated by field tests or engineering examination. The strength terms are defined as follows:

Description	Abbreviation	Undrained shear strength (kPa)
Very soft	vs	<12
Soft	s	12 - 25
Firm	f	25 - 50
Stiff	st	50 - 100
Very stiff	vst	100 - 200
Hard	h	>200

Cohesionless Soils

Cohesionless soils, such as clean sands, are classified on the basis of relative density, generally from the results of standard penetration tests (SPT), cone penetration tests (CPT) or dynamic penetrometers (PSP). The relative density terms are given below:

Relative Density	Abbreviation	SPT N value	CPT qc value (MPa)
Very loose	vl	<4	<2
Loose	l	4 - 10	2 -5
Medium dense	md	10 - 30	5 - 15
Dense	d	30 - 50	15 - 25
Very dense	vd	>50	>25

Soil Descriptions

Soil Origin

It is often difficult to accurately determine the origin of a soil. Soils can generally be classified as:

- Residual soil - derived from in-situ weathering of the underlying rock;
- Transported soils - formed somewhere else and transported by nature to the site; or
- Filling - moved by man.

Transported soils may be further subdivided into:

- Alluvium - river deposits
- Lacustrine - lake deposits
- Aeolian - wind deposits
- Littoral - beach deposits
- Estuarine - tidal river deposits
- Talus - scree or coarse colluvium
- Slopewash or Colluvium - transported downslope by gravity assisted by water. Often includes angular rock fragments and boulders.

Symbols & Abbreviations

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Introduction

These notes summarise abbreviations commonly used on borehole logs and test pit reports.

Drilling or Excavation Methods

C	Core Drilling
R	Rotary drilling
SFA	Spiral flight augers
NMLC	Diamond core - 52 mm dia
NQ	Diamond core - 47 mm dia
HQ	Diamond core - 63 mm dia
PQ	Diamond core - 81 mm dia

Water

▷	Water seep
▽	Water level

Sampling and Testing

A	Auger sample
B	Bulk sample
D	Disturbed sample
E	Environmental sample
U_{50}	Undisturbed tube sample (50mm)
W	Water sample
pp	pocket penetrometer (kPa)
PID	Photo ionisation detector
PL	Point load strength Is(50) MPa
S	Standard Penetration Test
V	Shear vane (kPa)

Description of Defects in Rock

The abbreviated descriptions of the defects should be in the following order: Depth, Type, Orientation, Coating, Shape, Roughness and Other. Drilling and handling breaks are not usually included on the logs.

Defect Type

B	Bedding plane
Cs	Clay seam
Cv	Cleavage
Cz	Crushed zone
Ds	Decomposed seam
F	Fault
J	Joint
Lam	lamination
Pt	Parting
Sz	Sheared Zone
V	Vein

Orientation

The inclination of defects is always measured from the perpendicular to the core axis.

h	horizontal
v	vertical
sh	sub-horizontal
sv	sub-vertical

Coating or Infilling Term

cln	clean
co	coating
he	healed
inf	infilled
stn	stained
ti	tight
vn	veneer

Coating Descriptor

ca	calcite
cbs	carbonaceous
cly	clay
fe	iron oxide
mn	manganese
slt	silty

Shape

cu	curved
ir	irregular
pl	planar
st	stepped
un	undulating

Roughness

po	polished
ro	rough
sl	slickensided
sm	smooth
vr	very rough

Other

fg	fragmented
bnd	band
qtz	quartz

Symbols & Abbreviations

Graphic Symbols for Soil and Rock

General


Asphalt


Road base


Concrete


Filling

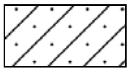
Soils


Topsoil

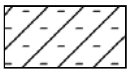

Peat


Clay

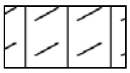

Silty clay

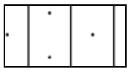

Sandy clay

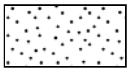

Gravelly clay

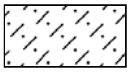

Shaly clay

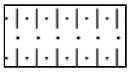

Silt


Clayey silt


Sandy silt


Sand

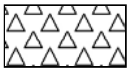

Clayey sand


Silty sand


Gravel


Sandy gravel


Cobbles, boulders

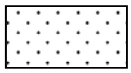

Talus

Sedimentary Rocks

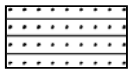

Boulder conglomerate

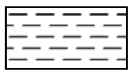

Conglomerate


Conglomeratic sandstone

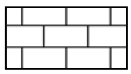

Sandstone


Siltstone


Laminite

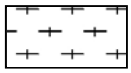

Mudstone, claystone, shale

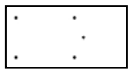

Coal


Limestone

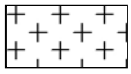
Metamorphic Rocks

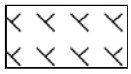

Slate, phyllite, schist

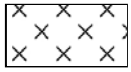

Gneiss

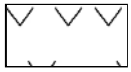

Quartzite

Igneous Rocks

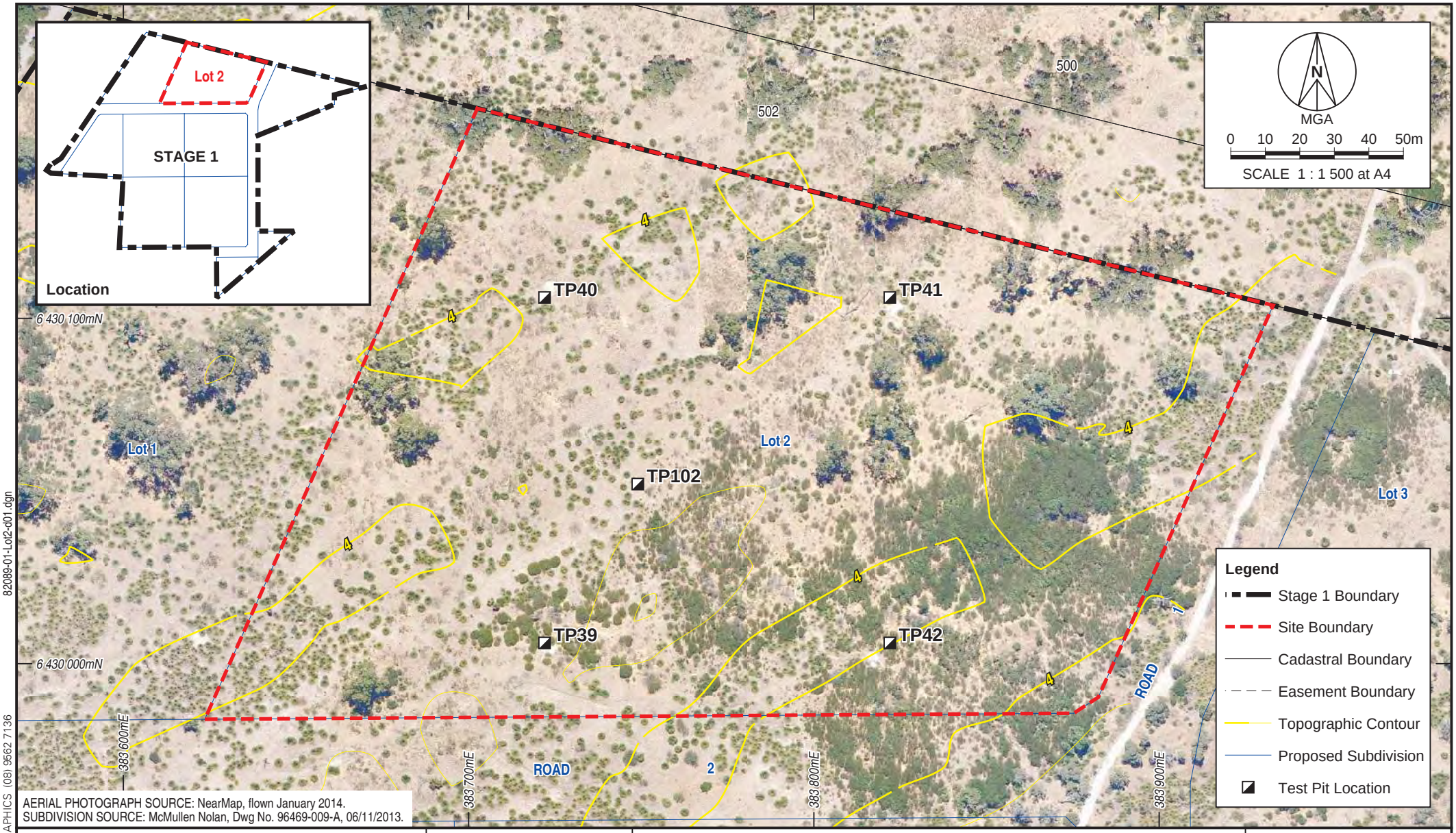

Granite


Dolerite, basalt, andesite


Dacite, epidote


Tuff, breccia


Porphyry



AERIAL PHOTOGRAPH SOURCE: NearMap, flown January 2014.
SUBDIVISION SOURCE: McMullen Nolan, Dwg No. 96469-009-A, 06/11/2013.

82089-01-Lot2-d01.dgn

PINPOINT CARTOGRAPHICS (08) 9562 7136

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Geotechnics / Environment / Groundwater

CLIENT: LandCorp	**Location of Tests - Lot 2** **Rockingham Industrial Zone** **Stage 1**	PROJECT No.: 82089.01
OFFICE: Perth		DRAWING No.: 1
DATE: 17 Feb 2014		REVISION: A

Appendix B

Results of Field Work

TEST PIT LOG

CLIENT: LandCorp
PROJECT: Rockingham Industrial Zone
LOCATION: Rockingham

SURFACE LEVEL: 4.4 m AHD*
EASTING: 383722
NORTHING: 6430006

PIT No: TP039
PROJECT No: 82089
DATE: 6/6/2013
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
	0.25	TOPSOIL - brown, sandy topsoil with some rootlets.							
		SAND - loose, light yellow, fine to medium grained, sand with a trace of silt, dry to moist.							
		-becoming medium dense from 1.05 m.		D	1.6				
	1.8	LIMESTONE - very low to low strength, light yellow, limestone.							
	2.2	SAND - light yellow, fine to medium grained, sand with a trace of silt, dry to moist.							
	3.0	Pit discontinued at 3.0m (Target)							

Dynamic Penetrometer Test (blows per 150mm): 5, 10, 15, 20

RIG: Yanmar 5 tonne excavator with a 600 mm toothed bucket

LOGGED: D Rubenis

SURVEY DATUM: MGA94 Zone 50

WATER OBSERVATIONS: No free groundwater observed.

REMARKS: *Surface level interpolated from a survey plan produced by McMullen Nolan.

☒ Sand Penetrometer AS1289.6.3.3
☐ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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TEST PIT LOG

CLIENT: LandCorp
PROJECT: Rockingham Industrial Zone
LOCATION: Rockingham

SURFACE LEVEL: 4.0 m AHD*
EASTING: 383722
NORTHING: 6430106

PIT No: TP040
PROJECT No: 82089
DATE: 6/6/2013
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
4		TOPSOIL - brown, sandy topsoil with some rootlets.							
	0.2	SAND - loose to medium dense, grey-brown, fine to medium grained, sand with a trace of silt, dry to moist.							
	0.4	LIMESTONE - low strength, light yellow, limestone.		D	0.6		PL(A) = 0.16 MPa		
3	1								1
	1.5	SAND - light yellow, fine to medium grained, sand with a trace of silt, dry to moist.							
2	2								2
1	3	3.0 Pit discontinued at 3.0m (Target)							3

Dynamic Penetrometer Test (blows per 150mm): 5, 10, 15, 20

RIG: Yanmar 5 tonne excavator with a 600 mm toothed bucket

LOGGED: D Rubenis

SURVEY DATUM: MGA94 Zone 50

WATER OBSERVATIONS: No free groundwater observed.

REMARKS: *Surface level interpolated from a survey plan produced by McMullen Nolan.

☒ Sand Penetrometer AS1289.6.3.3
☐ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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TEST PIT LOG

CLIENT: LandCorp
PROJECT: Rockingham Industrial Zone
LOCATION: Rockingham

SURFACE LEVEL: 4.2 m AHD*
EASTING: 383822
NORTHING: 6430106

PIT No: TP041
PROJECT No: 82089
DATE: 6/6/2013
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
4	0.25	TOPSOIL - brown, sandy topsoil with some rootlets.							
		SAND - Loose, light yellow, fine to medium grained, sand with a trace of silt, dry to moist.							
		-becoming medium dense from 0.75 m.							
3	1.1	LIMESTONE - low strength, light yellow, limestone.							
2	2.0	SAND - light yellow, fine to medium grained, sand with a trace of silt, dry to moist.							
1	3.0	Pit discontinued at 3.0m (Target)							

Dynamic Penetrometer Test (blows per 150mm): 5, 10, 15, 20

RIG: Yanmar 5 tonne excavator with a 600 mm toothed bucket

LOGGED: D Rubenis

SURVEY DATUM: MGA94 Zone 50

WATER OBSERVATIONS: No free groundwater observed.

REMARKS: *Surface level interpolated from a survey plan produced by McMullen Nolan.

☒ Sand Penetrometer AS1289.6.3.3
☐ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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Geotechnics | Environment | Groundwater

TEST PIT LOG

CLIENT: LandCorp
PROJECT: Rockingham Industrial Zone
LOCATION: Rockingham

SURFACE LEVEL: 4.0 m AHD*
EASTING: 383822
NORTHING: 6430006

PIT No: TP042
PROJECT No: 82089
DATE: 6/6/2013
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
4		TOPSOIL - brown, sandy topsoil with some rootlets.							
	0.2	SAND - loose to medium dense, light yellow, fine to medium grained, sand with a trace of silt, dry to moist.							
	0.9	LIMESTONE - low strength, light yellow to white, limestone.		D	1.0				
3	1								1
	1.45	SAND - light yellow, fine to medium grained, sand with a trace of silt, dry to moist.							
2	2								2
	3.0	Pit discontinued at 3.0m (Target)							3
1	3								

Dynamic Penetrometer Test (blows per 150mm): 5, 10, 15, 20

RIG: Yanmar 5 tonne excavator with a 600 mm toothed bucket

LOGGED: D Rubenis

SURVEY DATUM: MGA94 Zone 50

WATER OBSERVATIONS: No free groundwater observed.

REMARKS: *Surface level interpolated from a survey plan produced by McMullen Nolan.

☒ Sand Penetrometer AS1289.6.3.3
☐ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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Geotechnics | Environment | Groundwater

TEST PIT LOG

CLIENT: Landcorp
PROJECT: Rockingham Industrial Zone Stage 1
LOCATION: East Rockingham

SURFACE LEVEL: 4.3 m AHD*
EASTING:
NORTHING:

PIT No: TP102
PROJECT No: 82089.01
DATE: 23/1/2014
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
	0.1	TOPSOIL - grey, fine to medium grained, sandy topsoil with some silt and rootlets, dry.							
		SAND - medium dense, grey, fine to medium grained sand with some silt, dry. Roots observed to 1.2 m depth.		D	0.5				
	1.2	LIMESTONE - low strength, light grey-white, limestone, dry.							
		- becoming medium strength from 1.4 m depth.							
	1.5	Pit discontinued at 1.5m (refusal on medium strength limestone (estimated strength))		D	1.5		Rock sample		

RIG: 6 tonne excavator with 650 mm toothed bucket

LOGGED: DJB

SURVEY DATUM: MGA94

WATER OBSERVATIONS: No free groundwater observed.

REMARKS:

☒ Sand Penetrometer AS1289.6.3.3
☐ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	⧗	Water level	V	Shear vane (kPa)

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Geotechnics | Environment | Groundwater

Appendix C

Laboratory Results

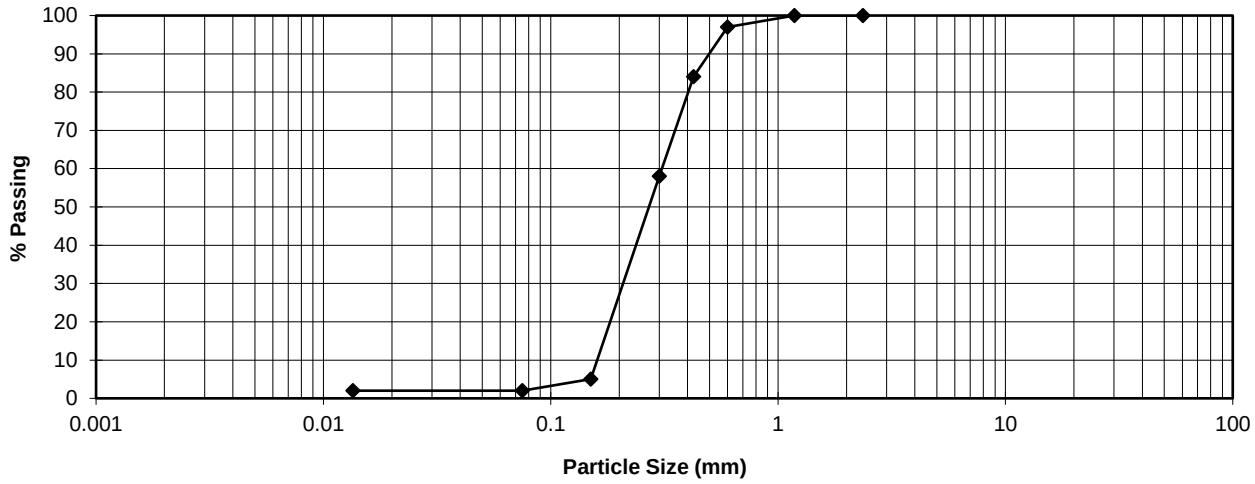
Particle Size Distribution & Plasticity Index tests

Mining &
Civil
Geotest Pty Ltd
unit1/1 Pusey Road, Jandakot, WA 6164
Ph (08) 9414 8022 Fax (08) 9414 8011
Email: matt@mcgeotest.com.au

Job No:	60017
Report No:	60017-P14/257
Sample No:	P14/257
Issue Date:	3 Febuary 2014

Client: Landcorp
Project: Rockingham Industrial Zone Stage 1
Location: East Rockingham

Sample location: TP102
Sample Depth: 0.50



SIEVE ANALYSIS WA 115.1

Sieve Size (mm)	% Passing
75.0	
37.5	
19.0	
9.5	
4.75	
2.36	100
1.18	100
0.600	97
0.425	84
0.300	58
0.150	5
0.075	2
0.0135	2

Plasticity index tests
AS 1289

Liquid limit 3.1.1	na	%
Plastic limit 3.2.1		%
Plasticity index 3.3.1		%
Linear shrinkage 3.4.1		%

Cracked ☐
Curled ☐

Client Address: 36 O'Malley Street, Osborne Park

Sampling Procedure: Tested as received

Approved signature

Matthew van Herk
AS PSDPI May 2009

APPENDIX C CALCULATIONS

EcoGraf Ltd
EcoGraf Processing Facility
Document Number: EPF-12332-CI-CAL-001
Drainage Calculations

Document History and Status

Date	Date issued	Reviewed by	Approved by	Revision	Revision type
8-Oct-21	8-Oct-21	RS	GR	A	Issued for Information
20-Nov-21	21-Nov-21	RS	GR	B	Issued for Information
12-Dec-21	14-Dec-21	RS	GR	C	Issued for Information

Document Information

Document Name: Drainage Calculations
Report author: R Sceresini
Project manager: Greg Rix
Client name: EcoGraf Ltd
Project name: EcoGraf Processing Facility
Document Number: EPF-12332-CI-CAL-001
Revision: C
Project number: 12332.J

EcoGraf Ltd
EcoGraf Processing Facility
Document Number: EPF-12332-CI-CAL-001
Drainage Calculations

Table of Contents

EcoGraf Ltd
EcoGraf Processing Facility
Document Number: EPF-12332-CI-CAL-001
Drainage Calculations

Item Number	Description
1	EcoGraf Processing Facility Detention Basin Calculations (20211212)
1.a	a) 1% AEP
1.b	b) 10% AEP
1.c	c) 20% AEP
1.d	d) 63.2% AEP

Development Engineering Consultants - Drainage Basin Spreadsheet

Client: EcoGraf
Location: At-lot detention calculations to establish runoff coefficient - commercial-type site
Designer: RSS
Condition: *• Where the sump is located at the catchment low point, storage capacity should reflect the volume generated by 1% AEP*

Data to be Input

Rainfall AEP (Percentage)	1
1EY Impervious Catchment (Ha)	**2.06**
Required Storage (1 in 1 YR 1 HR) (m3)	207.6
Available Storage (m3)	
Permeability	0.00026 m/s
Soakage rate (l/s/m2)	0.0200 1.73 m/day

Catchment Details	**Paved**	**Unpaved**	**Basin Area**	**Total**	
Gross Catchment Area	20402.74	14947.26	2230	37580	
Gross Catchment Area (Ha)	**2.040274**	**1.494726**	**0.223**	**3.758**	
Run-Off Co-efficient(C10)	0.9	0	1		
ARI Multiplier	1	0.95	1		
Run-Off Co-efficient(Cy)	0.9	0	1		**Effective C**
Impervious Area(Ha)	**1.84**	**0**	**0.223**	**2.06**	**0.55**

Basin Dimensions	Main EP			Small EP	
	Top	Base			
Base L	65.0	50	m	20	m
Base W	28.0	20	m	40	m

Tc (mins)	**Tc (hrs)**	**I (mm/hr) *1% AEP***	**Q_{IN} (L/s)**	**Total V_{IN} (m3)**	**Preliminary Height (m)**	**Q_{OUT} (soakage) (L/s)**	**Effective Continuing Loss (mm/hr)**	**V_{OUT} (soakage) (m3)**	**Net storage (after soakage) (m3)**	**Time of Water in Basin (hrs)**	
10	0.17	130	744	446		36.000	3.45	22	425	3.4	
15	0.25	104	595	535		36.000	3.45	32	503	4.1	
20	0.33	88	503	604		36.000	3.45	43	561	4.7	
30	0.50	68.3	391	703		36.000	3.45	65	638	5.4	
45	0.75	52.7	301	814		36.000	3.45	97	717	6.3	
60	1.00	43.9	251	904		36.000	3.45	130	774	7.0	
90	1.50	34.1	195	1053		36.000	3.45	194	859	8.1	
120	2.00	28.6	164	1178		36.000	3.45	259	919	9.1	
180	3.00	22.5	129	1390		36.000	3.45	389	1001	10.7	
270	4.50	17.8	102	1649		36.000	3.45	583	1066	12.7	
360	6.00	15	86	1853		36.000	3.45	778	1076	14.3	
540	9.00	11.7	67	2168		36.000	3.45	1166	1002	16.7	
720	12.00	9.68	55	2392		36.000	3.45	1555	837	18.5	
1080	18.00	7.27	42	2695		36.000	3.45	2333	362	20.8	
1440	24.00	5.82	33	2876		36.000	3.45	3110	-234	22.2	
2160	36.00	4.16	24	3084		36.000	3.45	4666	-1582	23.8	
2880	48.00	3.23	18	3193		36.000	3.45	6221	-3028	24.6	
4320	72.00	2.25	13	3336		36.000	3.45	9331	-5995	25.7	
5760	96.00	1.76	10	3479		36.000	3.45	12442	-8962	26.8	

Frequent Events must completely empty within 12 hours

1EY		63.20%									
60	1.00	18.4	105	379		36.000	3.45	130	249	2.92	63.2% AEP 1hr storm will be contained onsite
Frequent Events must completely empty within 12 hours										Compliant - less than 12 hours	

TWL (mAHD)	**Height**	**A (TWL)**	**Average Area**	**Vol (m3)**	**Treatment Storage (above LWL)**	**Detention Stoage (above LWL)**	**The Designated Height allows Storage for**	**AEP**	
0	0	4200		0	0	0	Static Water Level	Static Water Level	
1	0.4	4757		218	218	0	1 in 1 yr 1 hour	63.20%	
1.4	0.5	5215		378	378	160	1 in 1 yr	63.20%	24hr
1.9	0.6	6225		1530	1530	1312	5 year storage	20%	24hr
2.5	1.5	6866		1805	1805	1587	10 year storage	10%	24hr
4	2	7885		2875	2875	2657	100 year storage	1%	24hr

Development Engineering Consultants - Drainage Basin Spreadsheet

Client: EcoGraf
Location: At-lot detention calculations to establish runoff coefficient - commercial-type site
Designer: RSS

Data to be Input

Rainfall AEP (Percentage)	10	
1EY Impervious Catchment (Ha)	**2.06**	
Required Storage (1 in 1 YR 1 HR) (m3)	379	
Available Storage (m3)	218	
Permeability	0.00026	m/s
Soakage rate (l/s/m2)	0.0200	1.73 m/day

Catchment Details	**Paved**	**Unpaved**	**Basin Area**	**Total**	
Gross Catchment Area	20402.74	14947.26	2230	37580	
Gross Catchment Area (Ha)	**2.040274**	**1.494726**	**0.223**	**3.758**	
Run-Off Co-efficient(C10)	0.9	0	1		
ARI Multiplier	1	0.95	1		
Run-Off Co-efficient(Cy)	0.9	0	1		**Effective C**
Impervious Area(Ha)	**1.84**	**0**	**0.223**	**2.06**	**0.55**

Basin Dimensi	Main EP	Small EP
Base L	50.0 m	20.0 m
Base W	20.0 m	40.0 m

Tc (mins)	Tc (hrs)	I (mm/hr) *10% AEP*	Q_{IN} (L/s)	Total V_{IN} (m3)	Preliminary Height (m)	Q_{OUT} (soakage) (L/s)	Effective Continuing Loss (mm/hr)	V_{OUT} (soakage) (m3)	Net storage (after soakage) (m3)	Time of Water in Basin (hrs)	
10	0.17	87.9	503	302		36.000	3.45	22	280	2.3	
15	0.25	70.7	404	364		36.000	3.45	32	332	2.8	
20	0.33	59.8	342	410		36.000	3.45	43	367	3.2	
30	0.50	46.5	266	479		36.000	3.45	65	414	3.7	All frequent event storages must be designed to completely emply, following the cessation of rainfall, within 12 hrs. This is consistent with the criteria specified in Engineers Australia (2006).
45	0.75	35.9	205	554		36.000	3.45	97	457	4.3	
60	1.00	29.8	170	614		36.000	3.45	130	484	4.7	
90	1.50	22.9	131	707		36.000	3.45	194	513	5.5	
120	2.00	19	109	783		36.000	3.45	259	523	6.0	*Frequent event range from Tc of 10 minutes to 9 hours for this event - deemed acceptable*.
180	3.00	14.7	84	908		36.000	3.45	389	519	7.0	
270	4.50	11.4	65	1056		36.000	3.45	583	473	8.2	
360	6.00	9.48	54	1171		36.000	3.45	778	394	9.0	
540	9.00	7.29	42	1351		36.000	3.45	1166	185	10.4	
720	12.00	6.01	34	1485		36.000	3.45	1555	-70	11.5	
1080	18.00	4.52	26	1675		36.000	3.45	2333	-657	12.9	
1440	24.00	3.66	21	1809		36.000	3.45	3110	-1302	14.0	
2160	36.00	2.68	15	1987		36.000	3.45	4666	-2679	15.3	Minor Events for the 20% and 10% AEP for 36 hours and 48 hours (completely empty)
2880	48.00	2.14	12	2115		36.000	3.45	6221	-4106	16.3	Minor Events for the 20% and 10% AEP for 36 hours and 48 hours (completely empty)
4320	72.00	1.55	9	2298		36.000	3.45	9331	-7033	17.7	

Frequent Events must completely empty within 12 hours

1EY		63.20%									
60	1.00	18.4	105	379		36.000	3.45	130	249	2.92	63.2% AEP 1hr storm will be contained onsite.
Frequent Events must completely empty within 12 hours										Compliant - less than 12 hours	

Basin Dimensions

Base L	70.0
Base W	60.0
R.L. Base	2.2

TWL (mAHD)	Height	A (TWL)	Average Area	Vol (m3)	Treatment Storage (above LWL)	Detention Stoage (above LWL)	The Designated Height allows Storage for	AEP	
0	0	4200		0	0	0	Static Water Level	Static Water Level	
1	0.4	4757		218	218	0	1 in 1 yr 1 hour	63.20%	
1.4	0.5	5215		378	378	160	1 in 1 yr	63.20%	24hr
1.9	0.6	6225		1530	1530	1312	5 year storage	20%	24hr
2.5	1.5	6866		1805	1805	1587	10 year storage	10%	24hr
4	2	7885		2875	2875	2657	100 year storage	1%	24hr

Development Engineering Consultants - Drainage Basin Spreadsheet

Client: EcoGraf
Location: At-lot detention calculations to establish runoff coefficient - commercial-type site
Designer: RSS

Data to be Input

Rainfall AEP (Percentage)	20	
1EY Impervious Catchment (Ha)	**2.06**	
Required Storage (1 in 1 YR 1 HR) (m3)	207.6	
Available Storage (m3)	5950.0	
Permeability	0.00026	m/s
Soakage rate (l/s/m2)	0.0200	1.73 m/day

Catchment Details	**Paved**	**Unpaved**	**Basin Area**	**Total**	
Gross Catchment Area	20402.74	14947.26	2230	37580	
Gross Catchment Area (Ha)	**2.040274**	**1.494726**	**0.223**	**3.758**	
Run-Off Co-efficient(C10)	0.9	0	1		
ARI Multiplier	1	0.95	1		
Run-Off Co-efficient(Cy)	0.9	0	1		**Effective C**
Impervious Area(Ha)	**1.84**	**0**	**0.223**	**2.06**	**0.55**

Basin Dimensio	Main EP	Small EP
Base L	50.0 m	20.0 m
Base W	20.0 m	40.0 m

Tc (mins)	Tc (hrs)	I (mm/hr) *20% AEP*	Q_{IN} (L/s)	Total V_{IN} (m3)	Preliminary Height (m)	Q_{OUT} (soakage) (L/s)	Effective Continuing Loss (mm/hr)	V_{OUT} (soakage) (m3)	Net storage (after soakage) (m3)	Time of Water in Basin (hrs)	
10	0.17	75.7	433	260		36.000	3.45	22	238	2.0	
15	0.25	60.9	348	314		36.000	3.45	32	281	2.4	
20	0.33	51.5	295	354		36.000	3.45	43	310	2.7	
30	0.50	40.2	230	414		36.000	3.45	65	349	3.2	
45	0.75	31	177	479		36.000	3.45	97	382	3.7	
60	1.00	25.7	147	529		36.000	3.45	130	400	4.1	
90	1.50	19.8	113	612		36.000	3.45	194	417	4.7	
120	2.00	16.4	94	675		36.000	3.45	259	416	5.2	
180	3.00	12.6	72	778		36.000	3.45	389	390	6.0	
270	4.50	9.74	56	903		36.000	3.45	583	319	7.0	
360	6.00	8.09	46	1000		36.000	3.45	778	222	7.7	
540	9.00	6.19	35	1147		36.000	3.45	1166	-19	8.9	
720	12.00	5.09	29	1258		36.000	3.45	1555	-297	9.7	
1080	18.00	3.83	22	1420		36.000	3.45	2333	-913	11.0	
1440	24.00	3.1	18	1532		36.000	3.45	3110	-1578	11.8	
2160	36.00	2.28	13	1690		36.000	3.45	4666	-2975	13.0	Minor Events for the 20% and 10% AEP for 36 hours and 48 hours (completely empty)
2880	48.00	1.83	10	1809		36.000	3.45	6221	-4412	14.0	Minor Events for the 20% and 10% AEP for 36 hours and 48 hours (completely empty)
4320	72.00	1.34	8	1987		36.000	3.45	9331	-7344	15.3	

Frequent Events must completely empty within 12 hours

1EY		63.20%									
60	1.00	18.4	105	379		36.000	3.45	130	249	2.92	63.2% AEP 1hr storm will be contained onsite.
Frequent Events must completely empty within 12 hours										Compliant - less than 12 hours	

TWL (mAHD)	Height	A (TWL)	Average Area	Vol (m3)	Treatment Storage (above LWL)	Detention Stoage (above LWL)	The Designated Height allows Storage for	AEP	
0	0	4200		0	0	0	Static Water Level	Static Water Level	
1	0.4	4757		218	218	0	1 in 1 yr 1 hour	63.20%	
1.4	0.5	5215		378	378	160	1 in 1 yr	63.20%	24hr
1.9	0.6	6225		1530	1530	1312	5 year storage	20%	24hr
2.5	1.5	6866		1805	1805	1587	10 year storage	10%	24hr
4	2	7885		2875	2875	2657	100 year storage	1%	24hr

EcoGraf Ltd
EcoGraf Processing Facility
Document Number: EPF-12332-CI-CAL-001
Drainage Calculations

Item Number	Description
2	EcoGraf Processing Facility Soakwell Calculations (20211212)
1.a	a) 1% AEP
1.b	b) 10% AEP
1.c	c) 20% AEP
1.d	d) 50% AEP
1.e	e) 63.2% AEP

Development Engineering Consultants - Drainage Basin Spreadsheet

Client: EcoGraf
Location: At-lot detention calculations to establish runoff coefficient - commercial-type site
Designer: RSS

Data to be Input

Rainfall AEP (Percentage)	1	1EY
1EY Impervious Catchment (Ha)	**0.07**	63% AEP
Required Storage (1EY 1hr) (m3)	0.99	

Catchment Details	**Buidlings Area**	**Paved Area**	**Unpaved Area**	**Total**	
Lot Area (SQM)	860	0	0	860	
Proportion Paved	90%	90%	10%	190%	
Area Paved (Ha)	**0.0774**	**0**	**0**	**0.0774**	
Run-Off Co-efficient(C10)	0.9	0.9	0		
ARI Multiplier	1	1	0.95		
Run-Off Co-efficient(Cy)	0.9	0.9	0		**Effective C**
Impervious Area(Ha)	**0.07**	**0.00**	**0.00**	**0.07**	**0.90**

AEP	ARI	Effective C	Multiplier
63.2	1	0	
50	1.44	0	
20	4.48	0	
10	9.49	0	
5	20	0.09	
2	50	0.21	
1	100	0.28	

Area above ground inundated to 0.03m deep (backyard and front yard) (m2)	-	0.03	-	
Storage provided manholes/pipe (m3)	-			
Number of Soakwells	4			
Diameter of soakwells (m)	1.8			
Depth of each soakwell (m)	1.8	Area/total soak		
Storage required soakwells (m3)	**18.32**	10.18	m2	
Storage provided (m3)	18.32	2.03575204	l/s	
Effective Initial Loss (mm)	**21.30**			
Permeability	0.00026	m/s		(compacted sand based on Douglas Partners report dated March 2014)
Soakage rate (l/s/m2)	0.0200	1.73	m/day	

NOTE: All water is retained in soakwells up to and including 10% AEP (1 in 10yr ARI) without surcharge. For greater AEP storms water will surcharge soakwells and enter the road drainage system.

Residential (Drainage without outflow used for up to 20% AEP)

Volume of storage required is 1m3 per	**46.94**	**m2** **of total lot area**
Alternatively storage required is 1m3 per	**42.24**	**m2** **of paved area**

Tc (mins)	**Tc (hrs)**	**I (mm/hr)**	**Q_{IN} (L/s)**	**Total V_{IN} (m3)**	**Q_{OUT} (soakage) (L/s)**	**Effective Continuing Loss (mm/hr)**	**V_{OUT} (soakage) (m3)**	**Net storage (after soakage) (m3)**	**Volume of Storage Reqd for Total Area (m3)**	**V_{OUT} required (m3)**	**Q_{OUT} (L/s)**	
10	0.17	130	28.0	16.8	2.036	8.52	1.22	15.55	18.32	0.00	0.00	Drainage without outflow used for up to 1% AEP for commerical
15	0.25	104	22.4	20.1	2.036	8.52	1.83	18.29	18.32	0.00	0.00	Drainage without outflow used for up to 1% AEP for commerical
20	0.33	88	18.9	22.7	2.036	8.52	2.44	20.26	18.32	1.94	1.62	Drainage System contains a 15 min 1% AEP, then overflows
30	0.50	68.3	14.7	26.4	2.036	8.52	3.66	22.77	18.32	4.45	2.47	Drainage System contains a 15 min 1% AEP, then overflows
45	0.75	52.7	11.3	30.6	2.036	8.52	5.50	25.10	18.32	6.77	2.51	Drainage System contains a 15 min 1% AEP, then overflows
60	1.00	43.9	9.4	34.0	2.036	8.52	7.33	26.65	18.32	8.33	2.31	Drainage System contains a 15 min 1% AEP, then overflows
90	1.50	34.1	7.3	39.6	2.036	8.52	10.99	28.60	18.32	10.28	1.90	Drainage System contains a 15 min 1% AEP, then overflows
120	2.00	28.6	6.1	44.3	2.036	8.52	14.66	29.62	18.32	11.29	1.57	Drainage System contains a 15 min 1% AEP, then overflows
180	3.00	22.5	4.8	52.2	2.036	8.52	21.99	30.26	18.32	11.94	1.11	Drainage System contains a 15 min 1% AEP, then overflows
270	4.50	17.8	3.8	62.0	2.036	8.52	32.98	29.02	18.32	10.70	0.66	Drainage System contains a 15 min 1% AEP, then overflows
360	6.00	15	3.2	69.7	2.036	8.52	43.97	25.69	18.32	7.37	0.34	Drainage System contains a 15 min 1% AEP, then overflows
540	9.00	11.7	2.5	81.5	2.036	8.52	65.96	15.54	18.32	0.00	0.00	Drainage System contains events above 6 hours
720	12.00	9.68	2.1	89.9	2.036	8.52	87.94	1.96	18.32	0.00	0.00	
1080	18.00	7.27	1.6	101.3	2.036	8.52	131.92	-30.63	18.32	0.00	0.00	
1440	24.00	5.82	1.3	108.1	2.036	8.52	175.89	-67.78	18.32	0.00	0.00	
2160	36.00	4.16	0.9	115.9	2.036	8.52	263.83	-147.92	18.32	0.00	0.00	
2880	48.00	3.23	0.7	120.0	2.036	8.52	351.78	-231.78	18.32	0.00	0.00	
4320	72.00	2.25	0.5	125.4	2.036	8.52	527.67	-402.28	18.32	0.00	0.00	

1EY		63.20%										
60	1.00	18.4	0.3	1.10229984	2.036	8.52	7.33	-6.23	18.32	0.00	0.00	63.2% AEP 1hr stomr will be contained within the soakwells

Summary

Soakwells offer some reduction to storm events however base design on open drains feeding to detention basin

Development Engineering Consultants - Drainage Basin Spreadsheet

Client: EcoGraf
Location: At-lot detention calculations to establish runoff coefficient - commercial-type site
Designer: RSS

Data to be Input

Rainfall AEP (Percentage)	5	1EY
1EY Impervious Catchment (Ha)	**0.07**	63% AEP
Required Storage (1EY 1hr) (m3)	0.99	

Catchment Details	**Buidlings Area**	**Paved Area**	**Unpaved Area**	**Total**	
Lot Area (SQM)	860	0	0	860	
Proportion Paved	90%	90%	10%	190%	
Area Paved (Ha)	**0.0774**	**0**	**0**	**0.0774**	
Run-Off Co-efficient(C10)	0.9	0.9	0		
ARI Multiplier	1	1	0.95		
Run-Off Co-efficient(Cy)	0.9	0.9	0		**Effective C**
Impervious Area(Ha)	**0.07**	**0.00**	**0.00**	**0.07**	**0.90**

AEP	ARI	Effective C	Multiplier
63.2	1	0	
50	1.44	0	
20	4.48	0	
10	9.49	0	
5	20	0.09	
2	50	0.21	
1	100	0.28	

Area above ground inundated to 0.03m deep (backyard and front yard) (m2)	-	0.03	-	
Storage provided manholes/pipe (m3)	-			
Number of Soakwells	4			
Diameter of soakwells (m)	1.8			
Depth of each soakwell (m)	1.8	Area/total soak		
Storage required soakwells (m3)	**18.32**	10.18	m2	
Storage provided (m3)	18.32	2.03575204	l/s	
Effective Initial Loss (mm)	**21.30**			
Permeability	0.00026	m/s		(compacted sand based on Douglas Partners report dated March 2014)
Soakage rate (l/s/m2)	0.0200	1.73	m/day	

NOTE: All water is retained in soakwells up to and including 10% AEP (1 in 10yr ARI) without surcharge. For greater AEP storms water will surcharge soakwells and enter the road drainage system.

Residential (Drainage without outflow used for up to 20% AEP)

Volume of storage required is 1m3 per	**46.94**	**m2**	**of total lot area**
Alternatively storage required is 1m3 per	**42.24**	**m2**	**of paved area**

Tc (mins)	**Tc (hrs)**	**I (mm/hr)**	**Q_{IN} (L/s)**	**Total V_{IN} (m3)**	**Q_{OUT} (soakage) (L/s)**	**Effective Continuing Loss (mm/hr)**	**V_{OUT} (soakage) (m3)**	**Net storage (after soakage) (m3)**	**Volume of Storage Reqd for Total Area (m3)**	**V_{OUT} required (m3)**	**Q_{OUT} (L/s)**	
10	0.17	100	21.5	12.9	2.036	8.52	1.22	11.68	18.32	0.00	0.00	Drainage without outflow used for up to 1% AEP for commerical
15	0.25	80.5	17.3	15.6	2.036	8.52	1.83	13.74	18.32	0.00	0.00	Drainage without outflow used for up to 1% AEP for commerical
20	0.33	68	14.6	17.5	2.036	8.52	2.44	15.10	18.32	0.00	0.00	Drainage without outflow used for up to 1% AEP for commerical
30	0.50	52.9	11.4	20.5	2.036	8.52	3.66	16.81	18.32	0.00	0.00	Drainage without outflow used for up to 1% AEP for commerical
45	0.75	40.8	8.8	23.7	2.036	8.52	5.50	18.19	18.32	0.00	0.00	Drainage without outflow used for up to 1% AEP for commerical
60	1.00	33.8	7.3	26.2	2.036	8.52	7.33	18.83	18.32	0.51	0.14	Drainage System contains a 45 min 5% AEP, then overflows
90	1.50	26.1	5.6	30.3	2.036	8.52	10.99	19.31	18.32	0.99	0.18	Drainage System contains a 45 min 5% AEP, then overflows
120	2.00	21.7	4.7	33.6	2.036	8.52	14.66	18.93	18.32	0.61	0.09	Drainage System contains a 45 min 5% AEP, then overflows
180	3.00	16.9	3.6	39.2	2.036	8.52	21.99	17.26	18.32	0.00	0.00	Drainage System contains events above 2 hours
270	4.50	13.1	2.8	45.6	2.036	8.52	32.98	12.65	18.32	0.00	0.00	
360	6.00	11	2.4	51.1	2.036	8.52	43.97	7.11	18.32	0.00	0.00	
540	9.00	8.46	1.8	58.9	2.036	8.52	65.96	-7.03	18.32	0.00	0.00	
720	12.00	6.99	1.5	64.9	2.036	8.52	87.94	-23.02	18.32	0.00	0.00	
1080	18.00	5.27	1.1	73.4	2.036	8.52	131.92	-58.50	18.32	0.00	0.00	
1440	24.00	4.26	0.9	79.1	2.036	8.52	175.89	-96.76	18.32	0.00	0.00	
2160	36.00	3.1	0.7	86.4	2.036	8.52	263.83	-177.46	18.32	0.00	0.00	
2880	48.00	2.45	0.5	91.0	2.036	8.52	351.78	-260.76	18.32	0.00	0.00	
4320	72.00	1.76	0.4	98.1	2.036	8.52	527.67	-429.59	18.32	0.00	0.00	

1EY		63.20%										
60	1.00	18.4	0.3	1.10229984	2.036	8.52	7.33	-6.23	18.32	0.00	0.00	63.2% AEP 1hr stomr will be contained within the soakwells

Summary

Soakwells offer some reduction to storm events however base design on open drains feeding to detention basin

Development Engineering Consultants - Drainage Basin Spreadsheet

Client: EcoGraf
Location: At-lot detention calculations to establish runoff coefficient - commercial-type site
Designer: RSS

Data to be Input

Rainfall AEP (Percentage)	10	1EY
1EY Impervious Catchment (Ha)	**0.07**	63% AEP
Required Storage (1EY 1hr) (m3)	0.99	

Catchment Details	**Buidlings Area**	**Paved Area**	**Unpaved Area**	**Total**	
Lot Area (SQM)	860	0	0	860	
Proportion Paved	90%	90%	10%	190%	
Area Paved (Ha)	**0.0774**	**0**	**0**	**0.0774**	
Run-Off Co-efficient(C10)	0.9	0.9	0		
ARI Multiplier	1	1	0.95		
Run-Off Co-efficient(Cy)	0.9	0.9	0		**Effective C**
Impervious Area(Ha)	**0.07**	**0.00**	**0.00**	**0.07**	**0.90**

AEP	ARI	Effective C	Multiplier
63.2	1	0	
50	1.44	0	
20	4.48	0	
10	9.49	0	
5	20	0.09	
2	50	0.21	
1	100	0.28	

Area above ground inundated to 0.03m deep (backyard and front yard) (m2)	-	0.03	-	
Storage provided manholes/pipe (m3)	-			
Number of Soakwells	4			
Diameter of soakwells (m)	1.8			
Depth of each soakwell (m)	1.8	Area/total soak		
Storage required soakwells (m3)	**18.32**	10.18	m2	
Storage provided (m3)	18.32	2.03575204	l/s	
Effective Initial Loss (mm)	**21.30**			
Permeability	0.00026	m/s		(compacted sand based on Douglas Partners report dated March 2014)
Soakage rate (l/s/m2)	0.0200	1.73	m/day	

NOTE: All water is retained in soakwells up to and including 10% AEP (1 in 10yr ARI) without surcharge. For greater AEP storms water will surcharge soakwells and enter the road drainage system.

Residential (Drainage without outflow used for up to 20% AEP)

Volume of storage required is 1m3 per	**46.94**	**m2** **of total lot area**
Alternatively storage required is 1m3 per	**42.24**	**m2** **of paved area**

Tc (mins)	**Tc (hrs)**	**I (mm/hr)**	**Q_{IN} (L/s)**	**Total V_{IN} (m3)**	**Q_{OUT} (soakage) (L/s)**	**Effective Continuing Loss (mm/hr)**	**V_{OUT} (soakage) (m3)**	**Net storage (after soakage) (m3)**	**Volume of Storage Reqd for Total Area (m3)**	**V_{OUT} required (m3)**	**Q_{OUT} (L/s)**	
10	0.17	87.9	18.9	11.3	2.036	8.52	1.22	10.12	18.32	0	0	Drainage without outflow used for up to 10% AEP for commerical
15	0.25	70.7	15.2	13.7	2.036	8.52	1.83	11.85	18.32	0	0	Drainage without outflow used for up to 10% AEP for commerical
20	0.33	59.8	12.9	15.4	2.036	8.52	2.44	12.99	18.32	0.00	0.00	Drainage without outflow used for up to 10% AEP for commerical
30	0.50	46.5	10.0	18.0	2.036	8.52	3.66	14.33	18.32	0.00	0.00	Drainage without outflow used for up to 10% AEP for commerical
45	0.75	35.9	7.7	20.8	2.036	8.52	5.50	15.34	18.32	0.00	0.00	Drainage without outflow used for up to 10% AEP for commerical
60	1.00	29.8	6.4	23.1	2.036	8.52	7.33	15.74	18.32	0.00	0.00	Drainage without outflow used for up to 10% AEP for commerical
90	1.50	22.9	4.9	26.6	2.036	8.52	10.99	15.59	18.32	0.00	0.00	Drainage without outflow used for up to 10% AEP for commerical
120	2.00	19	4.1	29.4	2.036	8.52	14.66	14.75	18.32	0.00	0.00	Drainage without outflow used for up to 10% AEP for commerical
180	3.00	14.7	3.2	34.1	2.036	8.52	21.99	12.15	18.32	0.00	0.00	Drainage without outflow used for up to 10% AEP for commerical
270	4.50	11.4	2.5	39.7	2.036	8.52	32.98	6.73	18.32	0.00	0.00	Drainage without outflow used for up to 10% AEP for commerical
360	6.00	9.48	2.0	44.0	2.036	8.52	43.97	0.05	18.32	0.00	0.00	Drainage without outflow used for up to 10% AEP for commerical
540	9.00	7.29	1.6	50.8	2.036	8.52	65.96	-15.18	18.32	0.00	0.00	Drainage without outflow used for up to 10% AEP for commerical
720	12.00	6.01	1.3	55.8	2.036	8.52	87.94	-32.12	18.32	0.00	0.00	Drainage without outflow used for up to 10% AEP for commerical
1080	18.00	4.52	1.0	63.0	2.036	8.52	131.92	-68.94	18.32	0.00	0.00	Drainage without outflow used for up to 10% AEP for commerical
1440	24.00	3.66	0.8	68.0	2.036	8.52	175.89	-107.90	18.32	0.00	0.00	Drainage without outflow used for up to 10% AEP for commerical
2160	36.00	2.68	0.6	74.7	2.036	8.52	263.83	-189.16	18.32	0.00	0.00	Drainage without outflow used for up to 10% AEP for commerical
2880	48.00	2.14	0.5	79.5	2.036	8.52	351.78	-272.27	18.32	0.00	0.00	Drainage without outflow used for up to 10% AEP for commerical
4320	72.00	1.55	0.3	86.4	2.036	8.52	527.67	-441.29	18.32	0.00	0.00	Drainage without outflow used for up to 10% AEP for commerical

1EY		63.20%										
60	1.00	18.4	0.3	1.10229984	2.036	8.52	7.33	-6.23	18.32	0.00	0.00	63.2% AEP 1hr stomr will be contained within the soakwells

Summary

Soakwells offer some reduction to storm events however base design on open drains feeding to detention basin

Development Engineering Consultants - Drainage Basin Spreadsheet

Client: EcoGraf
Location: At-lot detention calculations to establish runoff coefficient - commercial-type site
Designer: RSS

Data to be Input

Rainfall AEP (Percentage)	20	1EY
1EY Impervious Catchment (Ha)	**0.07**	63% AEP
Required Storage (1EY 1hr) (m3)	0.99	

Catchment Details	**Buidlings Area**	**Paved Area**	**Unpaved Area**	**Total**	
Lot Area (SQM)	860	0	0	860	
Proportion Paved	90%	90%	10%	190%	
Area Paved (Ha)	**0.0774**	**0**	**0**	**0.0774**	
Run-Off Co-efficient(C10)	0.9	0.9	0		
ARI Multiplier	1	1	0.95		
Run-Off Co-efficient(Cy)	0.9	0.9	0		**Effective C**
Impervious Area(Ha)	**0.07**	**0.00**	**0.00**	**0.07**	**0.90**

AEP	ARI	Effective C	Multiplier
63.2	1	0	
50	1.44	0	
20	4.48	0	
10	9.49	0	
5	20	0.09	
2	50	0.21	
1	100	0.28	

Area above ground inundated to 0.03m deep (backyard and front yard) (m2)	-	0.03	-	
Storage provided manholes/pipe (m3)	-			
Number of Soakwells	4			
Diameter of soakwells (m)	1.8			
Depth of each soakwell (m)	1.8	Area/total soak		
Storage required soakwells (m3)	**18.32**	10.18	m2	
Storage provided (m3)	18.32	2.03575204	l/s	
Effective Initial Loss (mm)	**21.30**			
Permeability	0.00026	m/s		(compacted sand based on Douglas Partners report dated March 2014)
Soakage rate (l/s/m2)	0.0200	1.73	m/day	

NOTE: All water is retained in soakwells up to and including 10% AEP (1 in 10yr ARI) without surcharge. For greater AEP storms water will surcharge soakwells and enter the road drainage system.

Residential (Drainage without outflow used for up to 20% AEP)

Volume of storage required is 1m3 per	**46.94**	**m2** **of total lot area**
Alternatively storage required is 1m3 per	**42.24**	**m2** **of paved area**

Tc (mins)	**Tc (hrs)**	**I (mm/hr)**	**Q_{IN} (L/s)**	**Total V_{IN} (m3)**	**Q_{OUT} (soakage) (L/s)**	**Effective Continuing Loss (mm/hr)**	**V_{OUT} (soakage) (m3)**	**Net storage (after soakage) (m3)**	**Volume of Storage Reqd for Total Area (m3)**	**V_{OUT} required (m3)**	**Q_{OUT} (L/s)**	
10	0.17	75.7	16.3	9.8	2.036	8.52	1.22	8.54	18.32	0	0	Drainage without outflow used for up to 20% AEP for commerical
15	0.25	60.9	13.1	11.8	2.036	8.52	1.83	9.95	18.32	0	0	Drainage without outflow used for up to 20% AEP for commerical
20	0.33	51.5	11.1	13.3	2.036	8.52	2.44	10.84	18.32	0.00	0.00	Drainage without outflow used for up to 20% AEP for commerical
30	0.50	40.2	8.6	15.6	2.036	8.52	3.66	11.89	18.32	0.00	0.00	Drainage without outflow used for up to 20% AEP for commerical
45	0.75	31	6.7	18.0	2.036	8.52	5.50	12.50	18.32	0.00	0.00	Drainage without outflow used for up to 20% AEP for commerical
60	1.00	25.7	5.5	19.9	2.036	8.52	7.33	12.56	18.32	0.00	0.00	Drainage without outflow used for up to 20% AEP for commerical
90	1.50	19.8	4.3	23.0	2.036	8.52	10.99	11.99	18.32	0.00	0.00	Drainage without outflow used for up to 20% AEP for commerical
120	2.00	16.4	3.5	25.4	2.036	8.52	14.66	10.73	18.32	0.00	0.00	Drainage without outflow used for up to 20% AEP for commerical
180	3.00	12.6	2.7	29.3	2.036	8.52	21.99	7.27	18.32	0.00	0.00	Drainage without outflow used for up to 20% AEP for commerical
270	4.50	9.74	2.1	33.9	2.036	8.52	32.98	0.95	18.32	0.00	0.00	Drainage without outflow used for up to 20% AEP for commerical
360	6.00	8.09	1.7	37.6	2.036	8.52	43.97	-6.40	18.32	0.00	0.00	Drainage without outflow used for up to 20% AEP for commerical
540	9.00	6.19	1.3	43.1	2.036	8.52	65.96	-22.84	18.32	0.00	0.00	Drainage without outflow used for up to 20% AEP for commerical
720	12.00	5.09	1.1	47.3	2.036	8.52	87.94	-40.67	18.32	0.00	0.00	Drainage without outflow used for up to 20% AEP for commerical
1080	18.00	3.83	0.8	53.4	2.036	8.52	131.92	-78.56	18.32	0.00	0.00	Drainage without outflow used for up to 20% AEP for commerical
1440	24.00	3.1	0.7	57.6	2.036	8.52	175.89	-118.30	18.32	0.00	0.00	Drainage without outflow used for up to 20% AEP for commerical
2160	36.00	2.28	0.5	63.5	2.036	8.52	263.83	-200.30	18.32	0.00	0.00	Drainage without outflow used for up to 20% AEP for commerical
2880	48.00	1.83	0.4	68.0	2.036	8.52	351.78	-283.79	18.32	0.00	0.00	Drainage without outflow used for up to 20% AEP for commerical
4320	72.00	1.34	0.3	74.7	2.036	8.52	527.67	-452.99	18.32	0.00	0.00	Drainage without outflow used for up to 20% AEP for commerical

1EY		63.20%										
60	1.00	18.4	0.3	1.10229984	2.036	8.52	7.33	-6.23	18.32	0.00	0.00	63.2% AEP 1hr stomr will be contained within the soakwells

Summary

Soakwells offer some reduction to storm events however base design on open drains feeding to detention basin

Development Engineering Consultants - Drainage Basin Spreadsheet

Client: EcoGraf
Location: At-lot detention calculations to establish runoff coefficient - commercial-type site
Designer: RSS

Data to be Input

Rainfall AEP (Percentage)	50	1EY
1EY Impervious Catchment (Ha)	**0.07**	63% AEP
Required Storage (1EY 1hr) (m3)	0.99	

Catchment Details	**Buidlings Area**	**Paved Area**	**Unpaved Area**	**Total**	
Lot Area (SQM)	860	0	0	860	
Proportion Paved	90%	90%	10%	190%	
Area Paved (Ha)	**0.0774**	**0**	**0**	**0.0774**	
Run-Off Co-efficient(C10)	0.9	0.9	0		
ARI Multiplier	1	1	0.95		
Run-Off Co-efficient(Cy)	0.9	0.9	0		**Effective C**
Impervious Area(Ha)	**0.07**	**0.00**	**0.00**	**0.07**	**0.90**

AEP	ARI	Effective C	Multiplier
63.2	1	0	
50	1.44	0	
20	4.48	0	
10	9.49	0	
5	20	0.09	
2	50	0.21	
1	100	0.28	

Area above ground inundated to 0.03m deep (backyard and front yard) (m2)	-	0.03	-	
Storage provided manholes/pipe (m3)	-			
Number of Soakwells	4			
Diameter of soakwells (m)	1.8			
Depth of each soakwell (m)	1.8	Area/total soak		
Storage required soakwells (m3)	**18.32**	10.18	m2	
Storage provided (m3)	18.32	2.03575204	l/s	
Effective Initial Loss (mm)	**21.30**			
Permeability	0.00026	m/s		(compacted sand based on Douglas Partners report dated March 2014)
Soakage rate (l/s/m2)	0.0200	1.73	m/day	

NOTE: All water is retained in soakwells up to and including 10% AEP (1 in 10yr ARI) without surcharge. For greater AEP storms water will surcharge soakwells and enter the road drainage system.

Residential (Drainage without outflow used for up to 20% AEP)

Volume of storage required is 1m3 per	**46.94**	**m2** **of total lot area**
Alternatively storage required is 1m3 per	**42.24**	**m2** **of paved area**

Tc (mins)	**Tc (hrs)**	**I (mm/hr)**	**Q_{IN} (L/s)**	**Total V_{IN} (m3)**	**Q_{OUT} (soakage) (L/s)**	**Effective Continuing Loss (mm/hr)**	**V_{OUT} (soakage) (m3)**	**Net storage (after soakage) (m3)**	**Volume of Storage Reqd for Total Area (m3)**	**V_{OUT} required (m3)**	**Q_{OUT} (L/s)**	
10	0.17	58.2	12.5	7.5	2.036	8.52	1.22	6.29	18.32	0	0	Drainage without outflow used for up to 50% AEP for commerical
15	0.25	46.8	10.1	9.1	2.036	8.52	1.83	7.22	18.32	0	0	Drainage without outflow used for up to 50% AEP for commerical
20	0.33	39.7	8.5	10.2	2.036	8.52	2.44	7.80	18.32	0.00	0.00	Drainage without outflow used for up to 50% AEP for commerical
30	0.50	31.1	6.7	12.0	2.036	8.52	3.66	8.37	18.32	0.00	0.00	Drainage without outflow used for up to 50% AEP for commerical
45	0.75	24.1	5.2	14.0	2.036	8.52	5.50	8.49	18.32	0.00	0.00	Drainage without outflow used for up to 50% AEP for commerical
60	1.00	20.1	4.3	15.6	2.036	8.52	7.33	8.23	18.32	0.00	0.00	Drainage without outflow used for up to 50% AEP for commerical
90	1.50	15.5	3.3	18.0	2.036	8.52	10.99	7.00	18.32	0.00	0.00	Drainage without outflow used for up to 50% AEP for commerical
120	2.00	12.9	2.8	20.0	2.036	8.52	14.66	5.31	18.32	0.00	0.00	Drainage without outflow used for up to 50% AEP for commerical
180	3.00	9.89	2.1	23.0	2.036	8.52	21.99	0.98	18.32	0.00	0.00	Drainage without outflow used for up to 50% AEP for commerical
270	4.50	7.57	1.6	26.4	2.036	8.52	32.98	-6.61	18.32	0.00	0.00	Drainage without outflow used for up to 50% AEP for commerical
360	6.00	6.25	1.3	29.0	2.036	8.52	43.97	-14.95	18.32	0.00	0.00	Drainage without outflow used for up to 50% AEP for commerical
540	9.00	4.75	1.0	33.1	2.036	8.52	65.96	-32.87	18.32	0.00	0.00	Drainage without outflow used for up to 50% AEP for commerical
720	12.00	3.88	0.8	36.0	2.036	8.52	87.94	-51.91	18.32	0.00	0.00	Drainage without outflow used for up to 50% AEP for commerical
1080	18.00	2.91	0.6	40.5	2.036	8.52	131.92	-91.37	18.32	0.00	0.00	Drainage without outflow used for up to 50% AEP for commerical
1440	24.00	2.36	0.5	43.8	2.036	8.52	175.89	-132.05	18.32	0.00	0.00	Drainage without outflow used for up to 50% AEP for commerical
2160	36.00	1.74	0.4	48.5	2.036	8.52	263.83	-215.35	18.32	0.00	0.00	Drainage without outflow used for up to 50% AEP for commerical
2880	48.00	1.4	0.3	52.0	2.036	8.52	351.78	-299.77	18.32	0.00	0.00	Drainage without outflow used for up to 50% AEP for commerical
4320	72.00	1.05	0.2	58.5	2.036	8.52	527.67	-469.15	18.32	0.00	0.00	Drainage without outflow used for up to 50% AEP for commerical

1EY		63.20%										
60	1.00	18.4	0.3	1.10229984	2.036	8.52	7.33	-6.23	18.32	0.00	0.00	63.2% AEP 1hr stomr will be contained within the soakwells

Summary

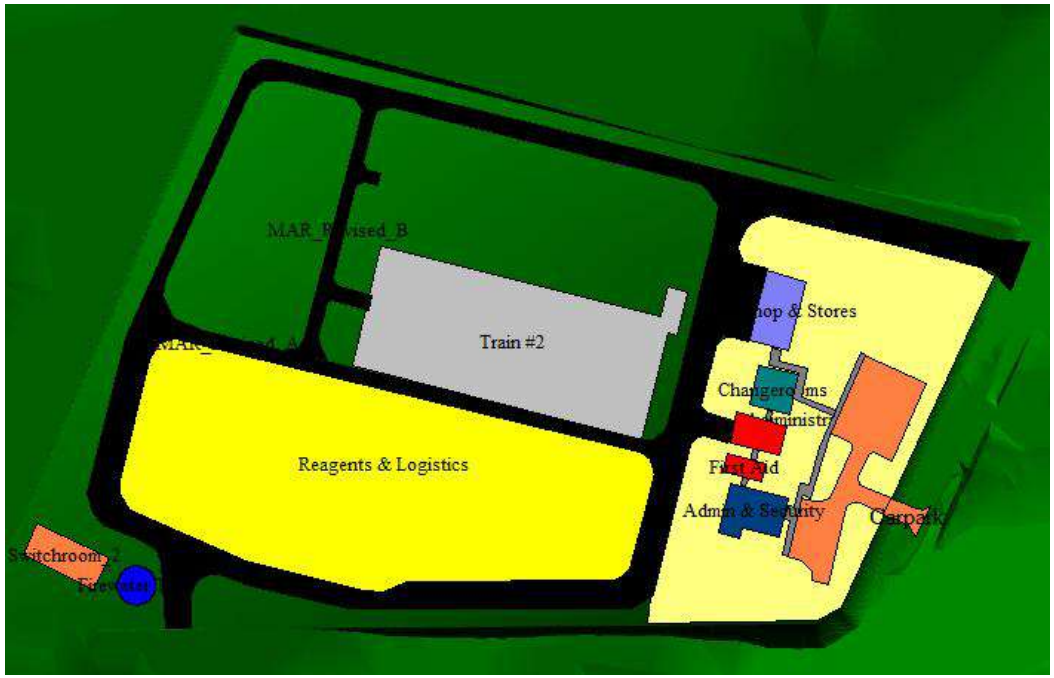
Soakwells offer some reduction to storm events however base design on open drains feeding to detention basin

EcoGraf Ltd
EcoGraf Processing Facility
Document Number: EPF-12332-CI-CAL-001
Drainage Calculations

Item Number	Description
3	EcoGraf Processing Facility_Area Evaluation (20211212)

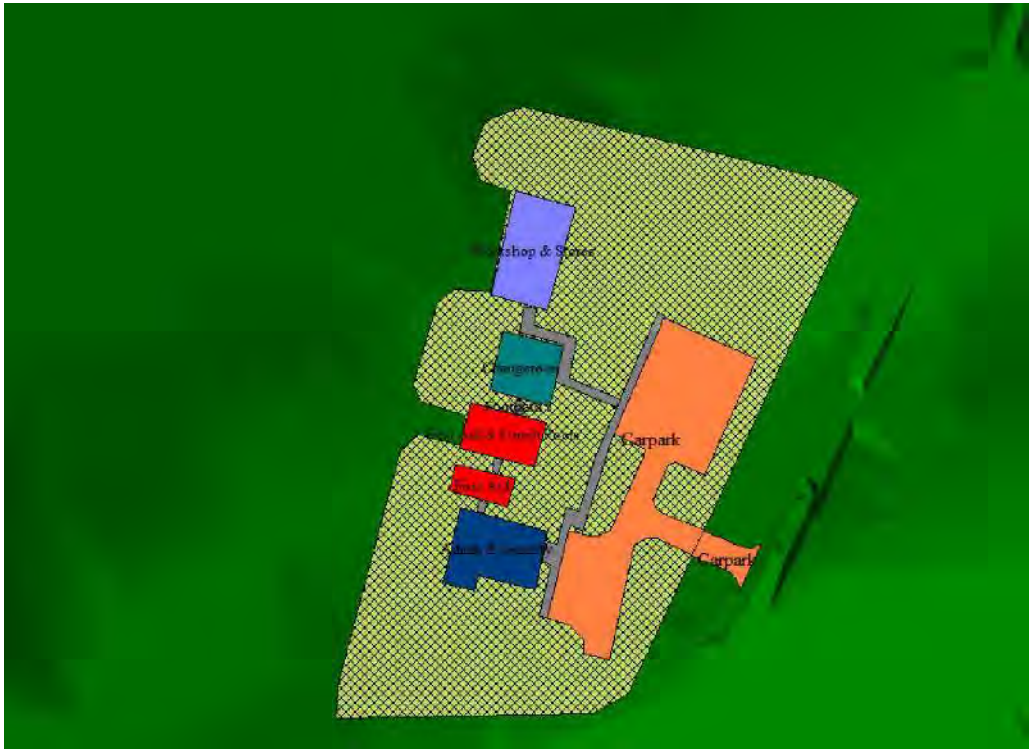
Area Requirements

	m2	Ha
Total Site Area	37,580	3.76
Switchroom	239	0.02
Carpark	1,040	0.10
Roads	6,238	0.62
Train #2	3,340	0.33
Reagents & Logistics	8,370	0.84
First Aid and Lunch Room	210	0.02
Changerooms	150	0.02
Workshop & Stores	260	0.03
Footpaths	210	0.02
Admin & Security	240	0.02
Firewater Tank	106	0.01
Main Event Pond	1,750	0.18
Smaller Event Pond	480	0.05
Paved Area	20,403	2.04
Unpaved	14,947	1.49
Pond	2,230	0.22



Area Requirements

	m2	Ha
Total Site Area	7,440	0.74
Administration Areas	**860**	**0.09**
Buildings	860	0.09
Unpaved	5,540	0.55
Carpark	1,040	0.10



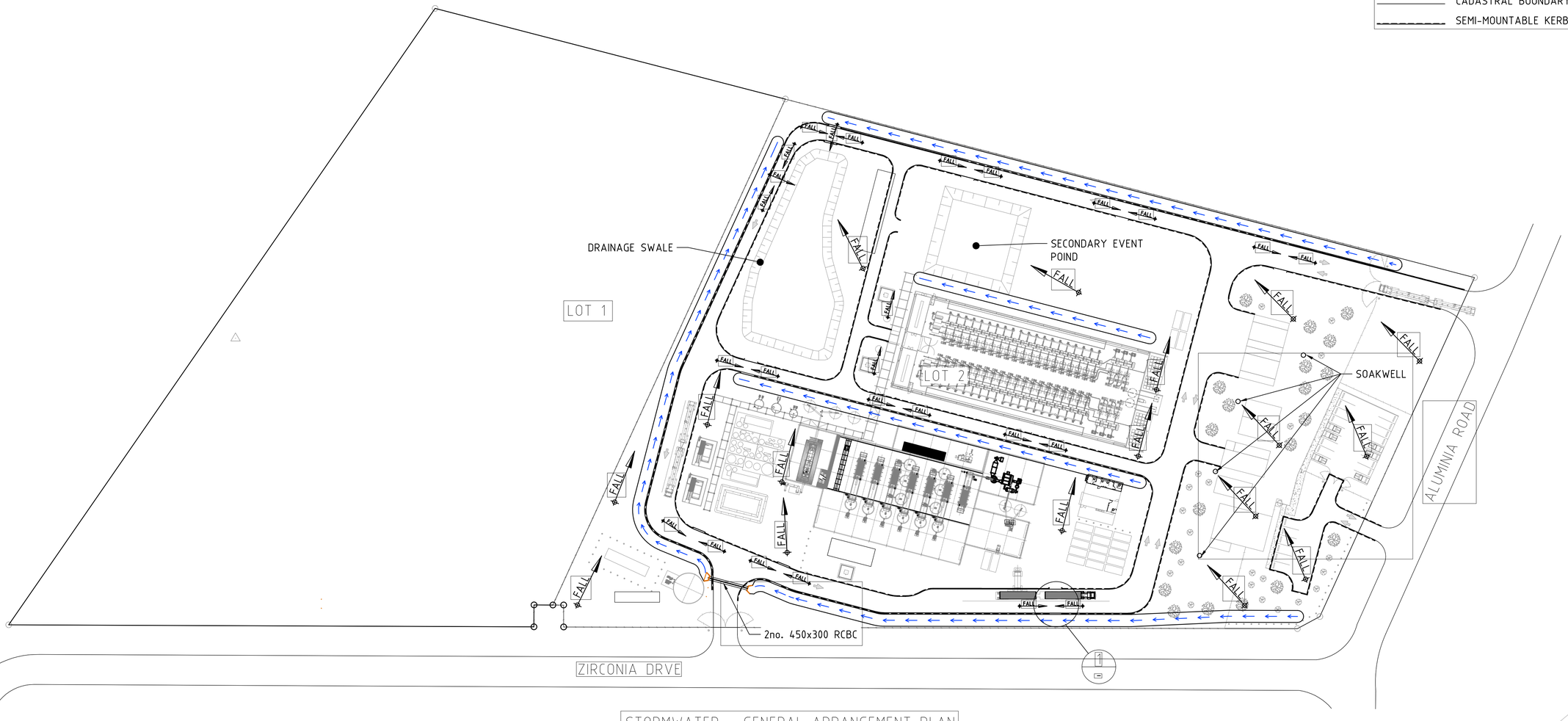
APPENDIX D DRAWINGS

The drawings contained within this Appendix (listed below) define are to be read in conjunction with this document:

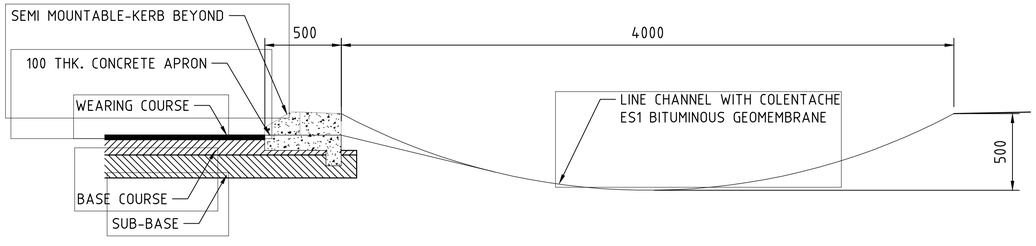
Reference Number	Description	Revision
12332-C-001	EcoGraf Processing Facility – Stormwater Drainage General Arrangement Plan – Stage 1	B
12332-C-002	EcoGraf Processing Facility – Earthworks Isopach Plan – Stage 1	C

NORTH

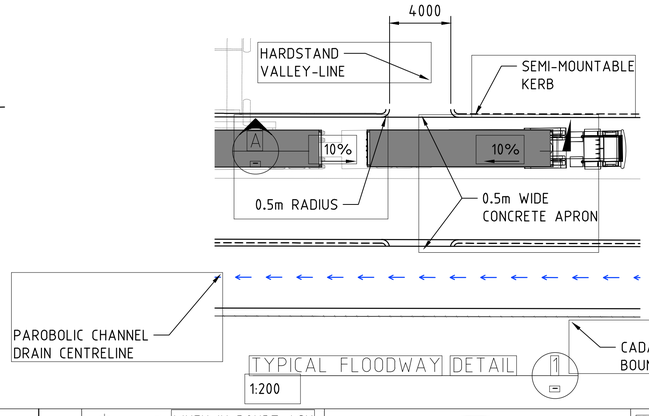
LEGEND
- PARABOLIC CHANNEL DRAIN
- CADASTRAL BOUNDARY
- SEMI-MOUNTABLE KERB



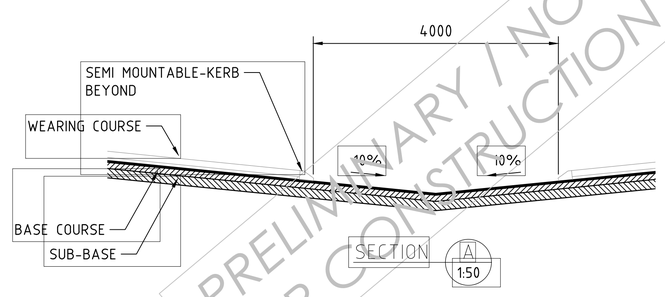
STORMWATER - GENERAL ARRANGEMENT PLAN
1:750



TYPICAL PARABOLIC CHANNEL DRAIN & KERB OPENING
1:20



TYPICAL FLOODWAY DETAIL 1
1:200



SECTION A
1:50

REV	DATE	REVISIONS	DRN	CHK	DSGN	TECH APP	PROJ APP
B		LAYOUT AMENDED	JF				
A	31.09.21	PRELIMINARY	JF	RS	RS	RTK	GR

REFERENCE DRAWINGS | DWG No

WHEN IN DOUBT-ASK DO NOT SCALE

GR ENGINEERING SERVICES LTD
ENGINEERING CONSULTANTS AND CONTRACTORS
179 Great Eastern Highway, Belmont Western Australia. 6104
Phone: (08) 6272 6000
Fax: (08) 6272 6001
ACN 121 542 738

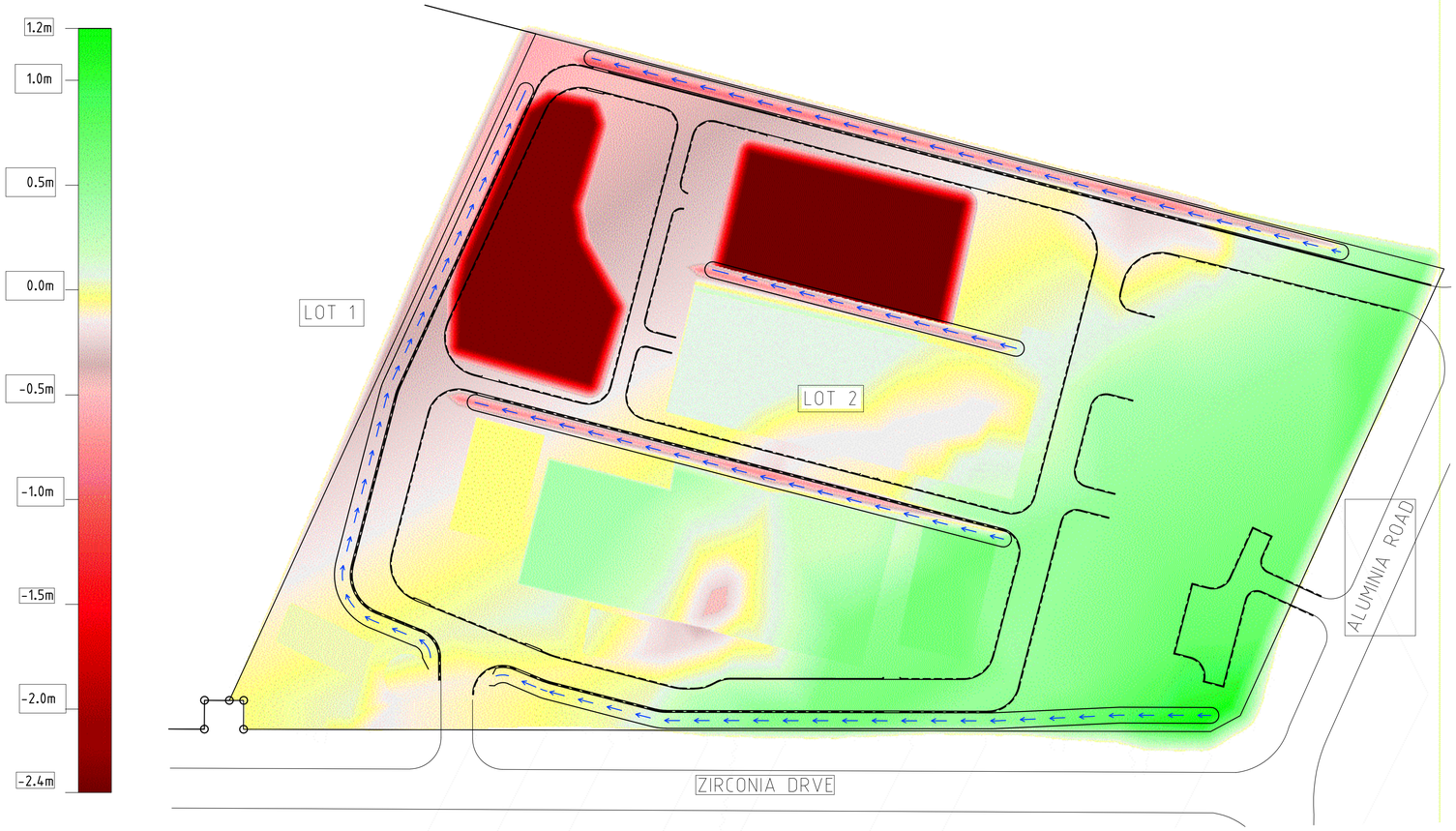
DRAWN	JF 29.09.21
CHECKED	
DESIGNED	
TECH APP	
PROJ APP	
CLIENT APP	

ECOGRAF LIMITED
ECOGRAF PROCESSING FACILITY
STORMWATER DRAINAGE
GENERAL ARANGEMENT PLAN - STAGE 1

A1	SCALE	JOB No	DRG No	REV
	1:750	12332	12332-C-001	B

NORTH

LEGEND
- RIDGE LINE
- VALLEY LINE
- PARABOLIC CHANNEL DRAIN
- CADASTRAL BOUNDARY
- SEMI-MOUNTABLE KERB



EARTHWORKS - ISOPACH PLAN
1:750

BULK EARTHWORKS

CUT VOLUME (CCM)	HAUL AND PLACE FROM STOCKPILE (CCM)	HAUL TO STOCKPILE (BCM)	IMPORT FROM OFFSITE (CCM)
6,980	504	560	1,107

	GRANULAR PAVEMENT (m^2)		CONCRETE PAVEMENT (m^2)
	SUBBASE PAVEMENT	BASECOURSE PAVEMENT	REINFORCED PAVEMENT
125mm THICK	7,275	-	-
200mm THICK	-	7,275	1,526
ASPHALT PAVEMENT (m^2)			
40MM THICK DENSE GRADED ASPHALT DG10 A15E PMB		6,238	
25mm BLACK ASPHALT AC10		1,037	

PRELIMINARY / NOT FOR CONSTRUCTION

REV	DATE	REVISIONS	DRN	CHK	DSGN	TECH APP	PROJ APP
C		LAYOUT AMENDED					
B	11.10.21	PRELIMINARY RE-ISSUE	JF	RS	RS	RTK	GR
A	31.09.21	PRELIMINARY	JF	RS	RS	RTK	GR

REFERENCE DRAWINGS | DWG No

WHEN IN DOUBT-ASK DO NOT SCALE

GR ENGINEERING SERVICES LTD
ENGINEERING CONSULTANTS AND CONTRACTORS
179 Great Eastern Highway, Belmont ACN 121 542 738
Western Australia 6104
Phone: (08) 6272 6000
Fax: (08) 6272 6001

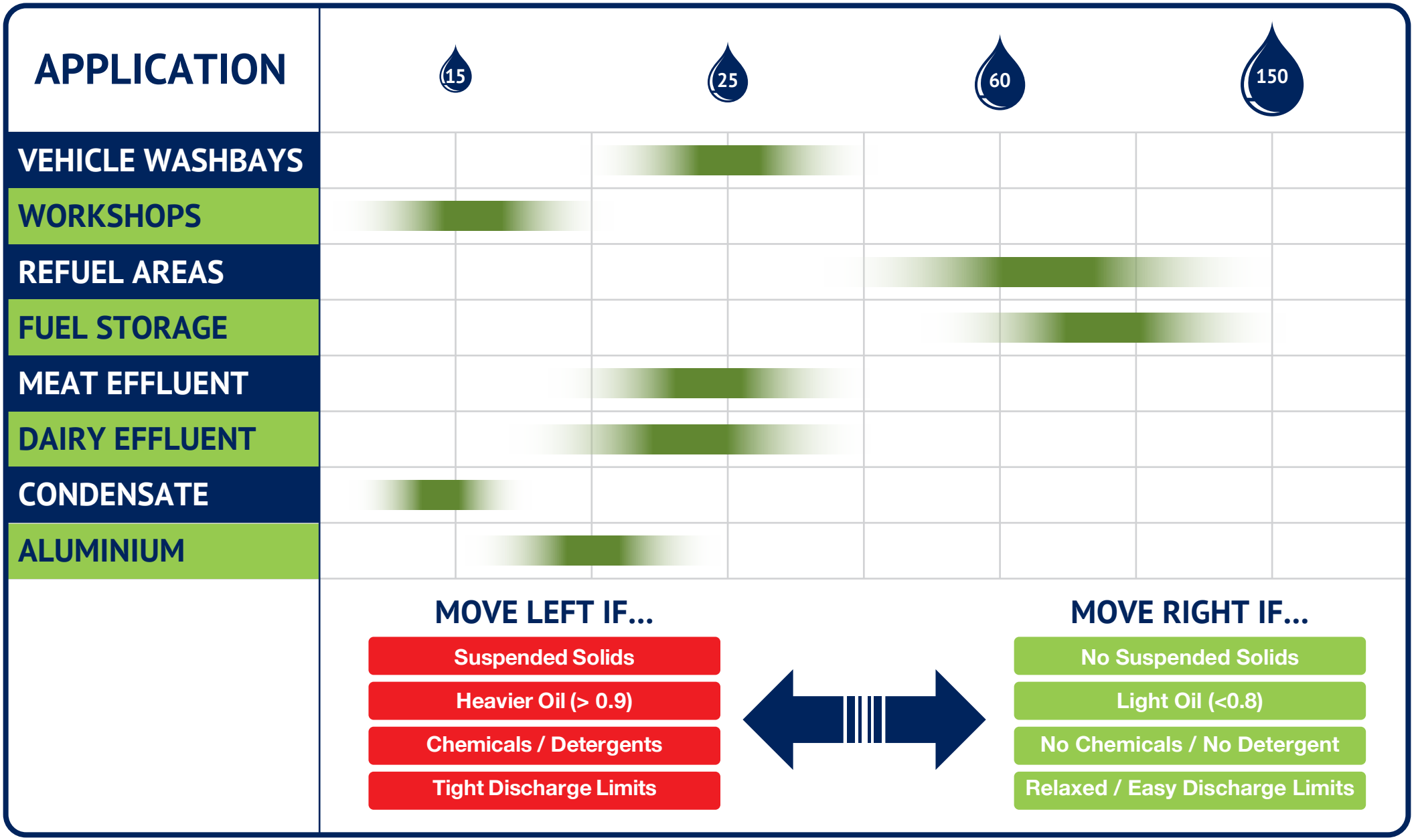
DRAWN	JF 29.09.21
CHECKED	
DESIGNED	
TECH APP	
PROJ APP	
CLIENT APP	

ECOGRAF LIMITED
ECOGRAF PROCESSING FACILITY
EARTHWORKS
ISOPACH PLAN - STAGE 1

A1 | SCALE 1:750 | JOB No 12332 | DRG No 12332-C-002 | REV C

ultraspin™

WHAT MICRON RATING DO I NEED?



ATTACHMENT 1

GENERAL NOTES FOR OILY WATER PIT DESIGN

1. GENERAL INFORMATION ONLY:
   a. THIS DRAWING AND THESE NOTES ARE A GENERAL GUIDE ONLY. ANY ACTUAL PIT DESIGNS WILL REQUIRE SITE–SPECIFIC DRAWINGS THAT ARE PREPARED BY COMPETENT EXPERIENCED PROFESSIONALS WHO WILL CONSIDER ALL END USE CUSTOMER SITE SPECIFIC REQUIREMENTS AS WELL AS FEDERAL, STATE OR LOCAL GOVERNMENT REQUIREMENTS AND ANY OTHER RELEVANT MATTERS.

2. SEPARATE STREAMS:
   a. INLET AND OUTLET STREAMS SHOULD BE SPACED AS FAR APART AS POSSIBLE TO ALLOW MAXIMUM RESIDENCE TIME FOR SETTLING.

3. MIN. PIT DEPTH:
   a. ALL PITS MUST HAVE A WORKING DEPTH OF AT LEAST 1m.
   b. WORKING DEPTH IS THE DEPTH OF WATER ABOVE THE SILT LAYER AT THE TIME THE SILT LAYER IS AT ITS DEEPEST – USUALLY AT THE TIME OF PIT CLEANING AND SILT BUILD–UP REMOVAL.

4. MINIMISE OBSTRUCTIONS:
   a. OBSTRUCTIONS INSIDE THE PIT SHOULD BE REDUCED OR ELIMINATED AS THEY MAY PREVENT SKIMMERS FROM WORKING PROPERLY. THIS MAY INCLUDE LADDERS, ETC.

5. SEDIMENT LOADS:
   a. SINGLE PIT ARRANGEMENTS SUCH AS DESIGN 1 ARE GENERALLY NOT SUITABLE FOR HIGH SEDIMENT LOADS.
   b. CAREFULLY CONSIDER HOW THE ACCUMULATED SEDIMENT WILL BE REMOVED AND HOW THE PIT WILL BE CLEANED. WEDGE PITS PROVIDE EASY CLEANING AND ARE COMMON ACROSS MOST INDUSTRIES.
   c. PIT STRUCTURES MAY NEED TO BE PROTECTED DURING CLEANING OPERATIONS, THIS NEEDS TO BE CONSIDERED IN THE DESIGN. FOR EXAMPLE IMBEDDED STEEL RAILS ON THE BOTTOM AND END WALLS OF THE PIT MAY HELP PROTECT CONCRETE FROM MECHANICAL DIGGERS

6. VERY HIGH OIL LOADS:
   a. IF THE DESIGN OIL SPILL IS LARGE DESIGNS 3 OR 4 MAY BE BEST. OIL SPILLS SHOULD BE CONSIDERED IN THE PIT DESIGN.

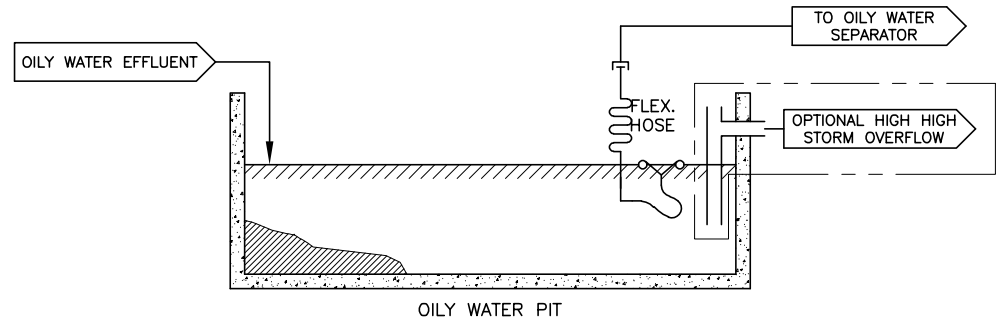
Pit Suitability			
Pit Type	Trash & debris	Suspended Solids	Gross Oil Spills
1	Low	Low	Low
2	All	All	Low
3	Low	All	All
4	All	All	All

7. TRASH & DEBRIS:
   a. IS MATERIAL LARGER THAN 5 MM THAT FLOATS ON THE SURFACE OF THE PIT THAT COULD CAUSE BLOCKAGE OF DOWNSTREAM EQUIPMENT. E.G. LEAVES, PAPER CUPS, GLOVES, PAPER, PLASTIC, RUBBISH.

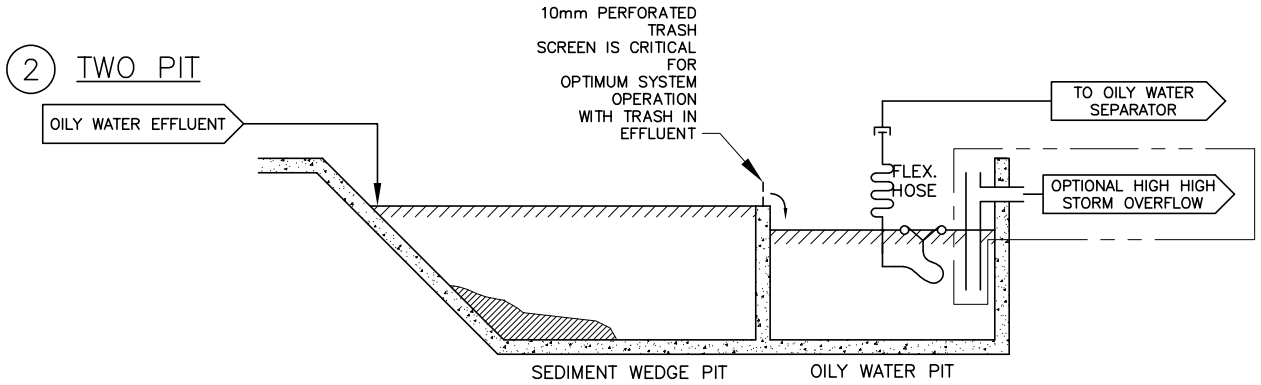
8. GROSS OIL SPILL:
   a. IS AN OIL SPILL THAT RESULTS IN A SUDDEN RELEASE OF A LARGE VOLUME OF OIL AND IS NOT CONSIDERED 'NORMAL'. AN OIL SPILLS LESS THAN 50 LITRES MIGHT BE CONSIDERED A 'LOW' SPILL DEPENDING ON THE SITE.

9. PIT VOLUMES:
   a. WHEN DETERMINING PIT VOLUMES FOR THE PROCESS IT IS IMPORTANT TO LOOK AT THE 'WORKING VOLUME' OF THE PIT NOT THE TOTAL VOLUME.
   b. THE WORKING VOLUME IS DIFFERENCE BETWEEN THE POINT WHERE THE PIT OVERFLOWS OR FLOODS AND THE LOWEST POINT YOU CAN OPERATE AT. THE LOW POINT CAN BE DUE TO SUMP PUMPS RUNNING DRY OR SKIMMER BEACHING FOR EXAMPLE.
   c. IT IS IMPORTANT TO SUBTRACT THE BUILD UP OF SEDIMENT OR SILT ON THE PIT FLOOR WHEN CALCULATING WORKING VOLUME.

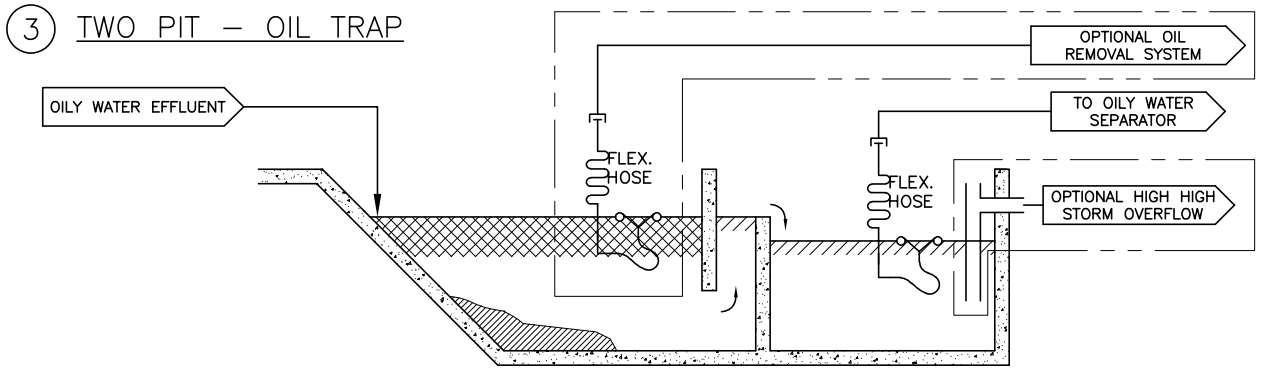
1 SINGLE PIT



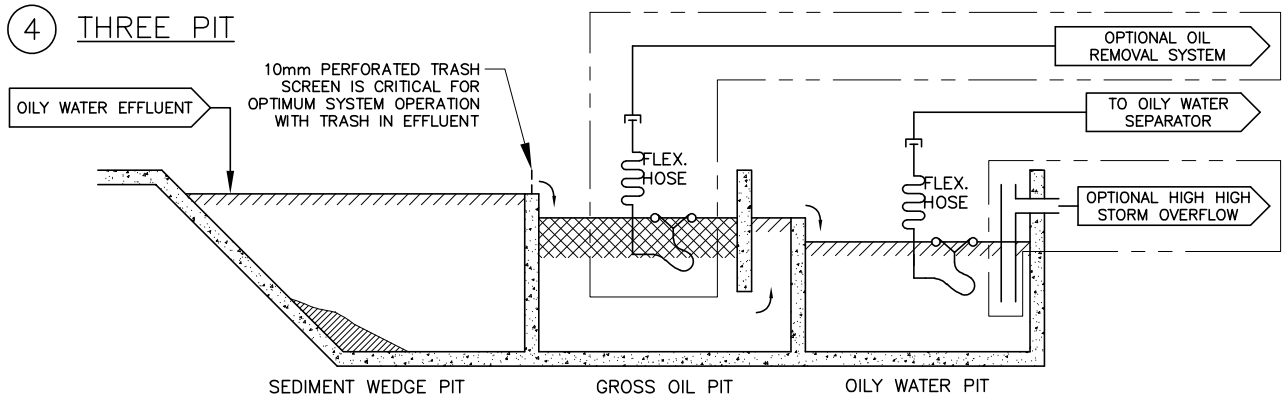
2 TWO PIT



3 TWO PIT – OIL TRAP



4 THREE PIT



REV	DESCRIPTION	DRN.	CHKD.	APP.	DATE
0	ISSUED FOR INFORMATION	D.C.S.	G.P.		27.09.13
1	GENERAL REVISIONS	JOK	I.S.	G.P.	20.10.15
2	WORKING CAPACITY NOTE ADDED	L.P.	G.P.	G.P.	11.05.18

DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE STATED

IF IN DOUBT ASK DO NOT SCALE

THIRD ANGLE PROJECTION UNLESS OTHERWISE STATED

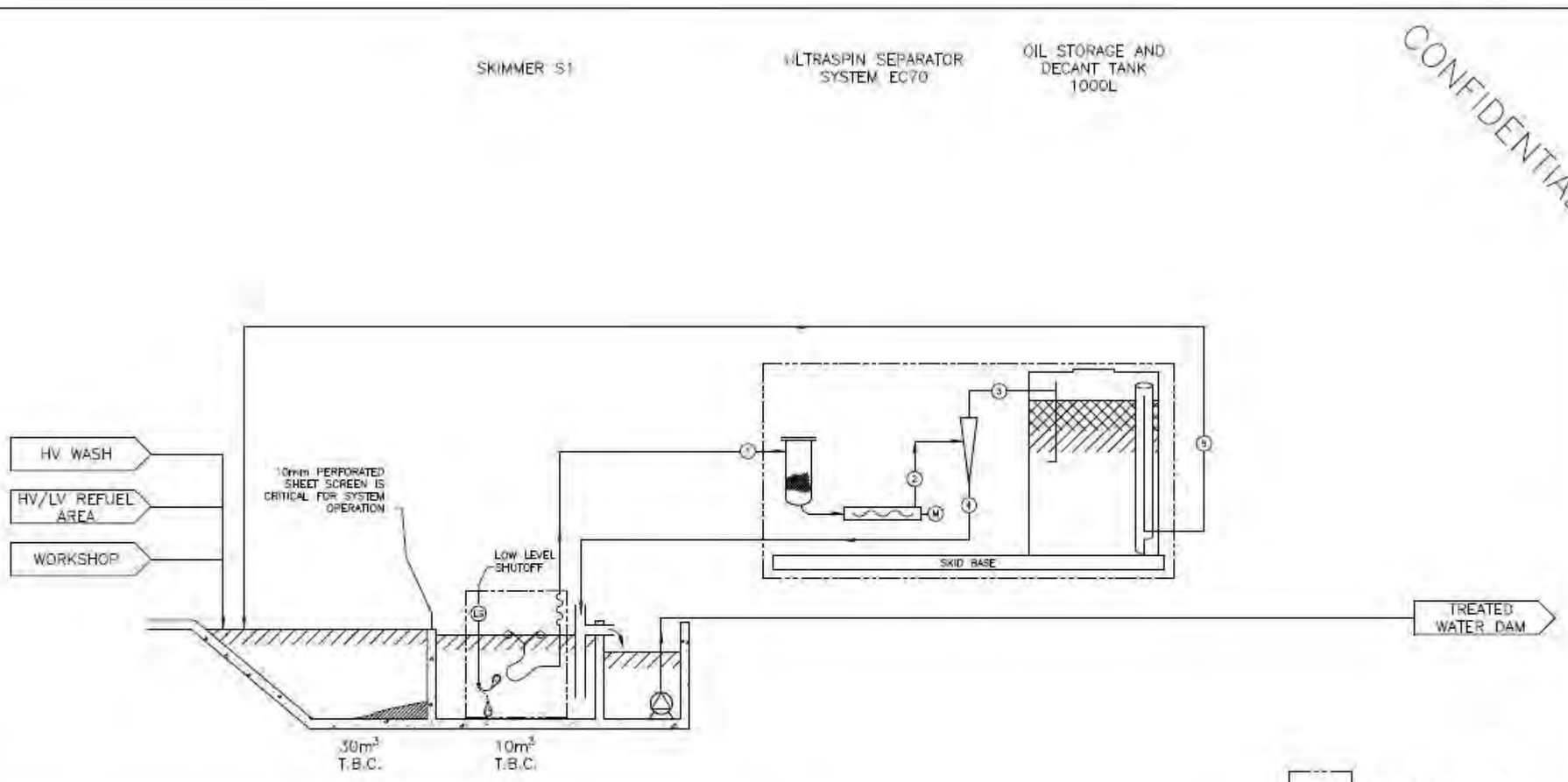
ULTRASPIN PTY LTD
46 WADHURST DRIVE, BORONIA, VIC. 3155
PH 61 3 8841 7200 FAX 61 3 8841 7299

CONFIDENTIAL

TITLE: TYPICAL OILY WATER PIT ARRANGEMENTS

CLIENT: GENERAL ISSUE

SCALE	SIZE	DOC No.	SHEET	REV
—	A4	I–P–0204–01	1 OF 1	2



PARAMETER (NORMAL OPERATING CONDITIONS)	STREAM ID				
	1	2	3	4	5
	SKIMMED OILY WATER	ULTRASPIN SEPARATOR FEED	SEPARATED OIL	TREATED WATER	WATER DECANT
PRESSURE (kPa)	−30	450	10	180	10
FLOW RATE (m^3/h)	7	7	0.35	6.65	0.35

DENOTES ULTRASPIN SCOPE OF SUPPLY.

GENERAL NOTES
1. ANY INTERCONNECTING PIPING IS NOT PART OF ULTRASPIN SUPPLY
2. SITE PIPING TO BE FREE DRAINING; NO RESTRICTIONS
3. OUTLET PIPING TO BE FREE DRAINING; NO RESTRICTIONS

REV	DESCRIPTION	DRAWN	CHKD	DATE
0	ISSUED FOR INFORMATION	L.P.	G.P.	07.08.17

DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE STATED
IF IN DOUBT ASK DO NOT SCALE
THIRD ANGLE PROJECTION UNLESS OTHERWISE STATED

ULTRASPIN PTY LTD
45 WADHURST DRIVE, BORONIA, VIC. 3155
PH 61 3 9841 9200

CONFIDENTIAL

TITLE
OILY WATER TREATMENT SYSTEM
PROCESS FLOW DIAGRAM (OPTION 2)

CLIENT
DACIAN GOLD
HV WASHBAY

SCALE	SIZE	DOC No.	SHEET	REV
–	A3	44574113–02	1 OF 1	0

ATTACHMENT 1

CONFIDENTIAL
NOT FOR CONSTRUCTION

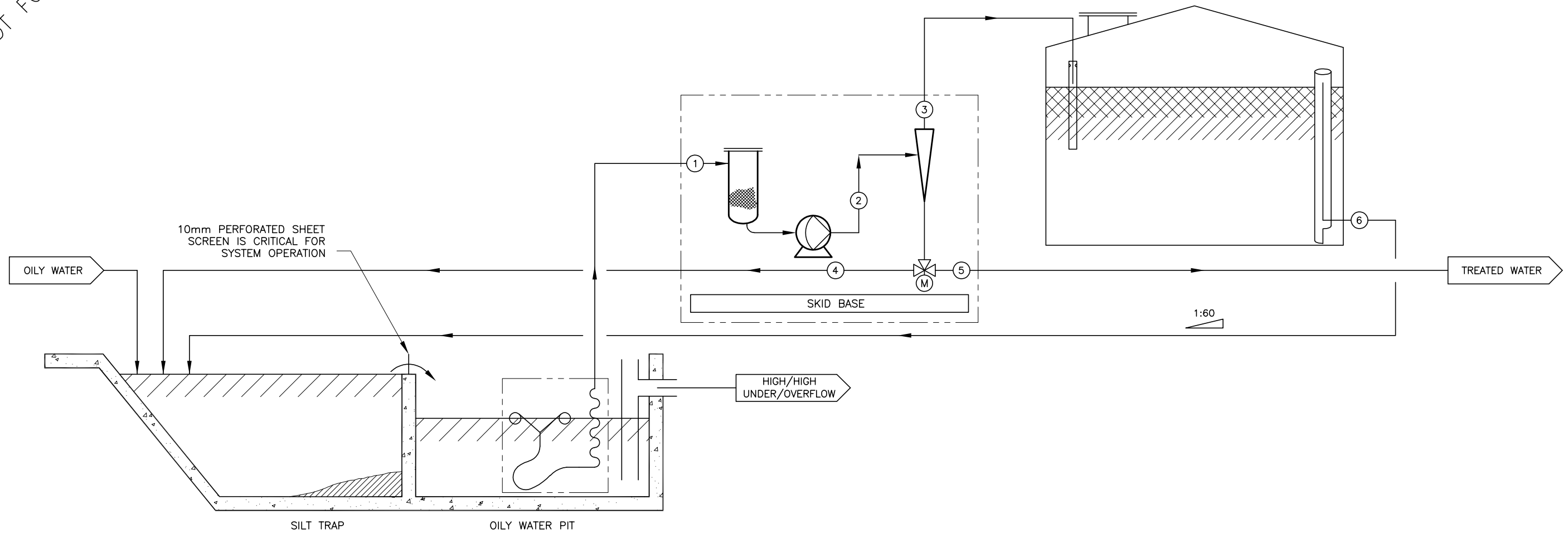
ULTRASPIN
OIL SKIMMER
MODEL: S1

DEBRIS STRAINER
3mm PERFORATION

SEPARATOR PUMP
AIR OPERATED
DIAPHRAGM PUMP

ULTRASPIN
OILY WATER SEPARATOR
MODEL: PB35–AR

OIL STORAGE AND
DECANT TANK



PARAMETER (NORMAL OPERATING CONDITIONS)	STREAM ID					
	1	2	3	4	5	6
	SKIMMED OILY WATER	DEOILING SEPARATOR FEED	DEOILING SEPARATOR REJECT	RECYCLE RETURN TO PIT	TREATED WATER	DECANT WATER
PRESSURE (kPa)	–30	400	5	180	180	5
FLOW RATE (m^3/h)	3.5	3.5	0.2	3.3	3.3	0.2

DENOTES ULTRASPIN SCOPE OF SUPPLY.

GENERAL NOTES
1. ANY INTERCONNECTING PIPING IS NOT PART OF ULTRASPIN SUPPLY
2. SITE PIPING TO BE FREE DRAINING; NO RESTRICTIONS
3. OUTLET PIPING TO BE FREE DRAINING; NO RESTRICTIONS
4. PUMP SUCTION MAX LENGTH 15m AND MAX VERTICAL RISE 2m

REV	DESCRIPTION	DRAWN	CHKD	DATE
0	ISSUED FOR APPROVAL	L.P.	–	13.11.18

DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE STATED

IF IN DOUBT ASK DO NOT SCALE

THIRD ANGLE PROJECTION UNLESS OTHERWISE STATED

ULTRASPIN PTY LTD
46 WADHURST DRIVE, BORONIA, VIC. 3155
PH 61 3 8841 7200

CONFIDENTIAL

TITLE
OILY WATER TREATMENT SYSTEM PROCESS FLOW DIAGRAM

CLIENT
TYPICAL
–

SCALE	SIZE	DOC No.	SHEET	REV
–	A3	PB35–AR–PFD	1 OF 1	0

Appendix E – Environmental Analysis Report

999 Hay Street,
Perth, WA 6000
Australia
www.ghd.com

Your ref: n/a
Our ref: 19561940

28 January 2022

Chief Executive Officer
City of Rockingham
PO BOX 2142
Rockingham WA 6967

Ecograf Battery Anode Material Facility: Lot 2 on Plan 404186, corner of Alumina Road and Zirconia Drive – Environmental analysis report

Dear Sir/Madam,

1. Introduction and scope

GHD was commissioned by Ecograf to complete, as part of the technical studies that will accompany the Development Assessment Panel application, an environmental analysis report. The report was prepared to satisfy the considerations listed for Development Applications in cl.4.4 of the City of Rockingham Planning Procedure No. 1.23 – Environmental Assessment.

2. Background

Ecograf Limited (Ecograf) is a battery anode material business, supporting the global transition to clean energy for the rapidly expanding electric vehicle and lithium-ion battery manufacturing industry. Ecograf is proposing to expand its production efforts as a response to market demand for graphite, typically for use in lithium-ion batteries.

The Project will involve milling of high-quality graphite flakes into battery-grade spherical graphite graphite to be used in lithium batteries which support the global transition to clean energy. Currently all global supply of spherical battery graphite is produced in China with a very toxic purification process using hydrofluoric acid. The Ecograf process removes the requirement to use hydrofluoric acid.

The Project will include the following facilities:

– Battery anode facility – Milling and purification of uncoated spherical graphite products
– Support offices
– Utilities corridor
– Roads and parking

This environmental analysis report has been written to support the Development Application. A Works Approval application has been prepared concurrently to the Development Application and will be submitted to the Department of Water and Environmental Regulation (DWER).

3. Environmental assessment

The environmental analysis against the considerations listed in cl.4.4 of the City of Rockingham Planning Procedure No. 1.23 – Environmental Assessment is shown in Table 1.

Table 1 Development Application environmental considerations

Development Application considerations	Assessment
The location, height, diameter at breast height and species of all trees onsite	Ministerial Statement 863, granted on 26/05/2011, was supported by a Strategic Environmental Assessment of the Rockingham Industry Zone (RIZ; EPA 2011). The strategic assessment identified the conservation values of the area including vegetation mapping of the area which identified four floristic community types. The15 trees on the site, five of which will be removed for the proposal are shown on the Site Plan. However, there is not sufficient information to identify their species at the desktop level. Additionally, MS 863 permits removal of all vegetation (subject to development approval).
Detailed site plan showing the location of the proposed development, including detailed information on any vegetation that will be removed to facilitate the proposed development, accessways and/or firebreaks	Broad scale (1:250,000) pre-European vegetation mapping of the area was completed by Beard (1979) at an association level (GoWA 2022). The Premises is within vegetation association 3048, vegetation type 18*; scrub-heath on the Swan Coastal Plain Mixed heath with scattered tall shrubs Acacia spp., proteaecea and myrtaceae.* This vegetation association has 29.9% of its extent remaining within the City of Rockingham, of which approximately 3.3 ha will be cleared. Refer to the Landscape Plan for the site for the detailed vegetation design.
The location of vegetation to be retained and the methodology used to protect it	Approximately 0.38 ha of land will be landscaped, and 0.34 ha of setback vegetation will be retained. The proposed Landscape Plan prepared by Plan E Landscape Architects will aim to retain and transplant as much of the existing vegetation as possible. 10 trees are proposed to be retained on the site. Methodology: – Trees to be retained will be flagged with tape – Areas to be cleared on the site will be well marked
The location and species of all trees proposed to be planted onsite	The Landscape Plan will aim to retain and transplant as many of the existing trees as possible. New trees and shrubs to be planted include: – *Eucalyptus gomphocephala* – *Allocasuarina sp* – *Melaleuca sp* – *Agonis sp* – *Xanthorrhoea sp* – *Banksia sp* To details on the location of the trees and vegetation to be planted on site refer to the Landscape Plan.
Opportunities to reduce the environmental impact by revising the proposal	The design for Ecograf has implemented the mitigation hierarchy as much as possible, with the resulting retention of vegetation and trees on site. The plants to revegetate the site will use native species to reduce impact. The development has been placed within the RIZ to reduce the environmental impacts. A review of Landgate data indicates that the area has historically been sparsely vegetated (GoWA 2022).

Development Application considerations	Assessment
	Both the state Ministerial Statement 863 and commonwealth EPBC approval (2010/5337) for the RIZ have conditions in place to reduce and offset the environmental impacts.
The potential of the proposal to contaminate soil and groundwater, and the requirement for contamination investigations	A review of DWER data shows that the development site is not listed as contaminated (GoWA 2022). The nearest contaminated site is located approximately 0.71 km north. A baseline contamination investigation will be undertaken prior to the commencement of the site lease. As Ecograf does not intent to undertake significant excavation or dewatering during construction there is a low risk of interaction with or exacerbation of contamination issues. During operations the graphite processing will involve the use of chemicals such as acid and caustic. To reduce the risk of contamination to soil and groundwater there are a number of planned controls: – All hydrocarbons or chemical containers will be stored within bunded containment areas – Bunded 14,500 L isotainers will be used to store caustic and acids on site and stored under roofed areas. Each Isotainer has its own separate bund which is sized at 110% the volume of the Isotainer. The concrete bunds are sealed with acid resistant epoxy coatings suitable for the reagent in use. Spillage into the bunds is to be pumped away to the Waste Water Treatment Plant (WWTP). Alternatively, spillage may be extracted by licenced waste transport operators for removal and disposal at a suitably licenced receival facility. – The Isotainers are stored away from the main sheds in an area accessible to be recharged via tankers to minimise the risk of spills. – Bunds and spill kits will be inspected weekly. Bund efficiency will also be monitored after large rainfall events. Rainfall captured into bunds will be pumped to the water treatment facility. – Surface water runoff will be retained on site in swales and directed to water storage. An oily water multistage interceptor system will treat water prior to storage in the large swale. – Spills will be contained with the use of spill kits. Contaminated soil will be disposed of to an appropriate landfill. Contaminated water will be pumped to the water treatment facility – Bores will be installed surrounding the premises and monitored 6 monthly to ensure no groundwater contamination is occurring. – All road surfaces will be kerbed to direct runoff to the various floodways. Entries into the drainage channels will be via nominated kerb openings. Hardstands will be constructed of concrete and roadways will be asphalt. The controls in place put the proposal at low risk of causing contamination to soil and groundwater.
Bushfire Management Plan and if any vegetation is proposed to be removed in order to reduce the bushfire risk of the development in accordance with SPP 3.7 - Planning in Bushfire Prone Areas	The development site is mapped within a bushfire prone area (GoWA 2022). The removal of vegetation of site will reduce bushfire risk. A Bushfire Management Plan prepared by Bushfire Prone Planning has been developed for the site and forms part of this application.
Coastal hazard risk in accordance with SPP 2.6 - State Coastal Planning	N/A. The site is not located on the coast.
Topography and if removal of vegetation is likely to result in significant erosion of landform	The topography of the site ranges from 6m to 9m Australian Height Datum (GoWA 2022). The site is mapped as a low wind erosion hazard and low water erosion hazard (GoWA 2022). The site generally grades towards the west and the intention is for the bulk earthworks design to emulate this natural drainage. The removal of vegetation on the site is unlikely to cause erosion.

Development Application considerations	Assessment
	The drainage systems necessary to collect, transfer and retain water are in accordance with the City of Rockingham Planning Procedure No 18 Urban Water Management and DWER Stormwater Management Manual for WA. The design will reduce the risk of erosion associated with the removal of vegetation on site.
The impact on local and regional surface and groundwater features	<u>Surface Water</u> The site is not within a Proclaimed Surface Water Area (GoWA 2022). No rivers or watercourses intersect the site or are located within the vicinity. There are no waterways, rivers or creeks or external catchments draining into the proposed site, and the site is characterised by deep well-draining sands. Swale drains are included within the site plan to capture rainwater There are no wetlands (Ramsar, Nationally Important, Geomorphic) wetlands with the site boundary (GoWA 2022). In addition, there are no Ramsar or Nationally Important wetlands within the vicinity of the Premises. A Geomorphic Wetland listed as a Conservation Category Wetland occurs approximately 1.2 km south-east of the Premises and a Resource Enhancement Wetland occurs approximately 0.5 km south-west of the Premises. <u>Groundwater</u> The site is located within the Cockburn Groundwater Area, proclaimed under the *Rights in Water and Irrigation Act 1914* (RIWI Act). The depth to groundwater is approximately 3 m below the natural surface, with the base of the aquifer approximately 30 m below the natural surface (DoW, 2021) The site is not located within a Public Drinking Water Source Area (PDWSA). No extraction of groundwater has been undertaken. <u>Water Management Strategy</u> Under Ministerial Statement 863 conditions, granted on 26/05/2011, a Water Management Strategy (WMS) was developed by Development WA for the Rockingham Industry Zone. Ecograf will act in accordance with the WMs and have developed a Surface Water Management Strategy (SWMS) for the site. The SWMS included a review of drainage systems necessary to collect, transfer and retain water in accordance with the City of Rockingham Planning Procedure No 18 Urban Water Management and DWER Stormwater Management Manual for WA. The control measures listed previously will limit the risk of impact to local and regional surface and groundwater features
Flood protection for any proposed buildings	The site is located within a low flood risk area (GoWA 2022). The implementation of the SWMS will reduce the risk from flood events.
The requirement for a Works Approval and License or Registration from DWER under the *Environmental Protection Regulations 1987*	Ecograf has submitted a Works Approval application to DWER which is currently being processed.
The impact of any emissions from industrial, commercial and rural developments on the health and amenity of people, with due regard shown to the EPA Document – *Separation Distances between Industrial and Sensitive Land Uses*	<u>Health</u> The potential impact to human health is from the dust generated from the graphite processing and potential gaseous emissions. To control these impacts the building will be negatively pressurised to prevent the escape of fine dusts. The graphite processing machinery is designed to separate and collect dust. Additionally, gases generated from activities will be sent to a scrubber and water waste will be treated on side before being sent to Water Corporation East Rockingham WWTP. The EPA - *Separation Distances between Industrial and Sensitive Land Uses* (2005) suggests industries that have dust and emissions impacts have a buffer distance ranging generally from 200 m to 2000 m. The site is approximately 1.5 km east and 3 km west of sensitive residential receptors, which combined with the control measures in place is sufficient to negate any adverse health impacts to humans.

Development Application considerations	Assessment
	<u>Amenity</u> The site is located within an industrial zone and is over 1 km away from sensitive residential receptors. Additionally, the site is topographically low, sitting at 6m to 9m Australian Height Datum so it will not have a dominant impact on the landscape. The project will have no impact on visual amenity.
Retention and detention of stormwater or other liquids produced on site	A Surface Water Management Strategy has been developed for the site; the design of the strategy ensures surface water runoff is contained within the site. Design measures include: – Drainage channels running the length of the site and receiving overland runoff from paved areas. – The channels discharge into the detention pond at the western most boundary. – Rainfall will be collected from downpipes and transferred via gutters to four belowground soak wells via a series of PVC pipes. – Surface water runoff will be retained on site in swales and directed to water storage. An oily water multistage interceptor system will treat water prior to storage in the large swale. – All road surfaces will be kerbed to direct runoff to the various floodways. Entries into the drainage channels will be via nominated kerb openings. Hardstands will be constructed of concrete and roadways will be asphalt. – The site will have an oily water multistage interceptor system system for any oil water produced during the process.
Proposed waste management and disposal method	The following waste management methods and controls are proposed for the site. <u>Inert and domestic wastes</u> – No waste disposal will be present onsite. – All wastes will be segregated in designated areas and removed from site for recycling, reuse or disposal by appropriately licenced subcontractors. <u>Solid wastes</u> – Capture of all solid wastes for disposal at an approved landfill site – Solid wastes will be stored in appropriate areas and in appropriate containers – All solid wastes will be segregated in designated areas and removed from site for recycling, reuse or disposal by appropriately licenced subcontractors. No capacity for long term storage has been allowed for and wastes will be regularly removed – EcoGraf has engaged with the Millar Road Landfill Facility to confirm that they are the appropriate facility for disposing of the benign solid wastes produced by the project. Completion of the optimisation process for the purification stage of the process will confirm that the waste produced will meet the requirements of the Landfill Waste Classification and Waste Definitions 1996 (As amended 2019). <u>Potential hydrocarbon and hazardous materials</u> – All hydrocarbons or chemical containers will be stored within bunded containment areas – Bunded 14,500 L isotainers will be used to store caustic and acids on site and stored under roofed areas. Each Isotainer has its own separate bund which is sized at 110% the volume of the Isotainer. The concrete bunds are sealed with acid resistant epoxy coatings suitable for the reagent in use. Spillage into the bunds is to pumped away to the waste water treatment plant. Alternatively, spillage may be extracted by licenced waste transport operators for removal and disposal at a suitably licenced receival facility. – The Isotainers are stored away from the main sheds in an area accessible to be recharged via tankers to minimise the risk of spills. – Bunds and spill kits will be inspected weekly. Bund efficiency will also be monitored after large rainfall events. Rainfall captured into bunds will be pumped to the water treatment facility.

Development Application considerations	Assessment
	– Surface water runoff will be retained on site in swales and directed to water storage. An oily water multistage interceptor system will treat water prior to storage in the large swale. – Spills will be contained with the use of spill kits. Contaminated soil will be disposed of to an appropriate landfill. Contaminated water will be pumped to the water treatment facility – Bores will be installed surrounding the premises and monitored 6 monthly to ensure no groundwater contamination is occurring. – All road surfaces will be kerbed to direct runoff to the various floodways. Entries into the drainage channels will be via nominated kerb openings. Hardstands will be constructed of concrete and roadways will be asphalt. <u>Wastewater</u> – All surface water will be collected and directed to on-site drainage swales. There will be no offsite release to surface water bodies during operation of the Project. – The oil/water multistage interceptor system will be designed as per a typical oily water pit arrangement and will include the following: • The inlet and outlet streams will be spaced as far apart as possible to allow for maximum residence time for setting • All pits will have a working depth (depth of water above the silt layer at the time the silt layer is at its deepest) of at least 1 m • Obstructions inside the pit will be reduced or eliminated to prevent skimmers from working properly • The accumulated sediment will be removed appropriately and the put will be cleaned • The pit structures will be protected during cleaning operations • The designed pit will be suitable for the levels of trash and debris, suspended solids and gross oil spills associated with the Project. – Wastewater generated from the Project will undergo the following treatment to ensure it meets Water Corporation Trade Waste receival requirements: • The graphite cleaning process will generate three waste liquor streams, a weak and strong acid stream and a caustic stream • EcoGraf are currently testing an option to recover reagents (acid and caustic) from the spent process liquor streams, which will reduce both the volume and extreme pH of the wastewater • Once the reagents are recovered, the streams will be combined, almost self-neutralising but with some small pH adjustment likely to be required • Toxic metals and other materials will be removed from the combined wastewater by precipitation • The wastewater, now suitable for discharge, will be sent to the inlet of Water Corporations East Rockingham WWTP as a trade waste • Solid wastes will be contained and disposed of at the Millar Road landfill facility. Additional details relating to waste management is contained within the waste management report prepared by Encycle Consulting.
Suitability of the site to support livestock in accordance with the Department of Primary Industries and Regional Development's *Stocking Rate Guidelines*	N/A. the development does not involve livestock.

Regards

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Graduate Environmental Scientist

+61 8 6222 8792
ellie.rivers@ghd.com

4. References

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Appendix F – Domestic Waste Management Report

encycle consulting

waste less, achieve more

EcoGraf Headquarters, East Rockingham

Waste Management Plan

27 January 2022

Rev_0

encycle consulting

waste less, achieve more

Encycle Consulting Pty Ltd
ABN 41 129 141 484

t: +61 8 9444 7668
JFerguson@encycle.com.au
www.encycle.com.au

Revision	Drafted	Reviewed	Date issued
Rev_0	J Ferguson	A Bremner	27 January 2022

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Glossary of terms and acronyms

Commingled recycling	Common recyclables, mostly packaging; such as glass, plastics, aluminium, steel, liquid paper board (milk cartons). Commingled recycling may include paper but often, and particularly in offices, paper and cardboard are collected separately.
General Waste	Material that is intended for disposal to landfill (or in some States, incineration), normally what remains after the recyclables have been collected separately.
MGB	Mobile Garbage Bin – A wheeled bin with a lid often used for kerbside collection of waste or recyclables. (Often called a 'wheelie bin').
MRB	Mobile Recycling Bin – A wheeled bin ("wheelie" bin) with a lid often used for kerbside collection of recyclables (similar to an MGB). Generally have a different colour body and/or lid to MGBs.
Organic waste	Separated food and/or 'green' material (e.g. grass clippings or vegetation prunings).
Recyclable	Material that can be collected separately from the general waste and sent for recycling. The precise definition will vary, depending upon location (i.e. systems exist for the recycling of some materials in some areas and not in others).
Recycling	Where a material or product undergoes a form of processing to produce a feedstock suitable for the manufacture of new products.
Reuse	The transfer of a product to another user, with no major dismantling or processing required. The term "reuse" can also be applied in circumstances where an otherwise disposable item is replaced by a more durable item hence avoiding the creation of waste (e.g. using a ceramic coffee mug in place of disposable cups).

1 Introduction

This Waste Management Plan (WMP) has been prepared for Hunt Architects on behalf of their client EcoGraf for the Development Application, for the proposed industrial graphite processing facility development on Zirconia Drive, East Rockingham. This WMP only takes into consideration the office administration areas, with the industrial component of the waste stream to be covered in the environmental report.

The proposed development contains 333 m^2 of office space for business administration.

This WMP has been prepared based on the following information:

- Architectural plans from Hunt Architects received 27 January 2022
- Floor areas (NLA) for the active spaces (office areas/meeting rooms) received 18 January 2022
- City of Rockingham – Planning Procedure 1.11, updated 30/09/2021
- WALGA 'Commercial and Industrial Waste Management Plan Guidelines' (2017)
- Conversation and email correspondence on 25 January 2022 with City of Rockingham, Aaron Blair, Acting Manager Waste Services regarding council waste management requirements

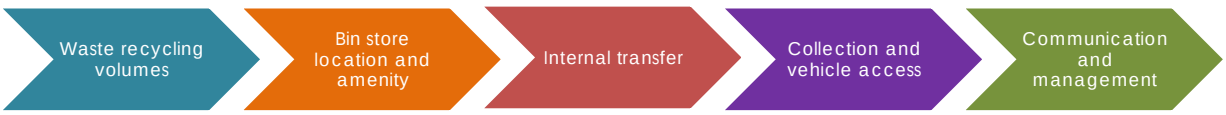
1.1 Context

For efficient and effective waste management, the collection and centralisation of waste and recyclables should be carefully considered at the building design phase. Key factors to consider at the design phase include:

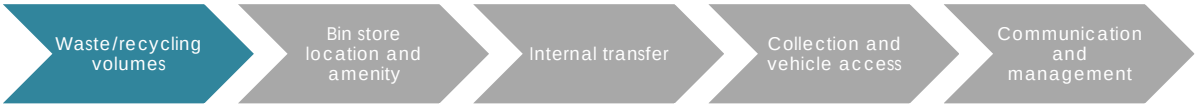
- The volumes of waste and recyclables likely to be generated during building operation
- Size of bin storage area
- Safety for all operatives involved in waste management
- Access to bins and storage areas from within the building
- Access for trucks for waste collection
- Local council requirements
- Amenity (odours and noise)
- The ongoing management of waste and recycling services

1.2 Key components of the WMP

This WMP consists of five core components. The following report will present detailed information on each of the following components.



2 Estimated waste and recycling volumes



2.1 Local government requirements for waste volumes and bin type

The WALGA 'Commercial and Industrial Waste Management Plan Guidelines' (2017) have been used as a basis for estimating waste generation rates for the office areas only for this development, in addition to Encycle's experience and knowledge. Specifically, the generation rates used are presented below. WALGA waste generation rates do not include a breakdown of material streams included in the 'recycling' stream. The final column presents Encycle Consulting's in-house estimate of the material streams present in the recycling stream based on our working experience of operational buildings in Perth.

For commercial waste and recycling the following rates have been applied.

Premises type	Waste generation rate	Recycling generation rate	Percentage breakdown of recycling stream by material
Office	0.1 L /1m²/day	0.1 L /1m²/day	79% paper 14% cardboard 10% soft plastics 7% commingled

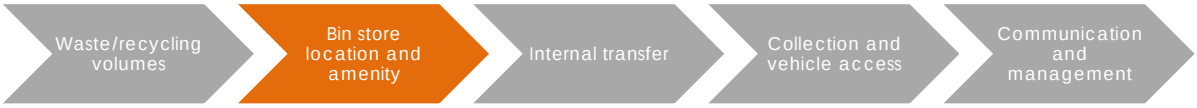
2.2 Number and type of bins required for office areas of development

The bin numbers for the office areas, based on 333 m² are shown in Table 1.

Table 1: Number of general waste and recycling bins for office areas

	Bin size (L)	Number of bins	Collection frequency
General Waste	240	1	Weekly
Commingled recycling	360	1	Fortnightly
Soft plastic	240	1	As required
FOGO (if/when needed)	120	1	Weekly
Ad hoc recyclables	Additional space is provided for recyclable items such as toners, printer cartridge, batteries, light globes etc.		

3 Bin store location and amenity



3.1 Bin store location

The office areas will have a separate bin store to allow for the individual storage and collection of administration office waste and recycling.

The bin store will be located on ground level nect to the main administration building (refer Figure 1). The layout of the bin stores is shown in Figure 2.

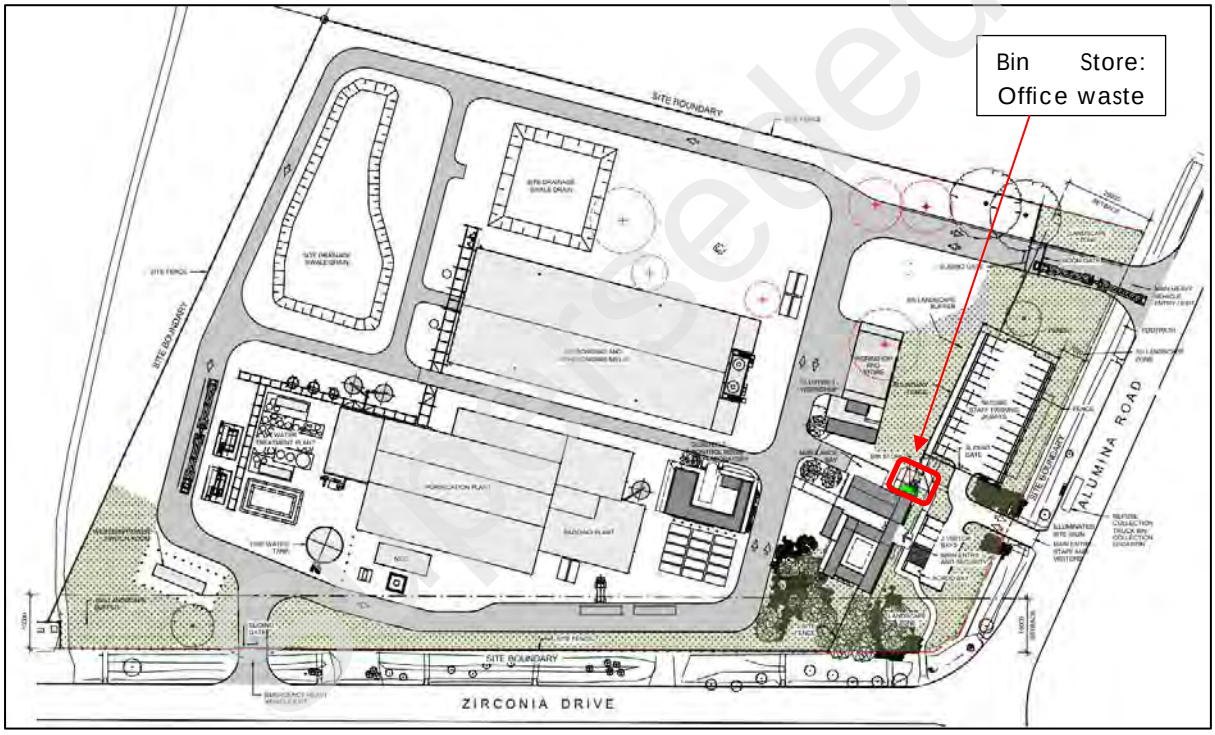


Figure 1: Site plan showing the location of office bin store

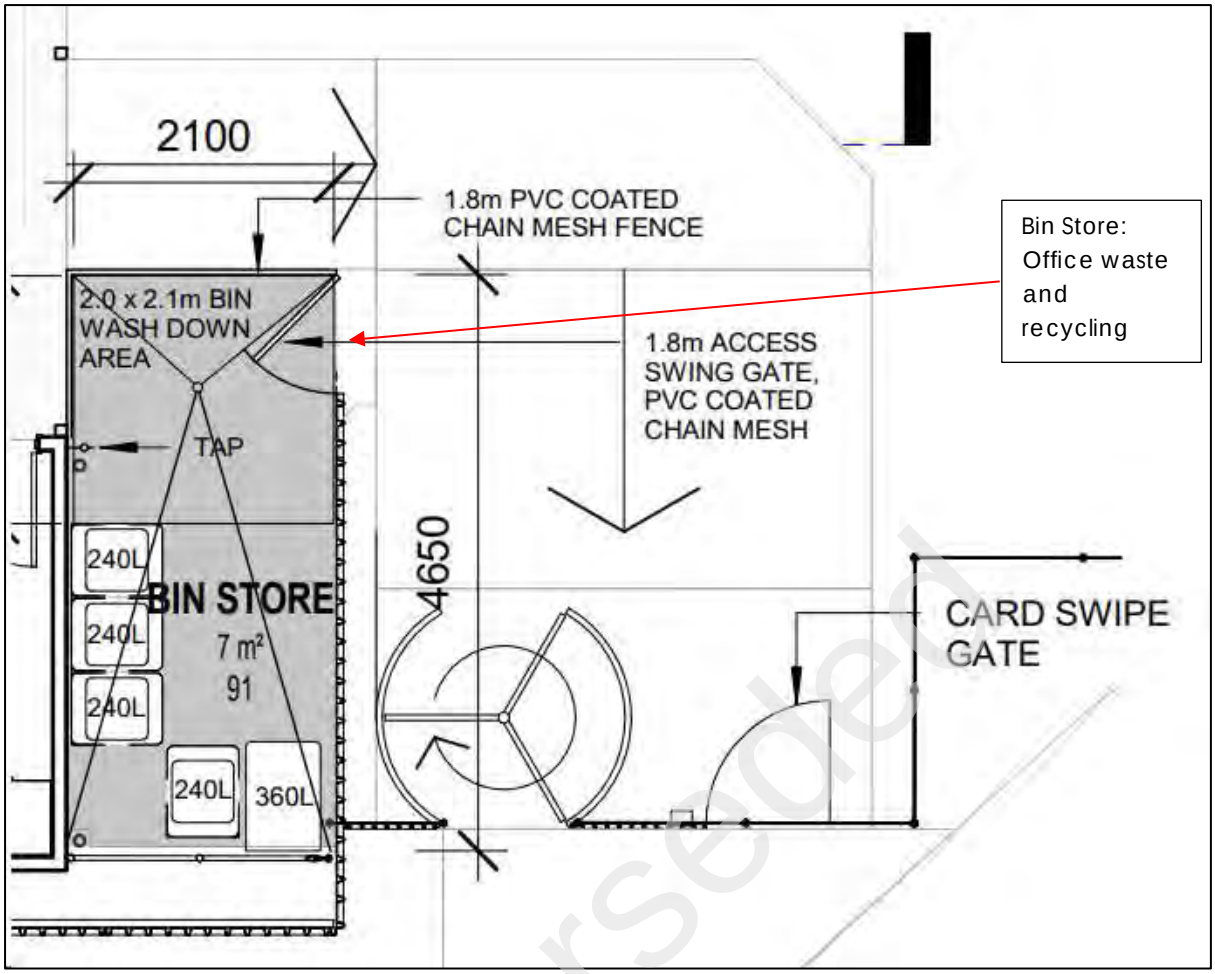
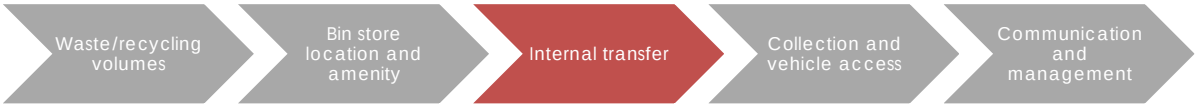


Figure 2: Layout of bin store

3.2 Bin store amenity

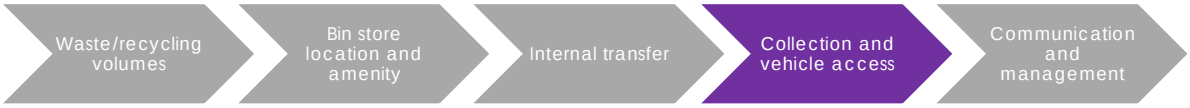
Bin Transfer	
Aisle door and lift width:	All doors, corridors and lifts on the transfer route are designed for the largest bin to fit through.
General health and safety:	Waste systems are designed to ensure that bins (particularly when full) are not required to be moved over any significant distances, up/down steep ramps (grade of slope <1:20) and definitely avoid stairs or other potential hazards.
	Manual handling of waste in garbage bags is excluded from the waste management systems where possible.
Bin store	
Washing bins and waste storage area:	Impermeable floors grading to an industrial floor waste (including a charged 'water-trap' connected to sewer or an approved septic system), with a hose cock to enable bins and /or the enclosure to be washed out. 100 mm floor waste gully to waste outlet. Cold water will be available.
Bin store walls and ceilings:	All internal walls in bin stores will be cement rendered (solid and impervious) to enable easy cleaning. Ceilings will be finished with a smooth faced, non-absorbent material capable of being easily cleaned. Walls and ceilings will be finished or painted in a light colour.
Ventilation and odour:	The design of bin store/s will provide for adequate separate ventilation with a system that complies with Australian Standard 1668 (AS1668). The ventilation outlet is not in the vicinity of windows or intake vents associated with other ventilation systems.
Doors:	Ventilated doors will be specified both internally and externally to enable bins to be easily wheeled into and out of the bin stores.
Vermin:	Self-closing doors to the bin store/s will be installed to eliminate access by vermin
Lighting:	Bin store/s will be provided with artificial lighting, sensor or switch controlled both internal/external to the room.
Noise:	Noise is to be minimised to prevent disruption to occupants or neighbours.
Fully Enclosed:	The bin store will be fully enclosed and only be accessible by staff and the waste service provider.
Aesthetics:	The bin store will be consistent with the overall aesthetics of the development.
Signage:	Visual aids and signage will be provided to ensure that the area works as intended.

4 Internal transfer



Office staff and/or cleaners from the office areas on the ground floor will manually transfer waste and recyclables to the bin store, located on the ground floor, via service corridors and safely marked out pathways.

5 Collection and vehicle access



The City of Rockingham will service the commercial general waste and recycling bins, while private service providers will service other collections if they are required.

On collection days City of Rockingham vehicles, consisting of rear-lift and side-lift (for general waste and recycling), can undertake a kerbside service from Alumina Road to the north of the main entry for staff and visitors. The rear-lift or side lift vehicles will drive in a forwards motion and park alongside the road verge closest to the bin presentation point to collect the bins. Bins will be presented in a single row along the road-verge for collection.

Analysis for vehicle ingress and egress has been completed by Hunt Architects taking into consideration the specifications of the largest rear lift waste collection vehicles (see Figure 3).

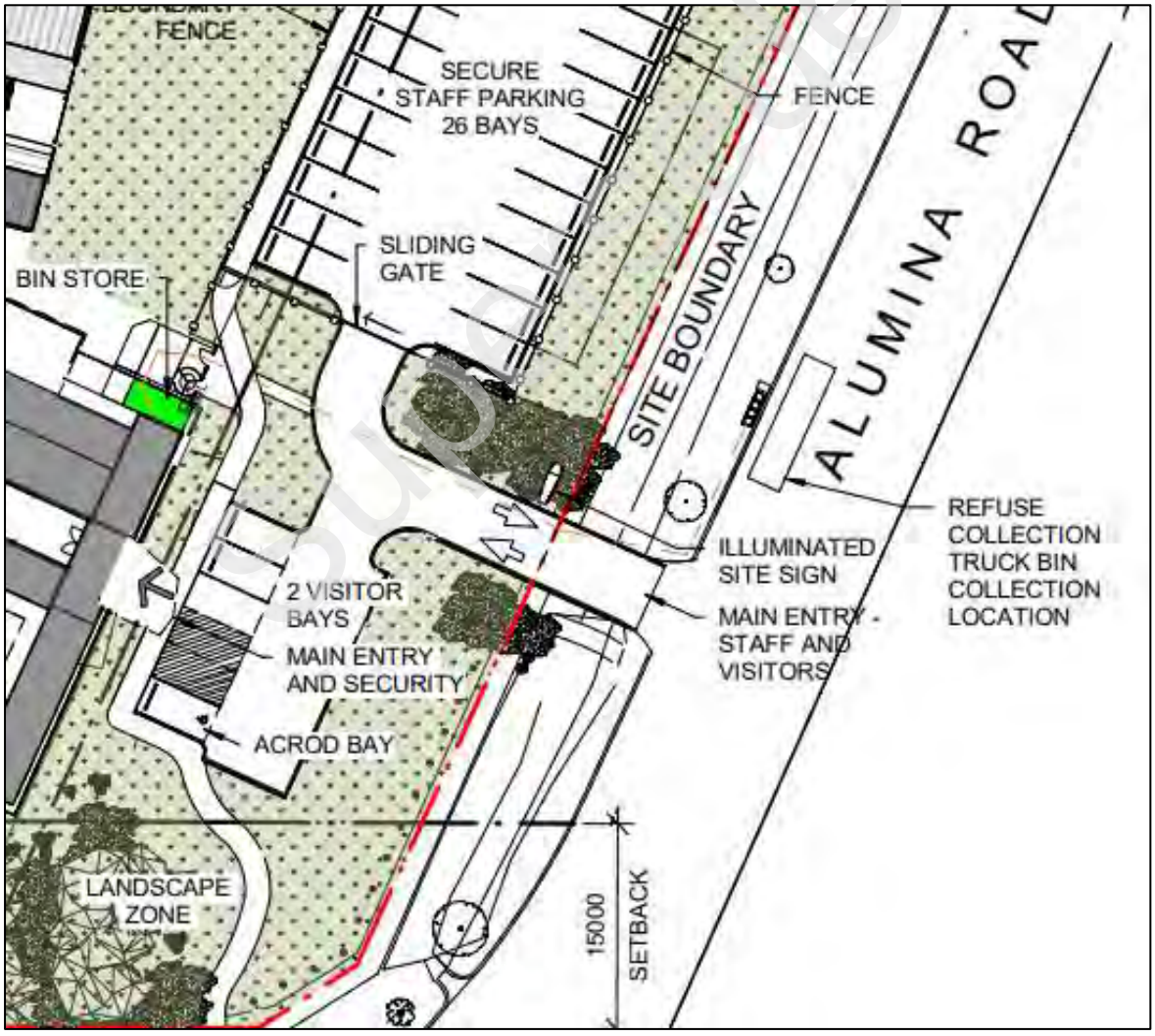
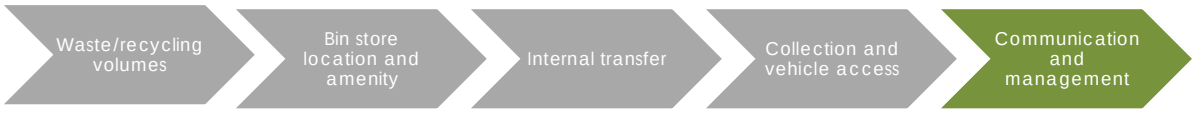


Figure 3: Alumina Road presentation and collection point for waste collection vehicles

6 Ongoing communication and management



6.1 Management

A designated EcoGraf staff member will be responsible for overseeing the waste management systems. The staff member will be trained and informed about their responsibility to work closely with the City of Rockingham regarding the schedule for collection and presentation of bins. The staff member will be responsible for maintaining the bin store in a clean and tidy condition at all times and ensuring bins are washed regularly.

6.2 Communication

EcoGraf staff members will be made aware through a corporate document (or equivalent) of the waste and recycling systems and how they should be used. An operational Waste Management Plan suitable for presenting to building users, including how the plan should be communicated will be developed and implemented during both the initial occupation and ongoing management of the building.

A designated EcoGraf staff member will be responsible for the continuing education of staff on correct segregation of waste and recyclables to ensure successful performance of the waste and recycling systems.

Appendix G – Bushfire Management Plan (BMP)

Bushfire management plan/Statement addressing the Bushfire Protection Criteria coversheet

Site address: Lot 2 Zirconia Drive, East Rockingham

Site visit: Yes ☑ No ☐

Date of site visit (if applicable): Day 18th Month August Year 2021

Report author or reviewer: Ian Macleod

WA BPAD accreditation level (please circle):

Not accredited ☐ Level 1 BAL assessor ☐ Level 2 practitioner ☑ Level 3 practitioner ☐

If accredited please provide the following.

BPAD accreditation number: 39131 Accreditation expiry: Month November Year 2022

Bushfire management plan version number: 1.1

Bushfire management plan date: Day 25th Month January Year 2022

Client/business name: Ecograf

	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 bushfire protection criteria elements)?		✔

Is the proposal any of the following (see SPP 3.7 for definitions)?	Yes	No
Unavoidable development (in BAL-40 or BAL-FZ)		✔
Strategic planning proposal (including rezoning applications)		✔
High risk land-use		✔
Vulnerable land-use		✔

None of the above ☑

Note: Only if one (or more) of the above answers in the tables is yes should the decision maker (e.g. local government or the WAPC) refer the proposal to DFES for comment.

Why has it been given one of the above listed classifications (E.g. Considered vulnerable land-use as the development is for accommodation of the elderly, etc.)?

The information provided within this bushfire management plan to the best of my knowledge is true and correct:

Signature of report author or reviewer 

Date 25th January 2022

Bushfire Management Plan

Lot 2 Zirconia Drive, East Rockingham

City of Rockingham

Planning Stage:	Development Application
Planning Development Type:	Construction of Class 4 - 9 Buildings
Bushfire Policy – Specific Development or Use Type:	N/A

Job Number:	190466
Assessment Date:	18 August 2021
Report Date:	19 January 2022

BPP Group Pty Ltd t/a Bushfire Prone Planning
ACN: 39 166 551 784 | ABN: 39 166 551 784

Level 1, 159-161 James Street
Guildford WA 6055

PO Box 388
Guildford WA 6935

08 6477 1144 | admin@bushfireprone.com.au

DOCUMENT CONTROL

PREPARATION		
Author:	Ian Macleod (BPAD Level 2 - No. 39131)	Ian Macleod
Co-Author:	Select.	
Review/Authorise:	Kathy Nastov (BPAD Level 3 - No. 27794)	K. Nastov

VERSION HISTORY		
Version	**Version Details**	**Date**
1.0	Original Document Issue	19 January 2022
1.1	Revised site plan, mapping amended.	25 January 2022

BMP (Standard DA-Non-Tourism) Template v8.5

DISTRIBUTION				
Destination	**Version**	**No. Copies**	**Hard Copy**	**Electronic Copy**
Person/Business: Shaun O'Neill/Ecograf **Email: soneill@ecograf.com.au**	1.1		☐	☒
Person/Business: **Email:**			☐	☐

Limitation of Liability: The measures contained in this Bushfire Management Plan, are considered to be minimum requirements and they do not guarantee that a building will not be damaged in a bushfire, persons injured, or fatalities occur either on the subject site or off the site while evacuating. This is substantially due to the unpredictable nature and behaviour of fire and fire weather conditions. Additionally, the correct implementation of the required bushfire protection measures will depend upon, among other things, the ongoing actions of the landowners and/or operators over which Bushfire Prone Planning has no control.

All surveys, forecasts, projections and recommendations made in this report associated with the proposed development are made in good faith based on information available to Bushfire Prone Planning at the time. All maps included herein are indicative in nature and are not to be used for accurate calculations.

Notwithstanding anything contained therein, Bushfire Prone Planning will not, except as the law may require, be liable for any loss or other consequences whether or not due to the negligence of their consultants, their servants or agents, arising out of the services provided by their consultants.

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EXECUTIVE SUMMARY

This Bushfire Management Plan is to accompany a Development Application for a Micronising, Spheronising and Purification Plant at Lot 2 Zirconia Drive, East Rockingham in the City of Rockingham. The proposal will be constructed wholly on Lot 2. However, there is scope to expand onto the neighbouring Lot 1 at a later date.

The assessments and bushfire protection measures detailed the BMP, assume that environmental approval will be achieved or clearing permit exemptions will apply. The whole of the subject lot is to be maintained to a low bushfire threat state. Substantial trees will be maintained where possible.

This proposal is compliant with the Acceptable Solutions of the Bushfire Protection Criteria.

The required bushfire protection measures can be achieved within the subject lot boundaries and will not affect the bushfire and environmental management of neighbouring lots.

The proposed development will provide an area of land within the lot that can be considered suitable for development as buildings within this area will be subject to BAL ratings of BAL-29 or lower. This meets the requirements established by Acceptable Solution A1.1 and its associated explanatory note.

Future buildings on the lot of the proposed development can be surrounded by an APZ that will ensure the potential radiant heat impact of a bushfire does not exceed 29 kW/m2 (BAL-29). The required APZ specifications of width, location and management can be achieved within the lot boundaries.

For this proposed development, the whole of the subject lot is to be managed and maintained to a low bushfire threat state in perpetuity.

Two different vehicular access/egress routes to two different destinations are available to the subject site. The routes are constructed public roads which are available to occupants of the site, and the public, at all times and under all weather conditions.

The proposed development has a looped internal driveway system for the main production area, with two different entry/exit locations. Proposed driveway widths range from 4 to 8 metres. A parking area for workers and visitors is separate to the main site access driveways and has an available turnaround area for fire appliances.

The subject lot will comply with the requirements of the local government annual firebreak notice issued under s33 of the Bush Fires Act 1954.

A reticulated water supply is available to the subject site Hydrants are located on Zirconia Drive and Alumina Road The nearest hydrant is located 28 metres from the subject site on the south side of Zirconia Drive.

Buildings of Class 4 to Class 9 are not required by the Building Code of Australia (BCA) to be constructed to comply with bushfire performance requirements. As the future buildings will be located in a bushfire prone area and may be subject to a bushfire attack, Bushfire Prone Planning recommends that some degree of upgrading be considered to improve the protection for occupants and the building's survivability. At a minimum protection from ember attack should be considered (i.e. constructed to the standard required for BAL-12.5).

1 PROPOSAL DETAILS

1.1 Description and Associated Plans and Maps

Proponent:	Ecograf
Bushfire Prone Planning Commissioned to Produce the Bushfire Management Plan (BMP) By:	Ecograf
For Submission To:	City of Rockingham
Purpose of the BMP:	To accompany a planning application
'Development' Site Total Area:	3.7711 hectares
Description of the Proposed Development/Use:	
This Bushfire Management Plan is to accompany a Development Application for a Micronising, Spheronising and Purification Plant at Lot 2 Zirconia Drive, East Rockingham in the City of Rockingham. The proposal will be constructed wholly on Lot 2. However, there is scope to expand onto the neighbouring Lot 1 at a later date.	

Figure 1.1

Proposed Development Site Layout Map

Lot 2 on Plan 404186
Zirconia Drive
EAST ROCKINGHAM
CITY OF ROCKINGHAM

Id	Building Description
1	Micronising-Spheronising Plant
2	Purification Plant
3	Bagging Plant
4	Workshop-Store
5	Administration-Security
6	Control Room - Lab
7	MCC
8	Water Treatment

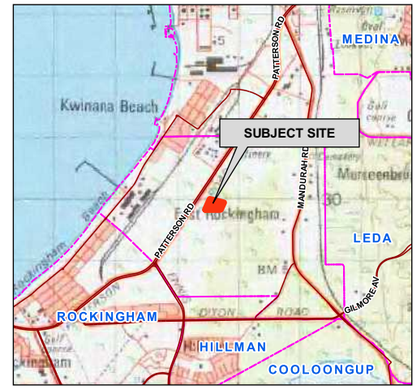
------ LEGEND ------

- Hydrant
- Fire Water Tank
- Structures
- Silo
- Container
- Western Power Switch Room
- Waste Water Pit
- Drainage Swale
- Managed Areas
- Landscape Areas
- Driveway
- Subject Lot
- Cadastre

0 10 20 30 40 50 60

Metres

------ LOCALITY ------



AERIAL IMAGERY: Landgate/SLIP

Coordinate System: GDA 1994 MGA Zone 50
Projection: Universal Transverse Merctaor Units: Metre
Map by: Ian Macleod 25-01-2022
SCALE (A3): 1 : 1000

BUSHFIRE PRONE PLANNING

ATTACHMENT 1

Figure 1.2

Proposed Development Bushfire Prone Areas Map

Lot 2 on Plan 404186
Zirconia Drive
EAST ROCKINGHAM
CITY OF ROCKINGHAM

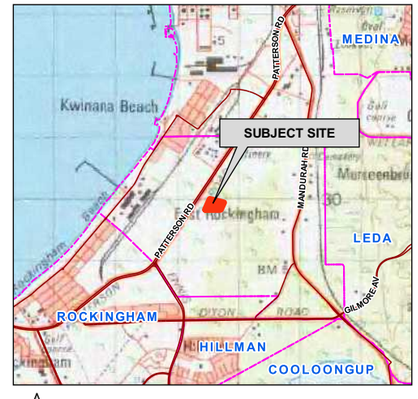
------ LEGEND ------

- DFES Stations
- Bush Fire Prone Areas 2021
- Subject Lot
- Cadastre

0 200 400 600 800 1,000 1,200

Metres

------ LOCALITY ------



AERIAL IMAGERY: Landgate/SLIP

BUSHFIRE PRONE PLANNING

Coordinate System: GDA 1994 MGA Zone 50
Projection: Universal Transverse Merctaor Units: Metre
Map by: Ian Macleod 20-12-2021
SCALE (A3): 1 : 20000

1.2 Existing Documentation Relevant to the Construction of this Plan

This section acknowledges any known reports or plans that have been prepared for previous planning stages, that refer to the subject area and that may or will impact upon the assessment of bushfire risk and/or the implementation of bushfire protection measures and will be referenced in this Bushfire Management Plan.

Table 2.1: Existing relevant documentation.

RELEVANT EXISTING DOCUMENTS		
Existing Document	Copy Provided by Client	Title
Structure Plan	N/A	
Environmental Report	No	
Landscaping (Revegetation) Plan	No	
Bushfire Risk Assessments	No	

2 ENVIRONMENTAL CONSIDERATIONS

2.1 Native Vegetation – Restrictions to Modification and/or Clearing

Many bushfire prone areas also have high biodiversity values. SPP 3.7 policy objective 5.4 recognises the need to consider bushfire risk management measures alongside environmental, biodiversity and conservation values (Guidelines s2.3).

There is a requirement to identify any need for onsite modification and/or clearing of native vegetation and whether this may trigger potential environmental impact/referral requirements under State and Federal environmental legislation. Confirmation that any proposed native vegetation modification and/or clearing is acceptable, should be received from the relevant agencies by the proponent and provided to the bushfire consultant for inclusion in the Bushfire Management Plan if it will influence the required bushfire planning assessments and outcomes. The following table details any potential environmental restrictions of which the author of this report is aware.

Table 2.2: Native vegetation and potential environmental considerations and restrictions.

NATIVE VEGETATION MODIFICATION / CLEARING - POTENTIAL ENVIRONMENTAL RESTRICTIONS IDENTIFIED				
Environmental Considerations / Features	Potential Mapping Data Source (SLIP / Local Planning)	Relevant to Proposed Development	Data Applied	Action Required
Onsite clearing of native vegetation is required.		Yes		
Environmental impact/referral requirements under State and Federal environmental legislation may be triggered.		Possible		
National Park / Nature Reserve	DBCA-011	No-Confirmed by Bushfire Consultant	Relevant Database Reviewed by Bushfire Consultant	None
Conservation Covenant	DPIRD-023	Not Known	Data Not Readily Available to Bushfire Consultant	Proponent to Seek Advice
Bush Forever Site	DPLH-019	No-Confirmed by Bushfire Consultant	Relevant Database Reviewed by Bushfire Consultant	None
RAMSAR Wetland	DBCA-010	Not Known	Data Not Readily Available to Bushfire Consultant	Proponent to Seek Advice
Geomorphic and Other Wetland	DBCA-011-019, 040, 043, 044	Not Known	Data Not Readily Available to Bushfire Consultant	Proponent to Seek Advice
Threatened and Priority Ecological Communities (TECs or PECs)	DBCA-038	Possible	Data Not Readily Available to Bushfire Consultant	Proponent to Seek Advice
Threatened and Priority Flora including Declared Rare Flora (DRFs)	DBCA-036	Possible	Data Not Readily Available to Bushfire Consultant	Proponent to Seek Advice
Land Identified as significant through a Local Biodiversity Strategy	LG - Intramaps	Not Known	Data Not Readily Available to Bushfire Consultant	Proponent to Seek Advice

Statement of how the identified environmental feature(s) is dealt with in this Bushfire Management Plan (and the location of relevant information):

The assessments and bushfire protection measures detailed the BMP, assume that environmental approval will be achieved or clearing permit exemptions will apply.

It is advised that the proponent seek further advice from an Environmental Consultant or the WA Department of Biodiversity Conservation and Attractions for further information on the condition and species contained within the proposed development area and the requirement for referral of the proposal.

Development Design Considerations

Establishing development in bushfire prone areas can adversely affect the retention of native vegetation through clearing associated with the creation of lots and/or asset protection zones. Where loss of vegetation is not acceptable or causes conflict with landscape or environmental objectives, it will be necessary to consider available design options to minimise the removal of native vegetation.

Table 2.3: Development design.

MINIMISE THE REMOVAL OF NATIVE VEGETATION	
Design Option	Assessment / Action
Reduction of lot yield	N/A
Cluster development	N/A
Construct building to a standard corresponding to a higher BAL as per BCA (AS 3959:2018 and/or NASH Standard)	N/A
Modify the development location	N/A
The whole of the subject lot is to be maintained to a low bushfire threat state. Substantial trees will be maintained where possible.	
IMPACT ON ADJOINING LAND	
Is this planning proposal able to implement the required bushfire protection measures within the boundaries of the land being developed so as not to impact on the bushfire and environmental management of neighbouring reserves, properties or conservation covenants?	Yes
The required bushfire protection measures can be achieved within the subject lot boundaries and will not affect the bushfire and environmental management of neighbouring lots.	

2.2 Retained Vegetation / Re-vegetation / Landscape Plans (including POS)

Riparian zones, wetland/foreshore buffers, road verges and public open space may have plans to re-vegetate or retain vegetation as part of the proposed development. Vegetation corridors may be created between offsite and onsite vegetation and provide a route for fire to enter a development area.

All retained/planned vegetation and its management will be considered in the development of this Bushfire Management Plan.

Is re-vegetation of riparian zones and/or wetland or foreshore buffers and/or public open space a part of this Proposal?	No
N/A	
Is the requirement for ongoing maintenance of existing vegetation in riparian zones and/or wetland or foreshore buffers and/or public open space a part of this Proposal?	No
N/A	
Has a landscape plan been developed for the proposed development?	No
N/A	

3 POTENTIAL BUSHFIRE IMPACT ASSESSMENT

3.1 Assessment Input

3.1.1 Fire Danger Index (FDI) Applied

AS 3959:2018 Table 2.1 specifies the fire danger index values to apply for different regions. The values used in the model calculations are for the Forest Fire Danger Index (FFDI) and for which equivalent representative values of the Grassland Fire Danger Index (GFDI) are applied as per Appendix B. The values can be modified if appropriately justified.

Table 3.1: Applied FDI Value

FDI VALUE			
Vegetation Areas	As per AS 3959:2018 Table 2.1	As per DFES for the Location	Value Applied
All Vegetation Areas	80	N/A	80

3.1.2 Vegetation Classification and Effective Slope

Classification: Bushfire prone vegetation identification and classification has been conducted in accordance with AS 3959:2018 s2.2.3 and the Visual Guide for Bushfire Risk Assessment in WA (DoP February 2016).

When more than one vegetation type is present, each type is identified separately, and the applied classification considers the potential bushfire intensity and behaviour from the vegetation types present and ensures the worst case scenario is accounted for – this may not be from the predominant vegetation type.

The vegetation structure has been assessed as it will be in its mature state (rather than what might be observed on the day). Areas of modified vegetation are assessed as they will be in their natural unmodified state (unless maintained in a permanently low threat, minimal fuel condition, satisfying AS 3959:2018 s2.2.3.2(f) and asset protection zone standards). Vegetation destroyed or damaged by a bushfire or other natural disaster has been assessed on its revegetated mature state.

Effective Slope: Refers to the ground slope under each area of classified vegetation and is described in the direction relative to the view from the building or proposed development site. Effective slope is not the same as 'average slope', rather it is the slope which most significantly influences fire behaviour. This slope has a direct and significant influence on a bushfire's rate of spread and intensity.

Where there is a significant change in effective slope under an area of classified vegetation, that will cause a change in fire behaviour, separate vegetation areas will be identified to enable the correct assessment.

When the effective slope, under a given area of bushfire prone vegetation, will be different relative to multiple proposed development sites, then the effective slopes corresponding to the different locations, are separately identified.

Table 3.2: Vegetation classification and effective slope.

ALL VEGETATION WITHIN 150 METRES OF THE PROPOSED DEVELOPMENT				
Vegetation Area	Identified Vegetation Types [1] or Description if 'Excluded'	Applied Vegetation Classification [1]	Effective Slope (degrees)[2] (AS 3959:2018 Method 1)	
			Assessed	Applied Range
1	Closed scrub D-13 Open scrub D-14	Class D Scrub	0	upslope or flat
2	Closed scrub D-13 Open scrub D-14	Class D Scrub	0	upslope or flat
3	Open forest A-03	Class A Forest	0	upslope or flat
4	Open scrub D-14	Class D Scrub	0	upslope or flat
5	Tussock grassland G-22	Class G Grassland	0	upslope or flat
6	Open scrub D-14	Class D Scrub	0	upslope or flat
7	Open heath C-11	Class C Shrubland	0	upslope or flat
8	Non-vegetated areas	Excluded as per Section 2.2.3.2 (e) Non Vegetated Areas	N/A	N/A
Representative photos of each vegetation area, descriptions and classification justification, are presented on the following pages. The areas of classified vegetation are defined, and the photo locations identified on Figure 3.1, the vegetation and topography map.				
Note[1]: Described and classified as per AS 3959:2018 Table 2.3 and Figures 2.3 and 2.4 (A)-(H) Note[2]: Effective slope measured as per AS 3959:2018 Section 2.2.5 and Appendix B Part B4				

VEGETATION AREA 1		
AS 3959:2018 Vegetation Classification Applied:	Class D Scrub	
Vegetation Types Present:	Closed scrub D-13	Open scrub D-14
Description/Justification:	Photos 1a and 1b: Coastal scrub to 3 metres tall, grass trees, grass understorey. Photo 1c: In background, thick scrub to 4 metres tall.	

Photo ID: 1a

Photo ID: 1b

Photo ID: 1c

VEGETATION AREA 2		
AS 3959:2018 Vegetation Classification Applied:	Class D Scrub	
Vegetation Types Present:	Closed scrub D-13	Open scrub D-14
Description/Justification:	Photos 2a and 2b: In background, closed scrub 4 to 6 metres tall, grass understorey. Photos 2c to 2f: Open scrub and grass trees to 3 metres tall, grass understorey.	

Photo ID: 2a

Photo ID: 2b

Photo ID: 2c

Photo ID: 2d

Photo ID: 2e

Photo ID: 2f

VEGETATION AREA 2	
AS 3959:2018 Vegetation Classification Applied:	Class D Scrub
Vegetation Types Present:	Open scrub D-14
Description/Justification:	Open scrub to 4 metres tall, grass trees, grass understorey.

Photo ID: 2g

VEGETATION AREA 3	
AS 3959:2018 Vegetation Classification Applied:	Class A Forest
Vegetation Types Present:	Open forest A-03
Description/Justification:	Photo 3a: Tuarts, open scrub, grass trees, grass understorey. Photo 3b: Along road reserve. Eucalypts to 12 metres, scrub and shrubs, grass understorey.

Photo ID: 3a	Photo ID: 3b

VEGETATION AREA 3	
AS 3959:2018 Vegetation Classification Applied:	Class A Forest
Vegetation Types Present:	Closed scrub D-13
Description/Justification:	Photos 3c to 3g: Tuarts, open scrub, grass trees, grass understorey.

Photo ID: 3c

Photo ID: 3d

Photo ID: 3e

Photo ID: 3f

Photo ID: 3g

VEGETATION AREA 4	
AS 3959:2018 Vegetation Classification Applied:	Class D Scrub
Vegetation Types Present:	Open scrub D-14
Description/Justification:	Open scrub to 3 metres tall, grass trees, grass understorey.

Photo ID: 4a

Photo ID: 4b

VEGETATION AREA 5	
AS 3959:2018 Vegetation Classification Applied:	Class G Grassland
Vegetation Types Present:	Tussock grassland G-22
Description/Justification:	Recently cleared area, grass regrowth, assessed in mature state as grassland.

Photo ID: 5a

Photo ID: 5b

VEGETATION AREA 5	
AS 3959:2018 Vegetation Classification Applied:	Class G Grassland
Vegetation Types Present:	Tussock grassland G-22
Description/Justification:	Vacant lot, grass regrowth. Assessed in mature state as grassland.

Photo ID: 5c

VEGETATION AREA 6	
AS 3959:2018 Vegetation Classification Applied:	Class D Scrub
Vegetation Types Present:	Open scrub D-14
Description/Justification:	Along road verges. Revegetated with shrubs and scrub. Occasional well spaced tree.

Photo ID: 6a

Photo ID: 6b

VEGETATION AREA 6	
AS 3959:2018 Vegetation Classification Applied:	Class D Scrub
Vegetation Types Present:	Open scrub D-14
Description/Justification:	Along road verges. Revegetated with shrubs and scrub. Occasional well spaced tree.

Photo ID: 6c

VEGETATION AREA 7	
AS 3959:2018 Vegetation Classification Applied:	Class C Shrubland
Vegetation Types Present:	Open heath C-11
Description/Justification:	Along road verges. Grass trees, sedges and low shrubs.

Photo ID: 7a

Photo ID: 7b

VEGETATION AREA 8	
AS 3959:2018 Vegetation Classification Applied:	Excluded as per Section 2.2.3.2 (e) Non Vegetated Areas
Vegetation Types Present:	No vegetation present
Description/Justification:	Limestone tracks and bitumen roads.

Photo ID: 8a

Photo ID: 8b

Photo ID: 8c

ATTACHMENT 1

Figure 3.1

Existing Topography & Classified Vegetation Map

Lot 2 on Plan 404186
Zirconia Drive
EAST ROCKINGHAM
CITY OF ROCKINGHAM

Vegetation Area	Vegetation Class	Vegetation Type	Effective Slope
1	D	Scrub	0
2	D	Scrub	0
3	A	Forest	0
4	D	Scrub	0
5	G	Grassland	0
6	D	Scrub	0
7	C	Shrubland	0
8	Ex	Exempt	

------ LEGEND ------

- Photos
- Elevation (m)
- Subject Lot
- 150 Assessment Area
- Cadastre

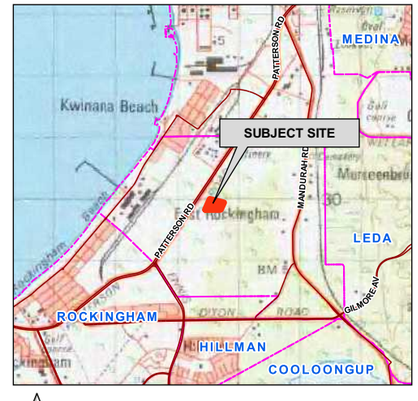
Classified Vegetation

- Class A - Forest
- Class C - Shrubland
- Class D - Scrub
- Class G - Grassland
- Exclusion 2.2.3.2

0 20 40 60 80 100 120

Metres

------ LOCALITY ------



AERIAL IMAGERY: Landgate/SLIP

BUSHFIRE PRONE PLANNING

Coordinate System: GDA 1994 MGA Zone 50
Projection: Universal Transverse Merctaor Units: Metre
Map by: Ian Macleod 20-12-2021
SCALE (A3): 1 : 2000

3.1.3 Vegetation Separation Distance

The vegetation separation distance is the horizontal distance measured from the relevant parts of an existing building or a future building's planned location (within a lot), to the determined edge of an area of classified vegetation.

This separation distance applied to determining a Bushfire Attack Level (BAL) can be either:

- The *measured distance* – for which the location of the building relative to the edge of classified vegetation must be known. This will result in single determined BAL that will apply to a building. (The measured distance is a required calculation input); or
- A *calculated minimum and maximum distance (range)* that will correspond to each individual BAL. The calculated distances provide an indicative (or achievable) BAL for which the determined BAL will be dependent on the known location of the building relative to the edge of classified vegetation.

  The calculated range of distances corresponding to each BAL can be presented in different formats (tables or a BAL contour map), dependent on the form of information that is most appropriate for the proposed development/use. These distance ranges corresponding to BAL(s) will be presented in Section 3.2: 'Assessment Output".

For the proposed development/use, the applicable vegetation separation distances will be presented within the Bushfire Management Plan in this location:	In Section 3.2 'Assessment Output' as a table containing the calculated ranges of distance corresponding to each BAL and illustrated as a BAL Contour Map.

3.2 Assessment Output

UNDERSTANDING THE RESULTS OF THE BUSHFIRE IMPACT ASSESSMENT

Bushfire Attack Levels (BALs) – Their Application in the Building Environment is Different to the Planning Environment

In the building environment, a ***determined BAL*** is required for the proposed construction at the building application stage. This is to inform approval considerations and establish the bushfire construction standards that are to apply. An indicative BAL is not acceptable for a building application.

In the planning environment, through the application of SPP 3.7 and associated Guidelines, the deemed to satisfy requirement for a proposed 'development site' or sites (defined by the LPS Amendment Regulations 2015 as "that part of a lot on which a building that is the subject of development stands or is to be constructed"), is that a BAL-29 or lower rating can be achieved once all works associated with the proposal are completed. For planning approval purposes, an ***indicative BAL*** can provide the required information.

Determined Bushfire Attack Level

A determined BAL is to apply to an existing building or the 'development site' on which the building is to be constructed and not to a lot or building envelope. Its purpose is to state the potential radiant heat flux to which the building will be exposed, thereby determining the construction standard to be applied.

A determined BAL cannot be given for a future building whose design and position on the lot are unknown or the vegetation separation distance has not been established. It is not until these variables have been fixed that a determined BAL can be stated, and a BAL Certificate can be issued.

The one exception is when a building ***of any dimension*** can be ***positioned anywhere*** on a proposed lot (within R-Code building setbacks) or within a defined building envelope, and always remain subject to the same BAL, regardless of the retention of any existing classified vegetation either onsite or offsite.

Indicative Bushfire Attack Level

If a BAL is not able to achieve 'determined' status it will be an indicative BAL. It indicates the BAL that can be achieved by the proposed development/use. However, it is conditional upon an assessment variable(s) being confirmed at a later stage (e.g. the building location is established/changed, or vegetation is modified/removed to establish the vegetation separation distance).

A BAL certificate cannot be issued for an indicative BAL – unless that BAL cannot vary (refer to 'Determined BAL' above).

In table form, a single or a range of indicative BAL(s) may be presented. If a single indicative BAL is stated for a defined area (i.e. the lot or building envelope), this will be the highest indicative BAL impacting the defined area.

In BAL contour map form (refer to Section 3.2.1), the illustrated BAL contours visually identify areas of land for which if any part of an existing or proposed building is located on that land and within the BAL contours, then the highest BAL affecting that building (or part of the land on which the building will be constructed), will be the indicative BAL that is to apply.

The BAL can only become a determined BAL once the actual location of that building on the land is known and/or the required minimum vegetation separation distance corresponding to the relevant BAL contour is established (refer to Table 3.3).

3.2.1 Bushfire Attack Level Results - BAL Contour Map Format

INTERPRETATION OF THE BUSHFIRE ATTACK LEVEL (BAL) CONTOUR MAP

The contour map will present different coloured contour intervals extending from the areas of classified bushfire prone vegetation. These represent the different bushfire attack levels that will exist at varying distances away from the classified vegetation in the event of a bushfire in that vegetation.

The areas of classified vegetation to be considered in developing the BAL contours, are those that will remain as the intended end state of the subject development once earthworks, clearing and/or landscaping and re-vegetation have been completed (or each stage completed).

Each bushfire attack level corresponds to a set range of radiant heat flux that is generated by a bushfire. That range is defined by the AS 3959:2018 BAL determination methodology.

The width of each shaded BAL contour is a diagrammatic representation of the separation distances from the classified vegetation that correspond to each BAL for each separately identified area of classified vegetation. They have been calculated by the application of the unique site variables including vegetation types and structure, ground slope and applied fire weather.

(Refer to Section 3.2 'Understanding the Results of the Bushfire Impact Assessment' for the explanation of how BAL(s) for buildings will be assessed from the BAL Contour Map).

Construction of the BAL Contours

VEGETATION AREAS APPLIED TO THE DEVELOPMENT OF THE BAL CONTOUR MAP

All identified areas of classified vegetation have been applied with the following exceptions:

1. For Figure 3.2, all classified vegetation within the existing lot 2 is excluded and the BAL contours are constructed into the lot from any classified vegetation outside the boundaries of Lot 2.

This approach is applied to indicate the achievable bushfire attack levels within the specified lot and the resultant area of developable land (i.e. subject to BAL-29 or less). It is based on the following assumptions:

1. Any classified vegetation within the subject lot will be managed by the landowner to meet asset protection zone standards.

VEGETATION SEPARATION DISTANCES APPLIED

The distances that have been applied to illustrating the width of each BAL contour shown in Figure 3.2 are stated in Table 3.3. These correspond to each Bushfire Attack Level and are specific to the proposed development site.

Table 3.3: Vegetation separation distances applied to construct the BAL contours.

BAL CONTOUR MAP – APPLIED VEGETATION SEPARATION DISTANCES								
Derived from the Application of Method 1 BAL Determination Methodology (AS 3959:2018 Section 2, Table 2.5)[1]								
Vegetation Area	Vegetation Classification	Effective Slope (degree range)	BAL and Corresponding Separation Distance (m)					
			BAL-FZ	BAL-40	BAL-29	BAL-19	BAL12.5	BAL-LOW
1	Class D Scrub	upslope or flat	<10	10-<13	13-<19	19-<27	27-<100	>100
2	Class D Scrub	upslope or flat	<10	10-<13	13-<19	19-<27	27-<100	>100
3	Class A Forest	upslope or flat	<16	16-<21	21-<31	31-<42	42-<100	>100
4	Class D Scrub	upslope or flat	<10	10-<13	13-<19	19-<27	27-<100	>100
5	Class G Grassland	upslope or flat	<6	6-<8	8-<12	12-<17	17-<50	>50
6	Class D Scrub	upslope or flat	<10	10-<13	13-<19	19-<27	27-<100	>100
7	Class C Shrubland	upslope or flat	<7	7-<9	9-<13	13-<19	19-<100	>100
Note[1] All the assessment inputs applied are presented in Section 3.1.								

ATTACHMENT 1

Id	Name
1	Micronising-Spheronising Plant
2	Purification Plant
3	Bagging Plant
4	Workshop-Store
5	Administration-Security
6	Control Room - Lab
7	MCC
8	Water Treatment

Vegetation Area	Vegetation Class	Vegetation Type	Effective Slope
1	D	Scrub	0
2	D	Scrub	0
3	A	Forest	0
4	D	Scrub	0
5	G	Grassland	0
6	D	Scrub	0
7	C	Shrubland	0

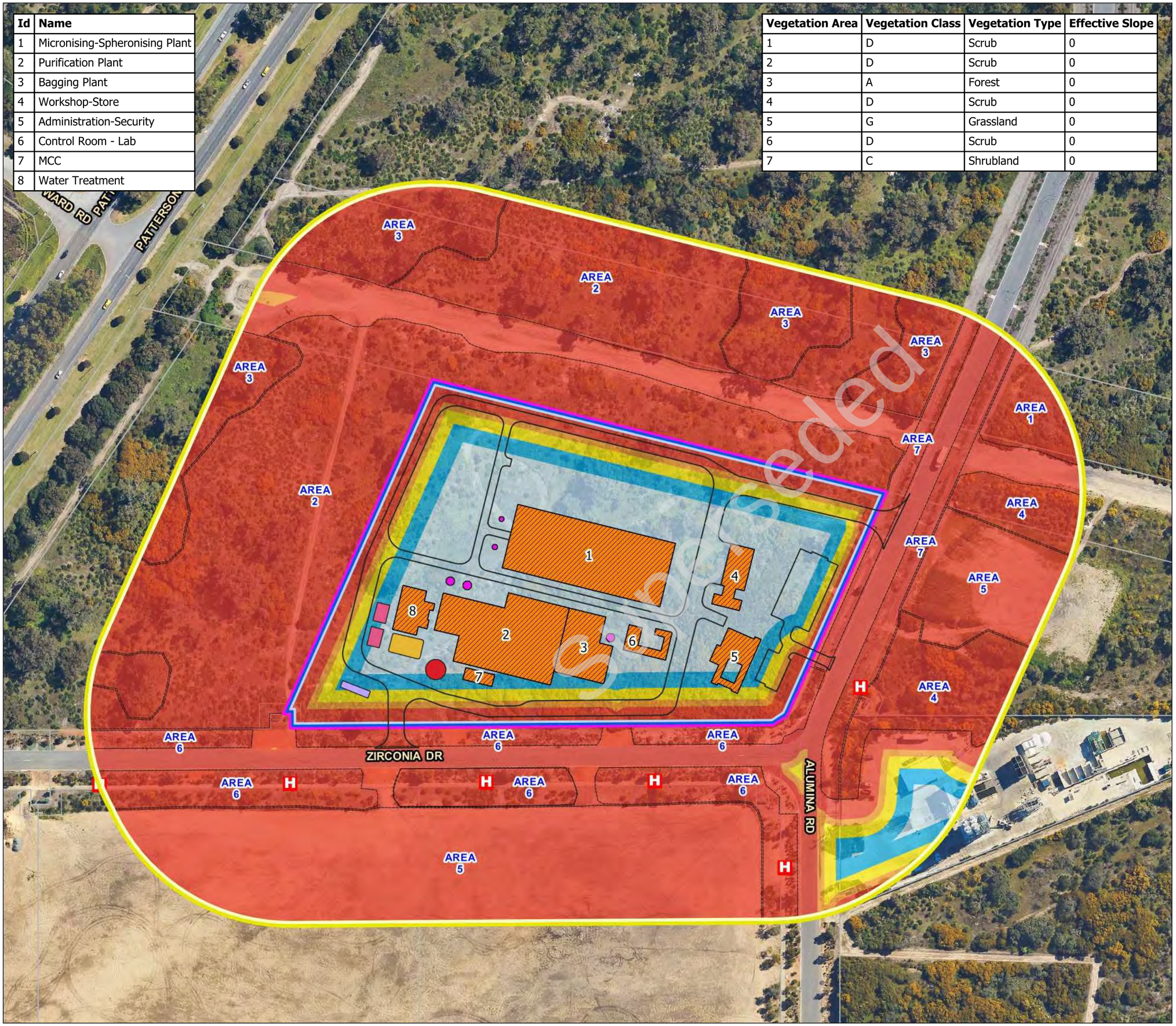


Figure 3.2

Proposed Development BAL Contour Map

Lot 2 on Plan 404186
Zirconia Drive
EAST ROCKINGHAM
CITY OF ROCKINGHAM

------ LEGEND ------

- Hydrant
- Fire Water Tank
- Structures
- Silo Legend
- Container
- Waste Water Pit
- Western Power Switch Room
- Driveway
- Asset Protection Zone
- Subject Lot
- 100m BAL Buffer
- Cadastre

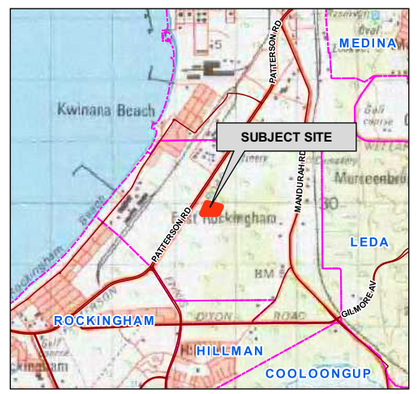
Bushfire Attack Levels

- BAL-FZ
- BAL-40
- BAL-29
- BAL-19
- BAL-12.5

0 20 40 60 80 100 120

Metres

------ LOCALITY ------



AERIAL IMAGERY: Landgate/SLIP

Coordinate System: GDA 1994 MGA Zone 50
Projection: Universal Transverse Merctaor Units: Metre
Map by: Ian Macleod 25-01-2022
SCALE (A3): 1 : 1800

BUSHFIRE PRONE PLANNING

3.2.2 Bushfire Attack Level Results - Derived from The BAL Contour Map

Table 3.4: Indicative and determined BAL(s) for existing and/or proposed building works.

BUSHFIRE ATTACK LEVEL FOR EXISTING/PLANNED BUILDINGS/STRUCTURE	
BAL Determination Methodology Applied[1]	Method 1 as per AS 3959:2018 s2.2.6 and Table 2.5.
Building/Structure Description (planned)	Indicative BAL (refer to start of s3.2)
1. Micronising - Spheronising Plant	**BAL-12.5**
2. Purification Plant	**BAL-19**
3. Bagging Plant	**BAL-19**
4. Workshop - Store	**BAL-12.5**
5. Administration - Security	**BAL-29**
6. Control Room - Laboratory	**BAL-12.5**
7. MCC	**BAL-19**
8. Water Treatment	**BAL-12.5**
Silos	**BAL-12.5**
Containers	**BAL-19**
Western Power Switch Room	**BAL-29**
Fire Water Tank	**BAL-19**
Note[1] Assessment inputs applied are presented in Section 3.1.	

4 IDENTIFICATION OF BUSHFIRE HAZARD ISSUES

In response to the Bushfire Management Plan requirements established by Appendix 5 of the Guidelines for Planning in Bushfire Prone Areas (WAPC 2017 v1.3), the following statements are made to assist in the understanding of whether the proposal is likely to be able to comply with the bushfire protection criteria now or in subsequent planning stages.

Spatial Context - Broader Landscape Considerations	
Wider road network and access constraints	Arterial roads are located nearby to the proposed development site providing access and egress in multiple directions. At a more local level Zirconia Drive and Alumina Road provide access and egress in two different directions from the subject lot. There is no access constraint for the subject site with regards to what is considered acceptable from a planning perspective.
Proximity of settlements and emergency services	The subject site is part of a large area of industrial allotments. The Rockingham townsite is approximately 2km from the subject site. Emergency services are located in Rockingham (3km by road) and in Kwinana (10km by road).
Bushfire prone vegetation types and extent (including conserved vegetation)	Large areas of bushfire prone vegetation exist across the broader landscape as retained native vegetation but interspersed with cleared and/or developed industrial lots. Vegetation types range from forest to scrub, shrub and grassland. The site would not be subject to large fire runs or landscape type bushfires due to developed industrial and residential lots creating a fragmented distribution of vegetation.
Topography and fire behaviour interactions.	The topography on and surrounding the subject lot is flat and will not increase bushfire rates of spread and intensity.
Potential for extreme fire behaviour and pyro convective events.	Unlikely due to fragmented vegetation and flat topography surrounding the site.
Environmental Considerations	
Constraints to implementing required and/or additional bushfire protection measures	The environment considerations as stated in Section 2 of this BMP are unlikely to affect the implementation of the required bushfire protection measures.
Provision of Access Within the Subject Site	
Potential constraints	No constraints to establishing the required access within the subject site will exist.
Potential Bushfire Impacts	
Flame and radiant heat and ability to establish an APZ	The proposed lot sizes will allow a suitable APZ to be established within the lot. This will prevent flame contact to the proposed buildings from the classified vegetation. Application of bushfire construction standards will mitigate the risks from radiant heat impact to what is considered an acceptable level.
Embers/firebrands, smoke and fire-driven wind	These will be the major impacts to the subject site. The appropriate protection measures of building construction and strict management of the APZ will mitigate the risk to what is considered an acceptable level.

5 ASSESSMENT AGAINST THE BUSHFIRE PROTECTION CRITERIA ESTABLISHED BY THE GUIDELINES

For a development application that is not a 'Tourism Land Use' to be considered compliant with SPP 3.7, it must satisfy (achieve) the intent of each of the four elements of the bushfire protection criteria. These criteria are established by the *Guidelines for Planning in Bushfire Prone Areas WAPC 2017 v1.3*). Compliance can be achieved by either:

- Meeting all applicable acceptable solutions corresponding to each element (i.e. the minimum bushfire protection measures that are deemed to satisfy planning requirements); or
- Where an acceptable solution cannot be met, by developing a performance solution that satisfies the established requirements.

5.1 Local Government Variations to Apply

Local governments may add to or modify the acceptable solutions of the Bushfire Protection Criteria (BPC) and/or apply technical requirements that vary from those specified in the Guidelines for Planning in Bushfire Prone Areas (WAPC). In such instances, this Proposal will be assessed against these variations and/or any specific local government technical requirements for emergency access and water. Refer to Appendices 2 and 3 for relevant technical requirements.

Will local or regional variations (endorsed by WAPC / DFES) to the applicable acceptable solutions established by the *Guidelines* or the *Position Statement: Tourism land uses in bushfire prone areas WAPC October 2019,* apply to this Proposal?	N/A

5.2 Summary of Assessment Against the Bushfire Protection Criteria

SUMMARISED OUTCOME OF THE ASSESSMENT AGAINST THE BUSHFIRE PROTECTION CRITERIA					
Element of the Bushfire Protection Criteria	Basis for the Proposal Achieving Full Compliance with SPP 3.7			The Proposal Cannot Achieve Full Compliance with SPP 3.7	
	Acceptable Solutions Met	Achieves the Intent of the Element			
	All applicable solutions are fully met	All applicable solutions are not fully met. A merit based assessment and/or a bushfire performance comparison of the proposals residual risk with that of the residual risk of the acceptable solution is conducted (refer Note 4)	A performance principle-based solution is applied	Bushfire planning development type that may not require full compliance is applied	An improvement in bushfire performance compared to the existing development is detailed (refer Note 4)
1. Location	✓			N/A	
2. Siting and Design of Development	✓				
3. Vehicular Access	✓				
4. Water	✓				

Note: The development proposal has been assessed:

1. Against the requirements established in Appendix 4 of the *Guidelines for Planning in Bushfire Prone Areas, WAPC 2017 v1.3 (Guidelines)*. The Guidelines are found at https://www.planning.wa.gov.au/8194.aspx; and
2. Applying the interpretation guidance provided in *Position Statement: Planning in bushfire prone areas – Demonstrating Element 1: Location and Element 2: Siting and design (WAPC Nov 2019)*.
3. Applying any endorsed variations to the Guideline's acceptable solutions and associated technical requirements that have been established by the local government. If known and applicable these have been stated in Section 5.1 with the detail included as an appendix if required by the local government.
4. When non-compliant with SPP 3.7 and when appropriate, by utilising additional compliance pathways that include the application of merit based assessment and comparative bushfire performance. The validity of this approach is derived from relevant decisions made by the responsible authorities (refer Appendix 2).

5.3 Assessment Detail

Element 1: Location	
Intent: To ensure that strategic planning proposals, subdivision and development applications are located in areas with the least possible risk of bushfire to facilitate the protection of people, property and infrastructure.	
Compliance: How the proposed development achieves the intent of Element 1:	By fully meeting all applicable acceptable solutions established by the bushfire protection criteria (Guidelines v1.3 WAPC 2017)

ASSESSMENT (COMPLIANCE) STATEMENTS

For each applicable acceptable solution, the following statements present the results of the assessment of the proposed development/use against the requirements established by the *Guidelines (WAPC 2017 v1.3)* and apply the interpretation guidance established by the *Position Statement: Planning in bushfire prone areas – Demonstrating Element 1: Location and Element 2: Siting and design (WAPC Nov 2019)*.

Acceptable Solution: A1.1: Development Location

ASSESSMENT AGAINST THE REQUIREMENTS ESTABLISHED BY THE GUIDELINES

The proposed development will provide an area of land within the lot that can be considered suitable for development as buildings within this area will be subject to BAL ratings of BAL-29 or lower. This meets the requirements established by Acceptable Solution A1.1 and its associated explanatory note.

ASSESSMENT AGAINST THE REQUIREMENTS ESTABLISHED BY THE POSITION STATEMENT

The position statement establishes that:

- The source of risk (the hazard) to be considered in Element 1 is the "level of bushfire exposure" from the type and extent of bushfire prone vegetation and the topography of the land on which it exists; and
- "Consideration should be given to the site context" which includes the land both "within and adjoining the subject site". The "hazards remaining within the site should not be considered in isolation of the hazards adjoining the site, as the potential impact of a bushfire will be dependent on the wider risk context."

The position statement also recognises:

- That the proposed development site and its surrounding land may be part of an area "identified for development or intensification of land use prior to the release of SPP 3.7"; consequently
- Consideration by decision-makers "should also be given to improving bushfire management of the site and surrounding area, thereby reducing the vulnerability of people property and infrastructure to bushfire"; and
- The application of mitigation measures to lessen the risk to the broader area would include improvements to the local road network (including emergency access ways), improvements/additions to firefighting water supply and increasing separation distance from the hazard.

The Hazard Within the Subject Site

The whole of the subject lot is to be managed and maintained to a low bushfire threat state. The proposed buildings will be subject to BAL ratings of BAL-29 or lower.

Application of appropriate building design, bushfire construction standards and the ongoing maintenance of the APZ will ensure the buildings will not be impacted by consequential fire within combustible materials used, stored or accumulated within the APZ.

Element 1: Location

The Hazard Adjoining the Subject Site

To the west, north and east of the subject site are areas of scrub, forest and grassland type vegetation. The vegetation is fragmented by developed industrial lots and constructed roadways.

To the south of the subject lot are narrow strips of scrub vegetation along the Zirconia Drive road verges. Further south are recently cleared and levelled lots that appear prepared for construction. However, this area is assessed as grassland. Further south are fragmented areas of forest, scrub and grassland.

The potential exists for intense bushfire behaviour to occur within these areas of bushfire prone vegetation. The potential bushfire impact on persons and property within the proposed development will be to increase the level of ember attack in the event of a bushfire.

This ember threat will be mitigated by the application of appropriate building design, bushfire construction standards and the ongoing maintenance of the required APZ, to ensure the buildings will not be impacted by consequential fire within combustible materials used, stored or accumulated within the APZ.

Element 2: Siting and Design of Development

Intent: To ensure that the siting and design of development (note: not building/construction design) minimises the level of bushfire impact.

Compliance: How the proposed development achieves the intent of Element 2:	By fully meeting all applicable acceptable solutions established by the bushfire protection criteria (Guidelines v1.3 WAPC 2017)

ASSESSMENT (COMPLIANCE) STATEMENTS

For each applicable acceptable solution, the following statements present the results of the assessment of the proposed development/use against the requirements established by the *Guidelines (WAPC 2017 v1.3)* and apply the interpretation guidance established by the *Position Statement: Planning in bushfire prone areas – Demonstrating Element 1: Location and Element 2: Siting and design (WAPC Nov 2019)*.

Acceptable Solution: A2.1: Asset Protection Zone

THE APZ - DEVELOPMENT SITING AND DESIGN PLANNING REQUIREMENTS

The necessary outcome of bushfire planning for development siting and design, is to ensure that a building can be located within the developable portion of any lot (i.e. outside those parts of the lot that form the required R-Code building setbacks, or any other excluded area), and be subject to potential radiant heat from a bushfire not exceeding 29 kW/m^2 (i.e. a maximum BAL of BAL-29).

This will be achieved when the size of the "low fuel area immediately surrounding a building", the asset protection zone (APZ), is large enough. This requires a certain separation distance to exist between the building and areas of classified vegetation. These are the BAL-29 APZ dimensions and they will vary dependent on site specific parameters.

The APZ should be contained solely within the boundaries of each lot, except in instances where the neighbouring lot(s) or adjacent public land will be managed in a low-fuel state on an ongoing basis, in perpetuity.

Where possible, planning for siting and design should incorporate elements that include non-vegetated areas (e.g. roads/parking/drainage) and/or formally managed areas of vegetation (public open space/recreation areas/ services installed in a common section of land), as either part of the required APZ dimensions or to additionally increase separation distances to provide greater protection. These elements create robust and easier managed asset protection zones.

THE ASSESSMENT

Future buildings on the lot of the proposed development can be surrounded by an APZ that will ensure the potential radiant heat impact of a bushfire does not exceed 29 kW/m^2 (BAL-29). The required APZ specifications of width, location and management can be achieved.

APZ Width: The required APZ dimensions to ensure buildings are subject to a maximum BAL of BAL-29 (measured from any external wall or supporting post or column to the edge of the classified vegetation), has been determined in Section 3.2 of this BMP and are:

BAL-29 APZ Dimensions		
Applicable to the proposed buildings:	Building to Vegetation Area 1	Minimum 13 metres
	Building to Vegetation Area 2	Minimum13 metres
	Building to Vegetation Area 3	Minimum 21 metres
	Building to Vegetation Area 4	Minimum 13 metres
	Building to Vegetation Area 5	Minimum 8 metres
	Building to Vegetation Area 6	Minimum 13 metres
	Building to Vegetation Area 7	Minimum 9 metres

Element 2: Siting and Design of Development

THE APZ – REQUIRED DIMENSIONS TO SATISFY FUTURE BUILDING (AND ONGOING MANAGEMENT)

It is important for the landowner to be aware that the APZ dimensions that will be required to be physically established and maintained on the lot surrounding relevant future buildings, may be different to those stated above for the BAL-29 APZ - which is the minimum dimension a planning proposal needs to show can be established to comply with SPP 3.7.

The actual APZ dimensions to be physically established and maintained, may be based on which of the following establishes the larger APZ dimension:

- The dimensions corresponding to the determined BAL of a building (refer to Section 3.2 for explanation of the 'planning' versus 'building' requirements and 'indicative' versus 'determined' BAL); or
- The APZ dimensions established by the local government's Firebreak Notice.

If the dimensions of the APZ that are to be established are known at this time, they will be stated below.

For this proposed development, the whole of the subject lot is to be managed and maintained to a low bushfire threat state in perpetuity.

As a reference for proposed and future building locations, the minimum required vegetation separation distances to achieve BAL ratings lower than BAL-29 are stated in the Tables below.

The Vegetation Separation Distances to be Established and Maintained to Achieve a BAL Rating of BAL-19		
Applicable to Proposed and Future Buildings.	Building to Vegetation Area 1	Minimum 19 metres
	Building to Vegetation Area 2	Minimum 19 metres
	Building to Vegetation Area 3	Minimum 31 metres
	Building to Vegetation Area 4	Minimum 19 metres
	Building to Vegetation Area 5	Minimum 12 metres
	Building to Vegetation Area 6	Minimum 19 metres
	Building to Vegetation Area 7	Minimum 13 metres

The Vegetation Separation Distances to be Established and Maintained to Achieve a BAL Rating of BAL-12.5		
Applicable to Proposed and Future Buildings.	Building to Vegetation Area 1	Minimum 27 metres
	Building to Vegetation Area 2	Minimum 27 metres
	Building to Vegetation Area 3	Minimum 42 metres
	Building to Vegetation Area 4	Minimum 27 metres
	Building to Vegetation Area 5	Minimum 17 metres
	Building to Vegetation Area 6	Minimum 27 metres
	Building to Vegetation Area 7	Minimum 19 metres

Element 2: Siting and Design of Development

APZ Location: Asset protection zones of the widths required to achieve a BAL-29 rating for the proposed development can be contained solely within the boundaries of the subject lot. Onsite vegetation will be required to be modified/removed, the authority for which will need to be received from the local government.

APZ Management: All vegetation that will require modification/removal and future management is onsite and therefore under the control of the landowner.

Retained vegetation will be managed in accordance with the technical requirements established by the Schedule 1: 'Standards for Asset Protection Zones (Guidelines). The APZ specifications are also detailed in Appendix 1 and the City of Rockingham may have additional requirements established by their Fire Control Notice.

Element 3: Vehicular Access	
Intent: To ensure that the vehicular access serving a subdivision/development is available and safe during a bushfire event.	
Compliance: How the proposed development achieves the intent of Element 3:	By fully meeting all applicable acceptable solutions established by the bushfire protection criteria (Guidelines v1.3 WAPC 2017)
ASSESSMENT (COMPLIANCE) STATEMENTS For each applicable acceptable solution, the following statements present the results of the assessment of the proposed development/use against the requirements established by the *Guidelines (WAPC 2017 v1.3).*	
Acceptable Solution: A3.1: Two Access Routes	
Two different access/egress routes to two different destinations are available to the subject site. The routes are constructed public roads which are available to occupants of the site, and the public, at all times and under all weather conditions.	
Acceptable Solution: A3.2: Public Road	
N/A No new roads are planned for this development.	
Acceptable Solution: A3.3: Cul-de-sacs (including a dead-end road)	
N/A	
Acceptable Solution: A3.4: Battle-axe	
N/A	
Acceptable Solution: A3.5: Private Driveways	
The proposed development has a looped internal driveway system for the main production area, with two different entry/exit locations. Proposed driveway widths range from 4 to 8 metres. A parking area for workers and visitors is separate to the main site access driveways and has an available turnaround area for fire appliances. The construction technical requirements established by the Guidelines will be complied with. These requirements are set out in Appendix 2.	
Acceptable Solution: A3.6: Emergency Access Way	
N/A	
Acceptable Solution: A3.7: Fire Service Access Routes	
N/A	
Acceptable Solution: A3.8: Firebreak Width	
The subject lot will comply with the requirements of the local government annual firebreak notice issued under s33 of the Bush Fires Act 1954.	

Element 4: Water	
Intent: To ensure water is available to the subdivision, development or land use to enable people, property and infrastructure to be defended from bushfire.	
Compliance: How the proposed development achieves the intent of Element 4:	By fully meeting all applicable acceptable solutions established by the bushfire protection criteria (Guidelines v1.3 WAPC 2017)
ASSESSMENT (COMPLIANCE) STATEMENTS For each applicable acceptable solution, the following statements present the results of the assessment of the proposed development/use against the requirements established by the *Guidelines (WAPC 2017 v1.3).*	
Acceptable Solution: A4.1: Reticulated Areas	
A reticulated water supply is available to the subject site Hydrants are located on Zirconia Drive and Alumina Road The nearest hydrant is located 28 metres from the subject site on the south side of Zirconia Drive.	
Acceptable Solution: A4.2: Non-Reticulated Areas	
N/A	
Acceptable Solution: A4.3: Non-Reticulated Areas – Individual Lots	
N/A	

5.4 Recommended Additional Bushfire Protection Measures

The following bushfire protection measures are recommended to be implemented and maintained. They are additional to those established by the relevant acceptable solutions applied to the proposed subdivision, development or use.

The relevant acceptable solutions are those against which this planning proposal has been assessed in Section 5.3 of this Bushfire Management Plan.

5.4.1 Recommended Additional Measures to Improve Bushfire Performance

Buildings of Class 4 to Class 9 are not required by the Building Code of Australia (BCA) to be constructed to comply with bushfire performance requirements. As the future buildings will be located in a bushfire prone area and may be subject to a bushfire attack, Bushfire Prone Planning recommends that some degree of upgrading be considered to improve the protection for occupants and the building's survivability. At a minimum protection from ember attack should be considered (i.e. constructed to the standard required for BAL-12.5).

SUMMARY OF RECOMMENDED ADDITIONAL BUSHFIRE PROTECTION MEASURES TO BE APPLIED		
Treatment Category	Brief Description	The Relevant Element and its Intent the Treatment Has Been Developed to Help Achieve
Siting and Design	Recommended minimum bushfire construction standard for buildings within the proposed subdivision to be BAL-12.5.	Element 2

ATTACHMENT 1

Id	Building Description
1	Micronising-Spheronising Plant
2	Purification Plant
3	Bagging Plant
4	Workshop-Store
5	Administration-Security
6	Control Room - Lab
7	MCC
8	Water Treatment

PATTERSON RD

PATTERSON RD

ZIRCONIA DR

ALUMINA RD

Figure 3.2

Proposed Development BAL Contour Map

Lot 2 on Plan 404186
Zirconia Drive
EAST ROCKINGHAM
CITY OF ROCKINGHAM

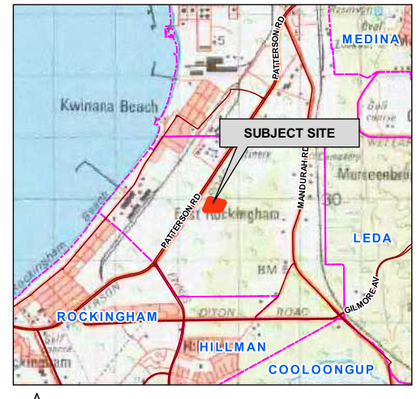
------ LEGEND ------

- Hydrant
- Fire Water Tank
- Access-Egress
- Structures
- Silo
- Container
- Waste Water Pit
- Drainage Swale
- Driveway
- Landscape Areas
- Managed Areas
- Asset Protection Zone
- Subject Lot
- Cadastre

0 20 40 60 80 100 120

Metres

------ LOCALITY ------



AERIAL IMAGERY: Landgate/SLIP

BUSHFIRE PRONE PLANNING

Coordinate System: GDA 1994 MGA Zone 50
Projection: Universal Transverse Merctaor Units: Metre
Map by: Ian Macleod 25-01-2022
SCALE (A3): 1 : 2000

6 RESPONSIBILITIES FOR IMPLEMENTATION AND MANAGEMENT OF THE BUSHFIRE PROTECTION MEASURES

Table 6.1: BMP Implementation responsibilities prior to occupancy or building.

Landowner (Developer) - Prior to Occupancy or Building	
No.	Implementation Actions
1	The local government may condition a development application approval with a requirement for the landowner/proponent to register a notification onto the certificate of title and deposited plan. This will be done pursuant to Section 70A *Transfer of Land Act 1893* as amended ('Factors affecting use and enjoyment of land, notification on title'). This is to give notice of the bushfire hazard and any restrictions and/or protective measures required to be maintained at the owner's cost. This condition ensures that: 1. Landowners/proponents are aware their lot is in a designated bushfire prone area and of their obligations to apply the stated bushfire risk management measures; and 2. Potential purchasers are alerted to the Bushfire Management Plan so that future landowners/proponents can continue to apply the bushfire risk management measures that have been established in the Plan.
2	Prior to construction and post planning approval, the entity responsible for having the BMP prepared should ensure that anyone listed as having responsibility under the Plan has endorsed it and is provided with a copy for their information and informed that it contains their responsibilities. This includes the landowners/proponents (including future landowners where the Plan was prepared as part of a subdivision approval), local government and any other authorities or referral agencies ('Guidelines' s4.6.3).
3	Prior to construction, establish the Asset Protection Zone (APZ) to the dimensions described in this Bushfire Management Plan. For this proposal, the whole of the subject lot is to be managed to APZ standards. Establish the APZ to the above dimensions and to the standards established by the Guidelines (refer to Appendix 1) or as varied by the local government through their Firebreak Notice. This is the responsibility of the landowner.
4	The subject lot is to be compliant with the City of Rockingham Fire Control Notice issued under s33 of the Bushfires Act 1954. This may include specifications for asset protection zones that differ from the Guideline's APZ Standards, with the intent to better satisfy local conditions. When these are more stringent than those created by the Guidelines, or less stringent and endorsed by the WAPC and DFES, they must be complied with. Refer to Appendix 1.
5	Prior to occupancy, install the private driveways to the standards stated in the BMP.
6	Prior to any building work, inform the builder of the existence of this Bushfire Management Plan and the responsibilities it contains, regarding the required construction standards. This may be: • The standard corresponding to the determined BAL, as per the bushfire provisions of the Building Code of Australia (BCA); and/or • A higher standard because the BMP establishes that the construction standard is to correspond to a higher BAL as an additional bushfire protection measure.

Table 6.2: Ongoing management responsibilities for the Landowner/Occupier.

Landowner/Occupier - Ongoing	
No.	Ongoing Management Actions
1	Maintain the Asset Protection Zone (APZ) to the dimensions described in this Bushfire Management Plan. For this proposal, the whole of the subject lot is to be managed to APZ standards. Maintain the APZ to the above dimensions and to the standards established by the Guidelines (refer to Appendix 1) or as varied by the local government through their Firebreak Notice. This is the responsibility of the landowner.
2	Comply with the City of Rockingham Fire Control Notice issued under s33 of the Bush Fires Act 1954. This may include specifications for asset protection zones that differ from the Guideline's APZ Standards, with the intent to better satisfy local conditions. When these are more stringent than those created by the Guidelines, or less stringent and endorsed by the WAPC and DFES, they must be complied with. Refer to Appendix 1.
3	Maintain vehicular access routes within the lot to the required surface condition and clearances as stated in the BMP.
4	Maintain the emergency water supply tank and its associated fittings and vehicular access in good working condition.
5	Ensure that any builders (of future structures on the lot) are aware of the existence of this Bushfire Management Plan and the responsibilities it contains regarding the application of construction standards corresponding to a determined BAL.
6	Ensure all future buildings the landowner has responsibility for, are designed and constructed in full compliance with: 1. the requirements of the WA Building Act 2011 and the bushfire provisions of the Building Code of Australia (BCA); and 2. with any identified additional requirements established by this BMP or the local government.
7	To implement and maintain, the recommended additional bushfire protection measures contained in Section 5.4 of this Bushfire Management Plan, if appropriate, in addition to the measures that are established by the acceptable solutions.

Table 6.3: Ongoing management responsibilities for the Local Government.

Local Government - Ongoing	
No.	Ongoing Management Actions
1	Monitor landowner compliance with this Bushfire Management Plan and the annual Fire Control Notice.

APPENDIX 1: TECHNICAL REQUIREMENTS FOR ONSITE VEGETATION MANAGEMENT

A1.1 Requirements Established by the Guidelines – Standards for Asset Protection Zones

(Source: Guidelines for Planning in Bushfire Prone Areas - WAPC 2017 v1.3 Appendix 4, Element 2, Schedule 1 and Explanatory Note E2.1)

DEFINING THE ASSET PROTECTION ZONE (APZ)

Description: An APZ is an area surrounding a building that is managed to reduce the bushfire hazard to an acceptable level (by reducing fuel loads). The width of the required APZ varies with slope and vegetation and varies corresponding to the BAL rating determined for a building (lower BAL = greater dimensioned APZ).

For planning applications, the minimum sized acceptable APZ is that which is of sufficient size to ensure the potential radiant heat impact of a fire does not exceed 29kW/m² (BAL-29). It will be site specific.

For subdivision planning, design elements and excluded/low threat vegetation adjacent to the lot(s) can be utilised to achieve the required vegetation separation distances and therefore reduce the required dimensions of the APZ within the lot(s).

Defendable Space: The APZ includes a defendable space which is an area adjoining the asset within which firefighting operations can be undertaken to defend the structure. Vegetation within the defendable space should be kept at an absolute minimum and the area should be free from combustible items and obstructions. The width of the defendable space is dependent on the space, which is available on the property, but as a minimum should be 3 metres.

Establishment: The APZ should be contained solely within the boundaries of the lot on which the building is situated, except in instances where the neighbouring lot or lots will be managed in a low-fuel state on an ongoing basis, in perpetuity.

The APZ may include public roads, waterways, footpaths, buildings, rocky outcrops, golf courses, maintained parkland as well as cultivated gardens in an urban context, but does not include grassland or vegetation on a neighbouring rural lot, farmland, wetland reserves and unmanaged public reserves.

[Note: Regardless of whether an Asset Protection Zone exists in accordance with the acceptable solutions and is appropriately maintained, fire fighters are not obliged to protect an asset if they think the separation distance between the dwelling and vegetation that can be involved in a bushfire, is unsafe.]

Schedule 1: Standards for APZ

Fences: within the APZ are constructed from non-combustible materials (e.g. iron, brick, limestone, metal post and wire). It is recommended that solid or slatted non-combustible perimeter fences are used.

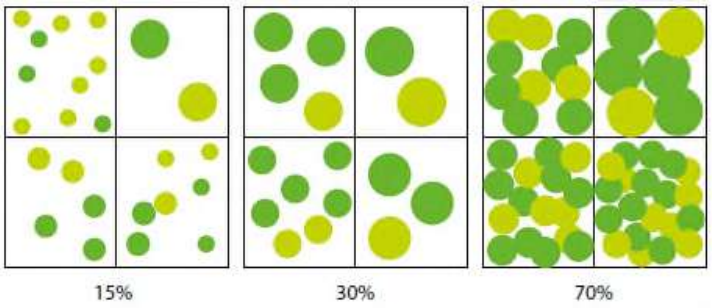
Objects: within 10 metres of a building, combustible objects must not be located close to the vulnerable parts of the building i.e. windows and doors.

Fine Fuel Load: combustible dead vegetation matter less than 6 mm in thickness reduced to and maintained at an average of two tonnes per hectare (example below).

Example: Fine fuel load of 2 t/ha
(Image source: Shire of Augusta Margaret River's Firebreak and Fuel Reduction Hazard Notice)

Trees (> 5 metres in height): trunks at maturity should be a minimum distance of 6 metres from all elevations of the building, branches at maturity should not touch or overhang the building, lower branches should be removed to a height of 2 metres above the ground and or surface vegetation, canopy cover should be less than 15% with tree canopies at maturity well spread to at least 5 metres apart as to not form a continuous canopy. Diagram below represents tree canopy cover at maturity.

Tree canopy cover – ranging from 15 to 70 per cent at maturity



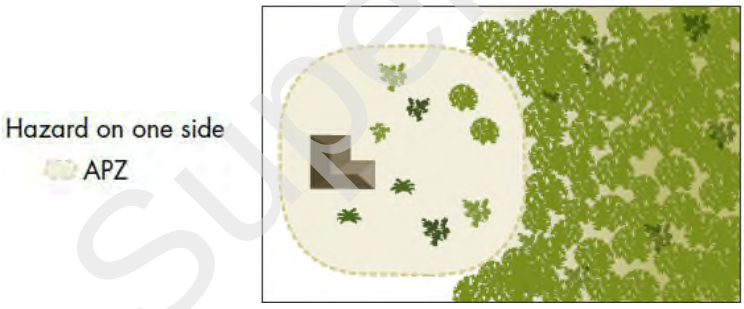
(Source: Guidelines for Planning in Bushfire Prone Areas 2017, Appendix 4)

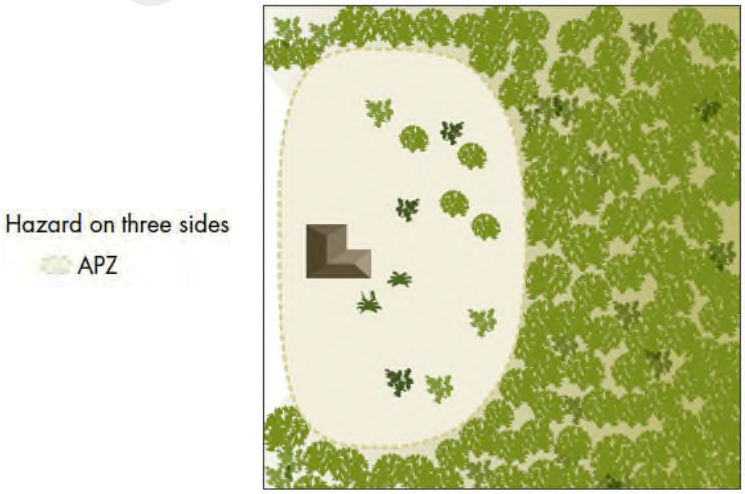
Shrubs (0.5 metres to 5 metres in height): should not be located under trees or within 3 metres of buildings, should not be planted in clumps greater than 5m2 in area, clumps of shrubs should be separated from each other and any exposed window or door by at least 10 metres. Shrubs greater than 5 metres in height are to be treated as trees.

Ground covers (<0.5 metres in height): can be planted under trees but must be properly maintained to remove dead plant material and any parts within 2 metres of a structure, but 3 metres from windows or doors if greater than 100 mm in height. Ground covers greater than 0.5 metres in height are to be treated as shrubs.

Grass: should be managed to maintain a height of 100 mm or less.

The following example diagrams illustrate how the required dimensions of the APZ will be determined by the type and location of the vegetation.





A1.2 Requirements Established by the Local Government – the Firebreak Notice

The local government's current Firebreak Notice is available on their website, at their offices and is distributed as ratepayer's information. It must be complied with.

These requirements are established by the local government's Firebreak Notice created under s33 of the Bushfires Act 1954 and issued annually (potentially with revisions). The Firebreak Notice may include additional components directed at managing fuel loads, accessibility and general property management with respect to limiting potential bushfire impact.

If Asset Protection Zone (APZ) specifications are defined in the Firebreak Notice, these may differ from the Standards established by the Guideline's, with the intent to better satisfy local conditions. When these are more stringent than those created by the Guidelines, or less stringent and endorsed by the WAPC and DFES, they must be complied with.

The APZ dimensions to be physically established and maintained, will be based on which of the following establishes the larger APZ dimension:

- The dimensions corresponding to the determined BAL of a building (refer to Section 3.2 explanation of the 'planning' versus 'building' requirements and 'indicative' versus 'determined' BAL(s)); or
- The APZ dimensions established by the local government's Firebreak Notice.

A1.3 Requirements Recommended by DFES – Property Protection Checklists

Further guidance regarding ongoing/lasting property protection (from potential bushfire impact) is presented in the publication 'DFES – Fire Chat – Your Bushfire Protection Toolkit'. It is available from the Department of Fire and Emergency Services (DFES) website.

A1.4 Requirements Established by AS 3959:2018 – 'Minimal Fuel Condition'

This information is provided for reference purposes. This knowledge will assist the landowner to comply with Management Requirement No. 3 set out in the Guidance Panel at the start of this Appendix. It identifies what is required for an area of land to be excluded from classification as a potential bushfire threat.

"Australian Standard - AS 3959:2018 Section 2.2.3.2: Exclusions - Low threat vegetation and non-vegetated areas:

The Bushfire Attack Level shall be classified BAL-LOW where the vegetation is one or a combination of the following:

a) Vegetation of any type that is more than 100m from the site.

b) Single areas of vegetation less than 1ha in area and not within 100m of other areas of vegetation being classified vegetation.

c) Multiple area of vegetation less than 0.25ha in area and not within 20m of the site or each other or other areas of vegetation being classified vegetation.

d) Strips of vegetation less than 20m in width (measured perpendicular to the elevation exposed to the strip of vegetation) regardless of length and not within 20m of the site or each other, or other areas of vegetation being classified vegetation.

e) Non-vegetated areas, that is, areas permanently cleared of vegetation, including waterways, exposed beaches, roads, footpaths, buildings and rocky outcrops.

f) *Vegetation regarded as low threat due to factors such as flammability, moisture content or fuel load. This includes grassland managed in a* ***minimal fuel condition,*** *(means insufficient fuel available to significantly increase the severity of a bushfire attack – for example, recognisable as short cropped grass to a nominal height of 100mm), mangroves and other saline wetlands, maintained lawns, golf courses (such as playing areas and fairways), maintained public reserves and parklands, sporting fields, vineyards, orchards, banana plantations, market gardens (and other non-curing crops), cultivated gardens, commercial nurseries, nature strips and windbreaks (single row of trees)."*

APPENDIX 2: TECHNICAL REQUIREMENTS FOR VEHICULAR ACCESS

Each local government may have their own standard technical requirements for emergency vehicular access, and they may vary from those stated in the Guidelines.

When required, these are stated in Section 5.1 of this bushfire management plan.

Requirements Established by the Guidelines – The Acceptable Solutions

(Source: Guidelines for Planning in Bushfire Prone Areas WAPC 2017 v1.3, Appendix 4)

VEHICULAR ACCESS TECHNICAL REQUIREMENTS - PART 1

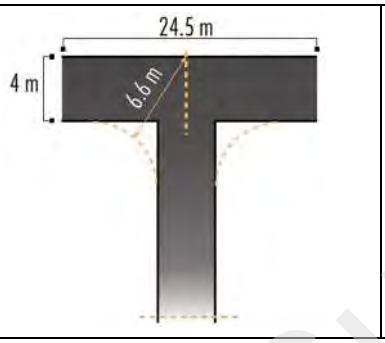
Acceptable Solution 3.5: Private Driveways

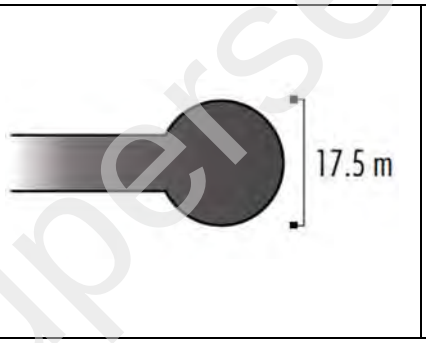
The following requirements are to be achieved:

- The design requirements set out in Part 2 of this appendix; and

Where the house site is more than 50 metres from a public road:

- Passing bays every 200 metres with a minimum length of 20 metres and a minimum width of two metres (ie combined width of the passing bay and constructed private driveway to be a minimum six metres);
- Turn-around areas every 500 metres and within 50 metres of a house, designed to accommodate type 3.4 fire appliances to turn around safely (ie kerb to kerb 17.5 metres);
- Any bridges or culverts are able to support a minimum weight capacity of 15 tonnes; and
- All weather surface (i.e. compacted gravel, limestone or sealed).





Acceptable Solution 3.8: Firebreak Width

Lots greater than 0.5 hectares must have an internal perimeter firebreak of a minimum width of three meters or to the level as prescribed in the local firebreak notice issued by the local government.

VEHICULAR ACCESS TECHNICAL REQUIREMENTS - PART 2					
Technical Component	Vehicular Access Types				
	Public Roads	Cul-de-sacs	Private Driveways	Emergency Access Ways	Fire Service Access Routes
Minimum trafficable surface (m)	6*	6	4	6*	6*
Horizontal clearance (m)	6	6	6	6	6
Vertical clearance (m)	4.5	4.5	4.5	4.5	4.5
Maximum grade <50 metres	1 in 10	1 in 10	1 in 10	1 in 10	1 in 10
Minimum weight capacity (t)	15	15	15	15	15
Maximum cross-fall	1 in 33	1 in 33	1 in 33	1 in 33	1 in 33
Curves minimum inner radius (m)	8.5	8.5	8.5	8.5	8.5
* A six metre trafficable surface does not necessarily mean paving width. It could, for example, include four metres of paving and one metre of constructed road shoulders. In special circumstances, where 8 lots or less are being serviced, a public road with a minimum trafficable surface of four metres for a maximum distance of ninety metres may be provided subject to the approval of both the local government and DFES.					

APPENDIX 3: TECHNICAL REQUIREMENTS FOR FIREFIGHTING WATER

Reticulated Areas

[Source: Guidelines for Planning in Bushfire Prone Areas WAPC 2017 v1.3, Appendix 4, Element 4]

The Water Corporation's 'No 63 Water Reticulation Standard' is deemed to be the baseline criteria for developments and should be applied unless local water supply authority's conditions apply.

The requirement is to supply a reticulated water supply and fire hydrants, in accordance with the technical requirements of the relevant water supply authority and DFES.

Key specifications in the most recent version/revision of the design standard include:

- ***Residential Standard*** – hydrants are to be located so that the maximum distance between the hydrants shall be no more than 200 metres.
- ***Commercial Standard*** – hydrants are to be located with a maximum of 100 metre spacing in Industrial and Commercial areas.
- ***Rural Residential Standard*** – where minimum site areas per dwelling is 10,000 m^2 (1ha), hydrants are to be located with a maximum 400m spacing. If the area is further subdivided to land parcels less than 1ha, then the residential standard (200m) is to be applied.

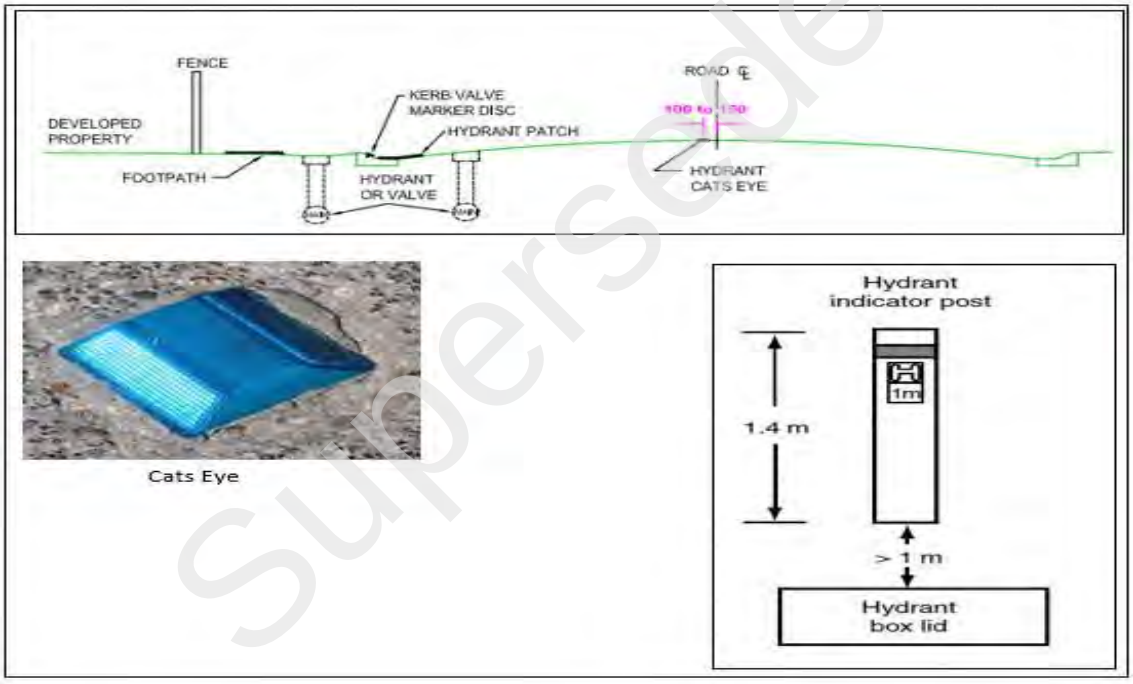


Figure A4.1: Hydrant Location and Identification Specifications

Appendix H – Noise Impact Statement

GRAPHITE RECYCLING AND MANUFACTURING FACILITY

Noise Impact Assessment

Prepared for:

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BASIS OF REPORT

This report has been prepared by SLR Consulting Australia Pty Ltd (SLR) with all reasonable skill, care and diligence, and taking account of the timescale and resources allocated to it by agreement with Ecograf Limited (the Client). Information reported herein is based on the interpretation of data collected, which has been accepted in good faith as being accurate and valid.

This report is for the exclusive use of the Client. This report may not be relied upon by other parties without written consent from SLR.

SLR disclaims any responsibility to the Client and others in respect of any matters outside the agreed scope of the work.

DOCUMENT CONTROL

Reference	Date	Prepared	Checked	Authorised
675.30077.00000	22 December 2021	Ying Liu	Luke Zoontjens	Luke Zoontjens

EXECUTIVE SUMMARY

SLR Consulting Australia Pty Ltd (SLR) has been commissioned by EcoGraf Limited (EcoGraf) to undertake a noise impact assessment of the proposed Graphite Recycling and Manufacturing Facility (GRMF) – Stage 1 Development located in Rockingham, Western Australia.

In support of the development permit application, this report provides an assessment of noise associated with operation of the GRMF. This assessment is to ascertain whether there would be potential noise issue(s) regarding operations, if so, identify options to ensure compliance with *Environmental Protection (Noise) Regulations 1997* and other relevant guidelines.

Baseline noise measurements were conducted to characterise existing noise levels. Noise emissions from individual plant items have been estimated based on supplier advice, internal libraries and/or published sources. Outdoor noise levels at nearby noise sensitive receivers surrounding the proposed GRMF were predicted using industry standard models which account for various effects from building shielding, terrain and weather.

The predicted noise levels are compliant with the environmental noise criteria for all operating periods.

Comparisons between predicted noise levels with the baseline noise data indicate that noise due to the proposed development is likely well below background levels, indicating it would usually be inaudible or difficult to perceive at the nearest residences.

On this basis, the proposed development is expected to comply with relevant environmental noise management criteria.

Recommendations

1. Staff training/inductions includes awareness of occupational and environmental noise hazards within the site and methods/actions they can take to reduce the risks with such hazards.
2. Consider field measurements during commissioning to confirm plant noise levels are less than or similar to that modelled.
3. Consider the use of automatic door closing systems for vehicle and personnel access to noisy spaces.

CONTENTS

APPENDICES

1 Introduction

SLR Consulting Australia Pty Ltd (SLR) has been commissioned by EcoGraf Limited (EcoGraf) to undertake a noise impact assessment of the proposed Graphite Recycling and Manufacturing Facility (GRMF) – Stage 1 Development located in Rockingham, Western Australia.

In support of the development permit application, this report provides an assessment of noise associated with the GRMF. The assessment is to ascertain whether there would be potential noise issue(s) regarding the installations and, if so, options to ensure compliance with Environmental Protection (Noise) Regulations 1997 and relevant environmental legislation for noise.

This report details the prediction of potential noise emissions and the assessment of noise impacts from the proposed development on surrounding noise sensitive premise. A description of acoustic terminology is provided in **Appendix A**.

1.1 Project description and site location

This proposed GRMF is located at Zirconia Drive, Rockingham, WA, with vehicular access off Alloy Ave. The proposed site is located within Kwinana industrial area. Outside the Kwinana industrial area, there are commercial/industrial areas around 1.3km away to the south, and two residential areas which are around 1.6km away to the west and 3.2km away to the east, respectively.

Figure 1 indicates the proximity of these surrounding areas to the GRMF.

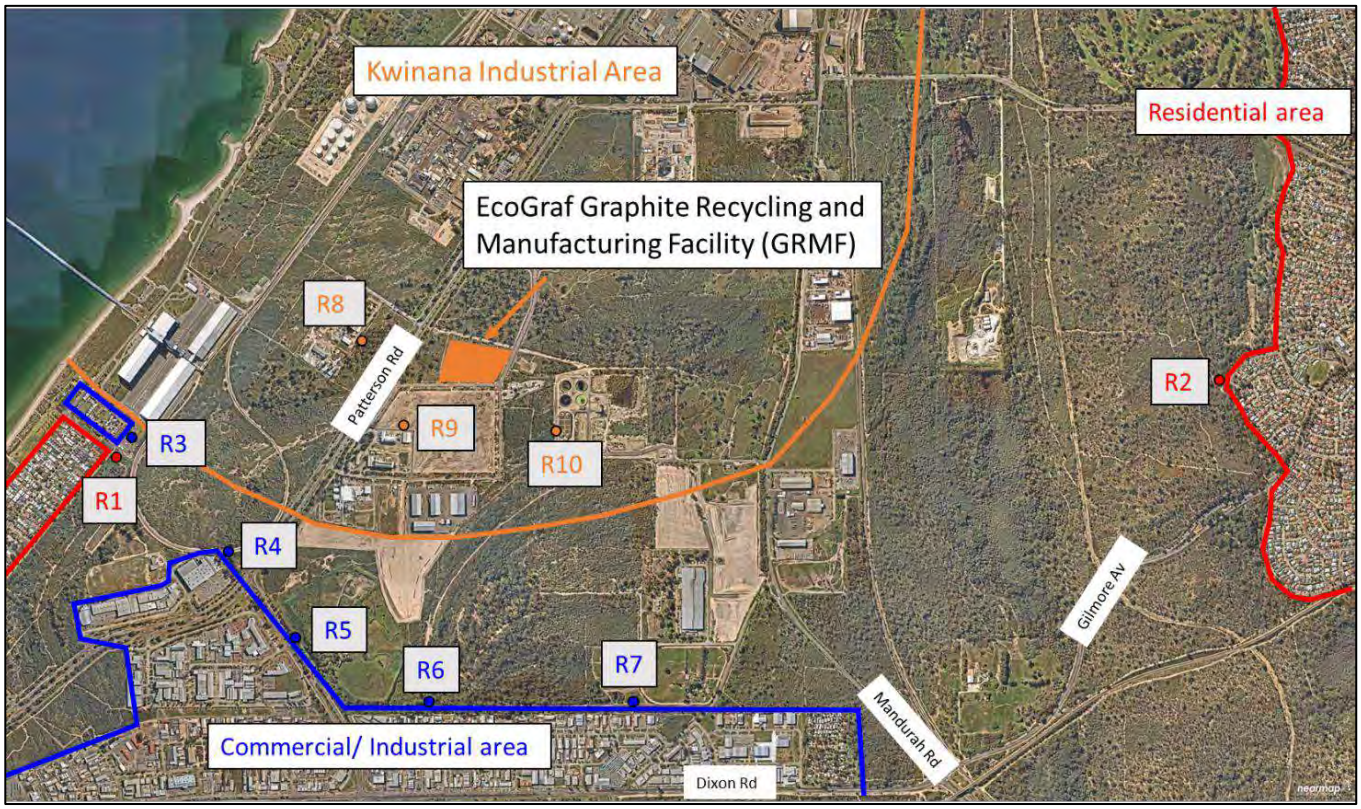


Figure 1 Annotated aerial image of the Graphite Recycling and Manufacturing Facility (GRMF) locality

The GRMF is proposed to operate as follows:

- All equipment operates 24hrs per day, aside from times where the plant is taken offline for planned maintenance.
- Material movements in Stage 1 occur during workdays (Monday to Friday), including bagged containerised graphite concentrate from port to plant 2 times/day, bagged containerised purified spherical graphite from plant to port 1 times/day and bagged containerised purified & impurified fine graphite from plant to port 1 times/day. This gives a total 4 truck movements per day.
- A forklift is employed to load/unload the material between different internal operational buildings, which is considered to be operated continuously for material transportation from unloading zone to mechanical shaping building and from SPG bagging building to truck loading.
- Car parking area for staff and visitors.

1.2 Scope of works

Operation of the facility will generate noise emissions which could have the potential to exceed relevant criteria.

SLR was instructed to:

- Review the proposed operational activities and develop a source emission database to primary sources of noise.
- Identify nearest noise sensitive receptors to provide a general overview of the existing environment at each site and establish relevant noise criteria for operation activities with reference to the Environmental Protection Noise Regulations 1997.
- Conduct baseline measurements to characterize the existing noise levels to assist in validating our noise model and assessing the relative change in noise levels due to the proposed development.
- Construct a noise prediction model that describes:
  - A 3D representation of the site and surrounding environment and communities.
  - The relevant sources of noise and their adopted noise emission levels.
  - Local buildings and other structures that may significantly screen or reflect noise.
  - Predict noise levels at nearest sensitive receptors and assess noise levels against the adopted operational noise criteria.
- Review a range of reasonable and practicable mitigation or management measures where predicted operational noise levels exceed the assessment criteria.

2 Noise criteria

Operational noise emissions are regulated by the Western Australian state government in the form of the *Western Australia Environmental Protection (Noise) Regulations 1997* (EPNR, the Regulations). To achieve compliance with this policy, noise levels at nearby residential areas are not to exceed defined limits referred to as Assigned Noise Levels. These limits are determined from consideration of prevailing background noise levels and 'influencing factors' that considers the level of commercial and industrial zoning in the locality.

The influencing factor considers zoning and road traffic around the nearest sensitive receiver of interest, within a 100 m and 450 m radius. A summary of the applicable noise limits is provided in **Table 1**. The specific assigned levels for each receiver are included in the sections of this report which detail the specific noise assessment for each site.

Table 1 Summary of assigned noise levels

Part of premises receiving noise	Time of day	Assigned level, dB		
		L_{A10}	L_{A1}	L_{Amax}
Noise Sensitive premises at locations within 15 metres of a building directly associated with a noise sensitive use	0700 to 1900 hours Monday to Saturday *('Day')*	45 + IF	55 + IF	65 + IF
	0900 to 1900 hours Sunday and public holidays *('Sundays')*	40 + IF	50 + IF	65 + IF
	1900 to 2200 hours all days *('Evening')*	40 + IF	50 + IF	55 + IF
	2200 hours on any day to 0700 Monday to Saturday and 0900 hours Sunday and public holidays *('Night')*	35 + IF	45 + IF	55 + IF
Noise Sensitive premises at locations further than 15 metres from a building directly associated with a noise sensitive use.	All hours	60	75	80
Commercial premises	All hours	60	75	80
Industrial and utility premises other than those in the Kwinana industrial Area	All hours	65	80	90
Industrial and utility premises in the Kwinana industrial Area	All hours	75	85	90

If noise emitted from any premises when received at any other premises cannot reasonably be free of intrusive characteristics of tonality, modulation and impulsiveness, then a series of adjustments must be added to the emitted levels (measured or calculated) and the adjusted level must comply with the assigned level.

The adjustments are detailed in **Table 2** and are further defined in Regulation 9(1) of the Environmental Protection (Noise) Regulations 1997.

Table 2 Adjustments to the emitted levels

Noise characteristic	Definition	Adjustment if present (Note[1])
Tones	Where the difference between the A weighted sound pressure level in any one third octave ban and the arithmetic average of the A weighted sound pressure levels in the two adjacent one third octave bands is greater than 3 dB in terms of L_{Aeq},T where the time period T is greater than 10% of the representative assessment period, or greater than 8 dB at any time when the sound pressure levels are determined as L_{ASlow} levels.	+5 dB
Modulation	A variation in the emission of noise that – • Is more than 3 dB L_{AFast} or is more than 3 dB L_{AFast} in any one third octave band; • Is present for at least 10% of the representative assessment period; and, • Is regular, cyclic and audible.	+5 dB
Impulsiveness	Present where the difference between the L_{APeak} and L_{Amax} is more than 15 dB when determined for single representative event.	+10 dB

Note 1 where noise emission is not music, these adjustments are cumulative to a maximum of 15 dB.

3 Assessment Methodology

3.1 Overview

Baseline noise measurements were conducted to characterise existing noise levels. A noise prediction model was established to estimate the noise levels at nearby noise sensitive receivers surrounding the proposed GRMF.

The results of baseline measurements were employed to validate the noise prediction model and assess the relative change in noise levels due to the proposed development. The predicted noise levels were assessed against the assigned levels to determine the potential compliance with the State Noise Regulations.

3.2 Baseline noise measurements

Where ambient levels are likely to be above relevant criteria at a desktop level, baseline noise measurements were undertaken to characterise existing noise levels and assess the potential change in noise levels due to the proposed development. The baseline noise measurements were undertaken as follows:

- Travel to the project site and install at least two noise loggers and undertake short-term attended noise measurements during equipment installation.
- After a period of seven days, return to the sites and collect all monitoring equipment.
- Analyse the data to quantify existing baseline noise levels and noise from current operations.

Two calibrated noise loggers were installed within the survey area for the period 9 to 16 August 2021. The detailed information of each logger setup is shown in the **Table 3**.

Table 3 Noise logger setup

Parameter	Noise logger 1	Noise logger 2
Photo		
Make / Model / Serial	01DB DUO 10210	01DB DUO 10933
Microphone calibration date	5th February 2021	5th February 2021
External system calibration date	8th November 2019	7th November 2019
System calibration date due	8th November 2021	7th November 2021

Parameter	Noise logger 1	Noise logger 2
Aerial Image		
Location description	Lewington Street, Rockingham 6168 -32.263414, 115.749211	Perham Cresent, Leda 6170 -32.261580, 115.801381

3.3 Noise prediction model

The noise emissions from the operation of GRMF were modelled using ISO 17534[1] compliant software (iNoise) and standardised equations and functions for outdoor noise propagation. The noise prediction algorithms account for the octave band sound power levels of the sources, the source heights, the distances to the receptors, building construction materials including the ceiling/roof and windows/walls.

The site scenario and the principal sources of noise included in the model are detailed in the subsections below.

3.3.1 Site scenario

The proposed site has been modelled using 3D spatial terrain data. The proposed graphite recycling and manufacturing facility, as well as all other significantly large buildings nearby, were modelled to account for screening and reflection of sound.

The detailed design of the proposed GRMF is demonstrated in **Figure 2**, where the red rectangles are the operation buildings that considered to have noisy mechanical plants be operated while the grey rectangles are the office buildings. The 3D view of the site scenario is displayed in **Figure 3**.

The influence of empty areas surrounding the proposed site (see **Figure 1**) have been included in the calculation as hard ground, noting that increased development would provide more attenuation.

[1] ISO 17534-1:2015 Acoustics — Software for the calculation of sound outdoors — Part 1: Quality requirements and quality assurance

Figure 2 The modelled layout of proposed graphite recycling and manufacturing facility

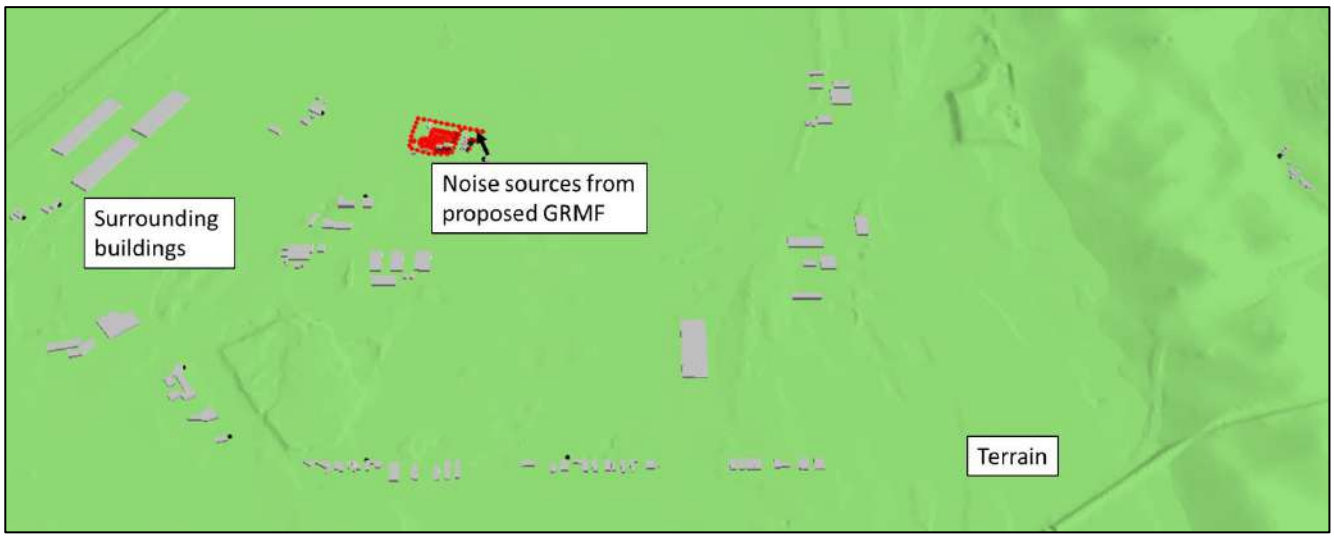


Figure 3 3D view of site scenario within the prediction model

A total of 10 receivers were used for the purpose of this assessment and they are described in **Table 4**.

Table 4 Assessed nearby noise sensitive receivers

EcoGraf GRMF	Noise sensitive premises located near the proposed site
Zirconia Drive, Rockingham, WA	Existing representative detached dwellings nearby (R1-R2) Existing representative commercial /industrial sites beyond Kwinana Industrial Area (R3-R7) Existing representative industrial sites within Kwinana Industrial Area (R8-R10)

The approximate locations of each noise sensitive receiver (R1-R10) to the proposed GRMF as well as the layout design within the site are shown in **Figure 1**.

3.3.2 Noise emission levels of sources

The advised operation hours of the plant are 24 hours per day, except when the plant is taken offline for planned maintenance. During operation, the principal sources of noise associated with the proposed development are:

- Light vehicle movements and parking activities from staff and customer
- Truck noise for material movements (4 truck passby per day)
- Forklifting noise around loading bay area (2 forklifting area)
- Operational noise, including different mechanical plants and relevant facilities.

The principal sources of noise are detailed in the below.

3.3.2.1 Light vehicle movements in car parking area

Approximately 25 carpark lots adjacent to eastern of the proposed site will be used by staff and visitors on site, with access via an entry point off Alloy Avenue. The staff and visitors' vehicles modelled are a mixture of passenger vehicles and light commercial vehicles such as utilities and 4WDs. Vehicle movements are expected during daytime in the car parking area (the yellow polygon area in **Figure 2**). Typical car parking noise events that may affect neighbouring properties include vehicle movement (tyre scuff, braking, etc) and door slamming.

Light vehicle movements noise emission levels based on the range referenced in the Association of Australian Acoustical Consultants (AAAC) typical sound power levels for car park vehicle movements. It is assumed 30 seconds of each light vehicle movement and 3 movement would occur per 15 minutes. The time-weighted spectrum of noise emission levels related to light vehicle movements are presented in **Table 5**. This has been applied to the car parking area as an area source in the model to assess the noise effect on the sensitive receptors. The duration of these events is considered infrequent, i.e. less than 10% of any continuous assessment period.

Table 5 Noise emission level – Light vehicle movements

Source	Sound power level in dBZ (unweighted), L_w re 1 pW									Overall level
	31.5Hz	**63 Hz**	**125 Hz**	**250 Hz**	**500 Hz**	**1k Hz**	**2k Hz**	**4k Hz**	**8k Hz**	**dBA**
Light vehicle movements	-	59	66	68	71	74	74	68	61	79

3.3.2.2 Truck movements for material loading/unloading

Truck movements are expected to transport the material during daytime on Monday to Friday. Deliveries are expected to be made in the proposed site along the green dots highlighted in **Figure 2.** EcoGraf has advised that there will be approximate four (4) truck loadings per day. Based on the above, the adjusted noise emission levels by speed and duration related to truck movements are presented in **Table 7**. This has been applied to the path of truck movements as a line source in the prediction model. The duration of these events is considered sporadic, i.e. less than 1% of any continuous assessment period.

Table 6 Noise emission level – Truck movements

Source	Sound power level in dBZ (unweighted), L_w re 1 pW									Overall level
	31.5Hz	63 Hz	125 Hz	250 Hz	500 Hz	1k Hz	2k Hz	4k Hz	8k Hz	dBA
Truck movements	-	87	94	96	101	103	102	98	88	108

3.3.2.3 Forklift movements for material delivery

Forklifts are expected to load/unload material continuously during operational hours in two forklifting areas shown in **Figure 2.** For these areas, noise emission levels related to forklift movements are presented in **Table 7**.

Table 7 Noise emission level – Forklifting

Source	Sound power level in dBZ (unweighted), L_w re 1 pW									Overall level
	31.5Hz	63 Hz	125 Hz	250 Hz	500 Hz	1k Hz	2k Hz	4k Hz	8k Hz	dBA
Forklifting	-	81	88	98	102	105	103	98	89	109

3.3.2.4 Main buildings

Based on the provided processing description and site design plans, the main buildings are outlined as red rectangles in **Figure 2**, including

- mechanical shaping building (MS 1+2),
- spiral flash dryer building (Dryer 22),
- plant building (Plant 23+24),
- purification building (PP17),
- bake kiln building (Kiln 16),
- SPG bagging plant building (SPG BP 20), and
- outdoor water treatment plants (W treat 27).

The principal noise sources in each building and the corresponding spectrum of the overall noise levels are shown in **Table 8**.

Conservatively, this operational noise assessment models all the machines running at 100% capacity continuously. Lower noise levels will result in practice where the actual utilisation rate is less. These buildings are modelled with openings / doors as per supplied drawings, and with steel framed, insulated steel linings. Roof sections are modelled as sound absorptive 'Anticon' style insulation between steel purlins and steel roof sheeting.

Table 8 Estimated noise emission level –Operation

Building	Key noise sources modelled	Qty.	Sound power level in dBZ (unweighted), L_w re 1 pW, per unit									
			Octave Band Centre Frequency, Hz									Overall
			31.5	63	125	250	500	1k	2k	4k	8k	dB(A)
Mechanical Shaping	Rotary mills, soft powder (Note [2])	52	-	80	87	88	90	88	87	82	37	93
	Fans	46	-	64	72	82	85	79	77	69	54	85
Spiral flash dryer	Dryer	1	-	94	94	93	89	88	83	80	-	92
Plant	Air compressors	1	-	81	86	88	90	90	87	81	74	94
	Dryer	1	-	94	94	93	89	88	83	80	-	92
	Steam boiler	1	-	105	99	101	98	95	88	78	-	100
Purification	Stirrers	12	-	60	71	84	83	83	82	78	73	88
	Pumps	12	-	71	74	81	90	89	84	81	74	93
Bake kiln	Kiln	1	-	56	71	81	89	96	98	96	90	103
	External fan	1	-	64	72	82	85	79	77	69	54	85
Water Treat (Outdoor)	Water Treat Pumps	2	-	76	79	86	95	94	89	86	79	98

Note 2 Noise emissions from the rotary mills are estimated based on supplier advice that levels would not exceed L_{Aeq} 85 dB at one metre distance in an open flat area.

3.4 Environmental propagation

The model uses the International Standard ISO 9613-2[2] method for calculating the outdoor noise propagation given the distances involved. The ISO method calculates noise levels with default meteorological conditions favourable for downwind propagation of noise (wind speeds between approximately 1 m/s and 5 m/s) or under a moderate ground-based temperature inversion.

These are considered more conservative than draft DWER guidelines which suggest the use of CONCAWE and higher bulk wind speeds.

3.5 Assigned Levels

The assigned noise levels for the nearby sensitive receivers surrounding the container collection depot are detailed in **Table 9**. These assigned levels on nearby residential areas include the influencing factor (IF) determined from the proximity of the receivers to main road, nearby commercial area and industrial area.

As some operations are forecast to occur during night-time period, the night-time assigned levels are considered to be the most stringent assessment criteria.

Table 9 Assigned Levels – Nearby Receivers

Sensitive receivers (Figure 3)	Notes	Influencing Factor, dB	Assigned Levels, L_{A10} dBA		
			Day	Evening	Night
Existing representative detached dwellings nearby (R1)	Residential area and within 100 m of industrial area	3	48	43	38

[2] International Standards Organization, 1996. ISO 9613-2:1996, Acoustics – attenuation of sound during propagation outdoors – Part 2: General method of calculation.

Sensitive receivers (Figure 3)	Notes	Influencing Factor, dB	Assigned Levels, LA10 dBA		
			Day	Evening	Night
Existing representative detached dwellings nearby (R2)	Residential area	-	45	40	35
Existing representative commercial /industrial sites beyond Kwinana Industrial Area (R3-R7)	commercial /industrial area	-	65/60	65/60	65/60
Existing representative industrial sites within Kwinana Industrial Area (R8-R10)	Kwinana industrial Area	-	75	75	75

4 Results and Discussion

4.1 Baseline measurement results

The following subsections describe results obtained during this period. A glossary of terms used is attached in **Appendix A**. Daily result tables are provided in **Table 10** and **Table 11**. **Appendix B** presents daily result figures for each location.

Table 10 'Lewington St' noise monitor daily results

Date	Background level, L_{A90}			Energy Average, L_{Aeq}		
	Day	Evening	Night	Day	Evening	Night
Monday, 9 August 2021	-	-	-	-	-	-
Tuesday, 10 August 2021	-	-	39	-	-	48
Wednesday, 11 August 2021	42	44	42	53	49	48
Thursday, 12 August 2021	44	45	44	51	49	49
Friday, 13 August 2021	44	46	42	53	51	49
Saturday, 14 August 2021	40	41	42	51	46	51
Sunday, 15 August 2021	41	44	-	49	48	-
Monday, 16 August 2021	-	-	-	-	-	-
Overall	**42**	**44**	**42**	**51**	**49**	**49**

From **Table 10** it can be seen that the typical day and night period background noise levels (L_{A90}) at the Lewington St noise unit were measured to be 42 dB. The typical day and night period average noise levels (L_{Aeq}) at the Lewington St noise unit were measured to be 51 dB and 49 dB, respectively.

From **Table 11** it can be seen that the typical day and night period background noise levels (L_{A90}) at the Perham Cres noise unit were measured to be 30dB and 32 dB, respectively. The typical day and night period average noise levels (L_{Aeq}) at the Lewington St noise unit were measured to be 47 dB and 40 dB, respectively.

Table 11 'Perham Cres' noise monitor daily results

Date	Background level, L_{A90}			Energy Average, L_{Aeq}		
	Day	Evening	Night	Day	Evening	Night
Monday, 9 August 2021	-	-	-	-	-	-
Tuesday, 10 August 2021	-	-	31	-	-	40

Date	Background level, L_{A90}			Energy Average, L_{Aeq}		
	Day	Evening	Night	Day	Evening	Night
Wednesday, 11 August 2021	31	31	29	47	38	40
Thursday, 12 August 2021	30	31	30	48	40	41
Friday, 13 August 2021	32	37	30	47	43	40
Saturday, 14 August 2021	32	32	26	47	39	37
Sunday, 15 August 2021	33	32	-	45	40	-
Monday, 16 August 2021	-	-	-	-	-	-
Overall	**32**	**32**	**30**	**47**	**40**	**40**

4.2 Predicted noise levels due to the proposed development

The noise impact due to the proposed operation and mechanical plant noise has been predicted for all outdoor receivers and the results are presented in **Table 12**. Noise contours of results are displayed in **Figure 4.**

Table 12 Predicted Noise Levels from operation and mechanical plant noise

Location / Receiver	Criteria $L_{A10, night}$ (dB)	Predicted L_{A10} (dB)	Expected outcome
Residential Building (R1)	38	31	Complies with criteria
Residential Building (R2)	35	<25	
Commercial/ Industrial Building (R3)	60/65	36	
Commercial/ Industrial Building (R4)	60/65	35	
Commercial/ Industrial Building (R5)	60/65	30	
Commercial/ Industrial Building (R6)	60/65	36	
Commercial/ Industrial Building (R7)	60/65	39	
Industrial Building within Kwinana Industrial Area (R8)	75	52	
Industrial Building within Kwinana Industrial Area (R9)	75	53	
Industrial Building within Kwinana Industrial Area (R10)	75	60	

Based on **Table 12** and **Figure 4** indicating compliance during the night period, noise emissions from the facility are expected to be compliant during all operating periods. The detailed grid contour of predicted noise level within the proposed GRMF site is presented in **Figure 5**.

Comparisons between **Table 12** with the baseline measurement results (**Section 4.1**) also indicate that noise due to the proposed development is likely inaudible or difficult to perceive at nearby residences.

Figure 4 Grid contour of predicted noise level due to the proposed GRMF, L_{A10}

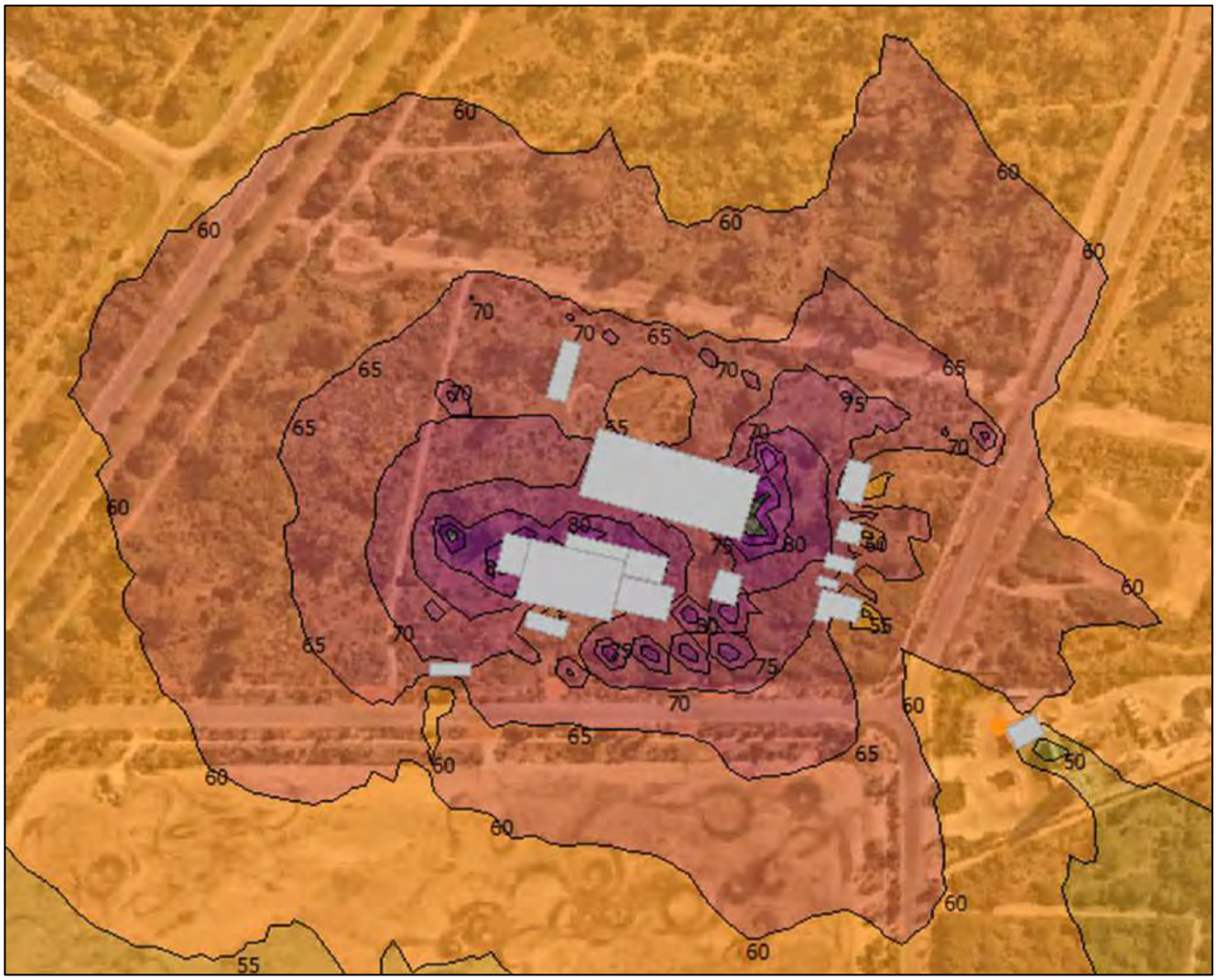


Figure 5 Detailed grid contour of predicted noise level within the proposed GRMF site, L_{A10}

4.3 Predicted noise levels within main buildings

Cumulative noise levels within main operation buildings have been predicted and the results to inform OH&S measures to protect the workforce from potential noise hazards. The modelled reverberant sound levels within operation buildings are listed in **Table 13**.

Table 13 Reverberant sound level of mechanical shaping building

Source	Sound pressure level in dBZ (unweighted), L_p re 20 µPa									Overall level
	31.5Hz	63 Hz	125 Hz	250 Hz	500 Hz	1k Hz	2k Hz	4k Hz	8k Hz	dBA
Mechanical Shaping building	-	72	79	78	78	76	73	67	45	81
Spiral flash dryer building	-	72	72	70	65	64	58	54	-	69
Plant building	-	86	81	80	76	74	68	61	58	79
Purification building	-	58	63	71	75	73	68	63	58	77
Bake kiln building	-	43	53	62	66	72	73	70	72	79

The occupational noise standard is L_{Aeq} 85dB for 8 hours of equivalent noise exposure according to the AS/NZS 1269 series of standards.

Field measurements will likely need to be undertaken during commissioning to verify risks in terms of occupational noise exposure.

5 Conclusion

SLR has been commissioned to undertake an environmental noise assessment of the proposed Graphite Recycling and Manufacturing Facility located at Zirconia Drive, East Rockingham. Noise generated by the proposed development has been considered with regard to *Western Australia Environmental Protection (Noise) Regulations 1997* requirements.

The predictions indicate that the proposed development as currently documented will comply with the relevant criteria at the most exposed noise receptors, thus confirming the suitability of the site for such development.

6 Recommendations

The following recommendations are proposed to ensure ongoing compliance with relevant noise criteria during the operation of the facility as part of a management plan:

1. Staff training/inductions includes awareness of occupational and environmental noise hazards within the site and methods/actions they can take to reduce the risks with such hazards.
2. Consider field measurements during commissioning to confirm plant noise levels are less than or similar to that modelled.
3. Consider the use of automatic door closing systems for vehicle and personnel access to noisy spaces.

APPENDIX A

Glossary of Acoustic Terminology

1. Sound Level or Noise Level

The terms 'sound' and 'noise' are almost interchangeable, except that 'noise' often refers to unwanted sound.

Sound (or noise) consists of minute fluctuations in atmospheric pressure. The human ear responds to changes in sound pressure over a very wide range with the loudest sound pressure to which the human ear can respond being ten million times greater than the softest. The decibel (abbreviated as dB) scale reduces this ratio to a more manageable size by the use of logarithms.

The symbols SPL, L or LP are commonly used to represent Sound Pressure Level. The symbol LA represents A-weighted Sound Pressure Level. The standard reference unit for Sound Pressure Levels expressed in decibels is 2 x 10^{-5} Pa.

2. 'A' Weighted Sound Pressure Level

The overall level of a sound is usually expressed in terms of dBA, which is measured using a sound level meter with an 'A-weighting' filter. This is an electronic filter having a frequency response corresponding approximately to that of human hearing.

People's hearing is most sensitive to sounds at mid frequencies (500 Hz to 4,000 Hz), and less sensitive at lower and higher frequencies. Different sources having the same dBA level generally sound about equally loud.

A change of 1 dB or 2 dB in the level of a sound is difficult for most people to detect, whilst a 3 dB to 5 dB change corresponds to a small but noticeable change in loudness. A 10 dB change corresponds to an approximate doubling or halving in loudness. The table below lists examples of typical noise levels.

Sound Pressure Level (dBA)	Typical Source	Subjective Evaluation
130	Threshold of pain	Intolerable
120	Heavy rock concert	Extremely noisy
110	Grinding on steel	
100	Loud car horn at 3 m	Very noisy
90	Construction site with pneumatic hammering	
80	Kerbside of busy street	Loud
70	Loud radio or television	
60	Department store	Moderate to quiet
50	General Office	
40	Inside private office	Quiet to very quiet
30	Inside bedroom	
20	Recording studio	Almost silent

Other weightings (eg B, C and D) are less commonly used than A-weighting. Sound Levels measured without any weighting are referred to as 'linear', and the units are expressed as dB(lin) or dB.

3. Sound Power Level

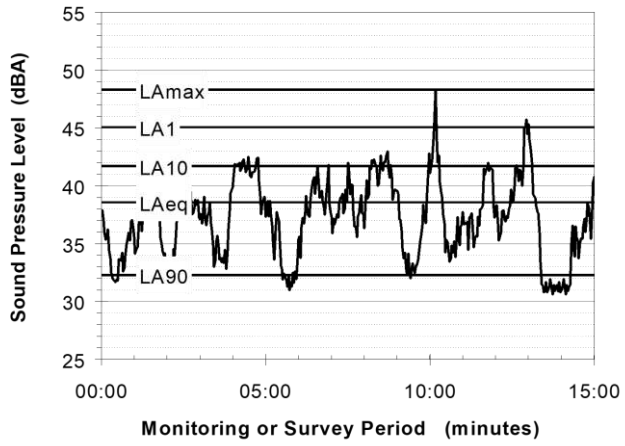
The Sound Power of a source is the rate at which it emits acoustic energy. As with Sound Pressure Levels, Sound Power Levels are expressed in decibel units (dB or dBA), but may be identified by the symbols SWL or LW, or by the reference unit 10^{-12} W.

The relationship between Sound Power and Sound Pressure is similar to the effect of an electric radiator, which is characterised by a power rating but has an effect on the surrounding environment that can be measured in terms of a different parameter, temperature.

4. Statistical Noise Levels

Sounds that vary in level over time, such as road traffic noise and most community noise, are commonly described in terms of the statistical exceedance levels LAN, where LAN is the A-weighted sound pressure level exceeded for N% of a given measurement period. For example, the LA1 is the noise level exceeded for 1% of the time, LA10 the noise exceeded for 10% of the time, and so on.

The following figure presents a hypothetical 15 minute noise survey, illustrating various common statistical indices of interest.



Of particular relevance, are:

LA1 The noise level exceeded for 1% of the 15 minute interval.

LA10 The noise level exceeded for 10% of the 15 minute interval. This is commonly referred to as the average maximum noise level.

LA90 The noise level exceeded for 90% of the sample period. This noise level is described as the average minimum background sound level (in the absence of the source under consideration), or simply the background level.

LAeq The A-weighted equivalent noise level (basically, the average noise level). It is defined as the steady sound level that contains the same amount of acoustical energy as the corresponding time-varying sound.

5. Frequency Analysis

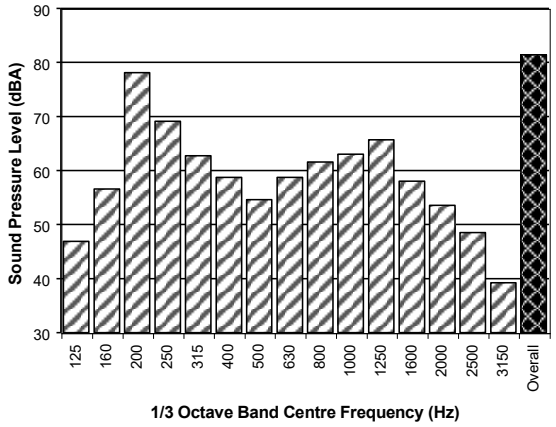
Frequency analysis is the process used to examine the tones (or frequency components) which make up the overall noise or vibration signal.

The units for frequency are Hertz (Hz), which represent the number of cycles per second.

Frequency analysis can be in:

- Octave bands (where the centre frequency and width of each band is double the previous band)
- 1/3 octave bands (three bands in each octave band)
- Narrow band (where the spectrum is divided into 400 or more bands of equal width)

The following figure shows a 1/3 octave band frequency analysis where the noise is dominated by the 200 Hz band. Note that the indicated level of each individual band is less than the overall level, which is the logarithmic sum of the bands.



6. Annoying Noise (Special Audible Characteristics)

A louder noise will generally be more annoying to nearby receivers than a quieter one. However, noise is often also found to be more annoying and result in larger impacts where the following characteristics are apparent:

- **Tonality** - tonal noise contains one or more prominent tones (ie differences in distinct frequency components between adjoining octave or 1/3 octave bands), and is normally regarded as more annoying than 'broad band' noise.
- **Impulsiveness** - an impulsive noise is characterised by one or more short sharp peaks in the time domain, such as occurs during hammering.
- **Intermittency** - intermittent noise varies in level with the change in level being clearly audible. An example would include mechanical plant cycling on and off.
- **Low Frequency Noise** - low frequency noise contains significant energy in the lower frequency bands, which are typically taken to be in the 10 to 160 Hz region.

7. Vibration

Vibration may be defined as cyclic or transient motion. This motion can be measured in terms of its displacement, velocity or acceleration. Most assessments of human response to vibration or the risk of damage to buildings use measurements of vibration velocity. These may be expressed in terms of 'peak' velocity or 'rms' velocity.

The former is the maximum instantaneous velocity, without any averaging, and is sometimes referred to as 'peak particle velocity', or PPV. The latter incorporates 'root mean squared' averaging over some defined time period.

Vibration measurements may be carried out in a single axis or alternatively as triaxial measurements (ie vertical, longitudinal and transverse).

The common units for velocity are millimetres per second (mm/s). As with noise, decibel units can also be used, in which case the reference level should always be stated. A vibration level V, expressed in mm/s can be converted to decibels by the formula 20 log (V/Vo), where Vo is the reference level (10^{-9} m/s). Care is required in this regard, as other reference levels may be used.

8. Human Perception of Vibration

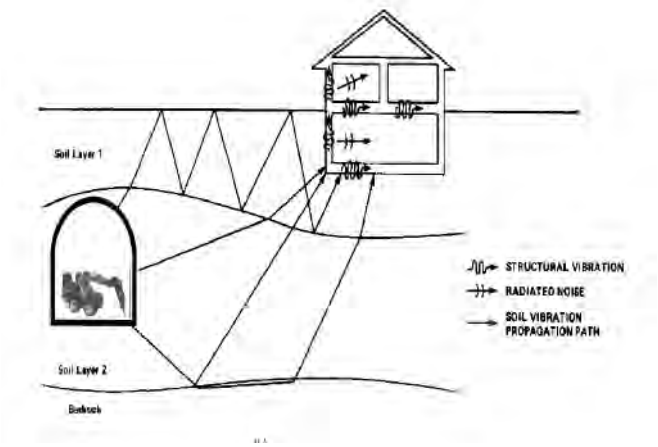
People are able to 'feel' vibration at levels lower than those required to cause even superficial damage to the most susceptible classes of building (even though they may not be disturbed by the motion). An individual's perception of motion or response to vibration depends very strongly on previous experience and expectations, and on other connotations associated with the perceived source of the vibration. For example, the vibration that a person responds to as 'normal' in a car, bus or train is considerably higher than what is perceived as 'normal' in a shop, office or dwelling.

9. Ground-borne Noise, Structure-borne Noise and Regenerated Noise

Noise that propagates through a structure as vibration and is radiated by vibrating wall and floor surfaces is termed 'structure-borne noise', 'ground-borne noise' or 'regenerated noise'. This noise originates as vibration and propagates between the source and receiver through the ground and/or building structural elements, rather than through the air.

Typical sources of ground-borne or structure-borne noise include tunnelling works, underground railways, excavation plant (eg rockbreakers), and building services plant (eg fans, compressors and generators).

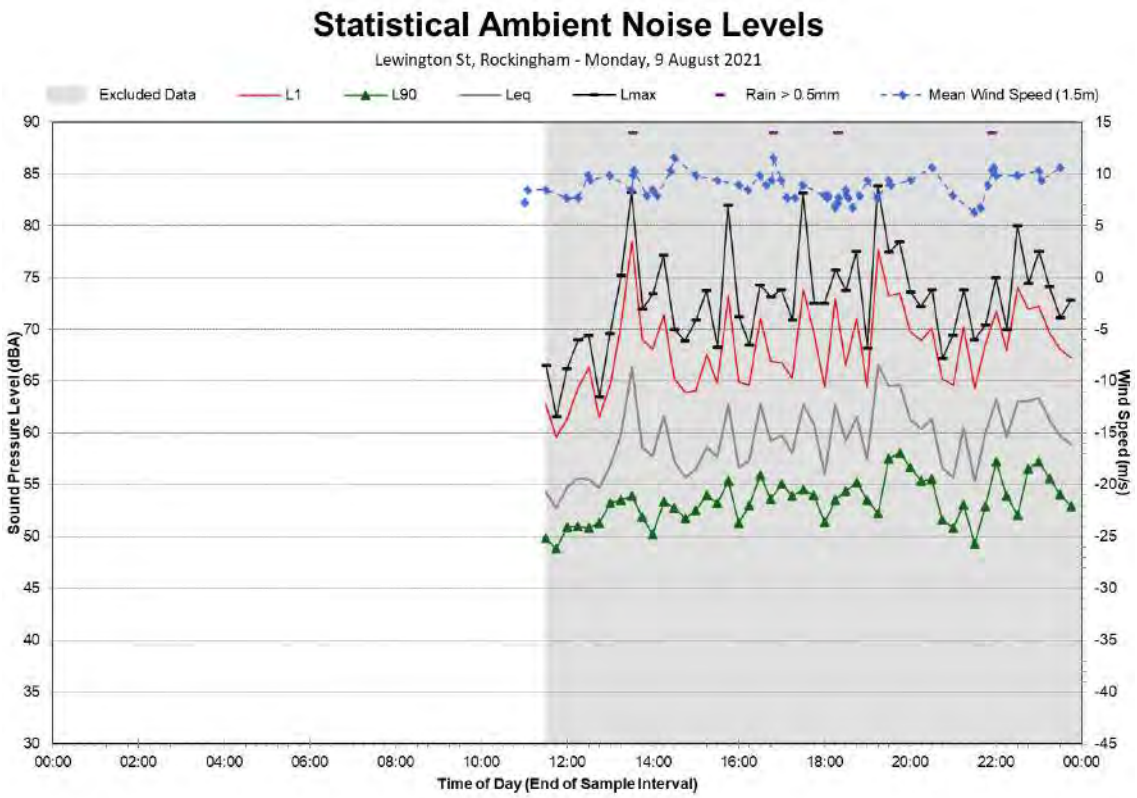
The following figure presents an example of the various paths by which vibration and ground-borne noise may be transmitted between a source and receiver for construction activities occurring within a tunnel.

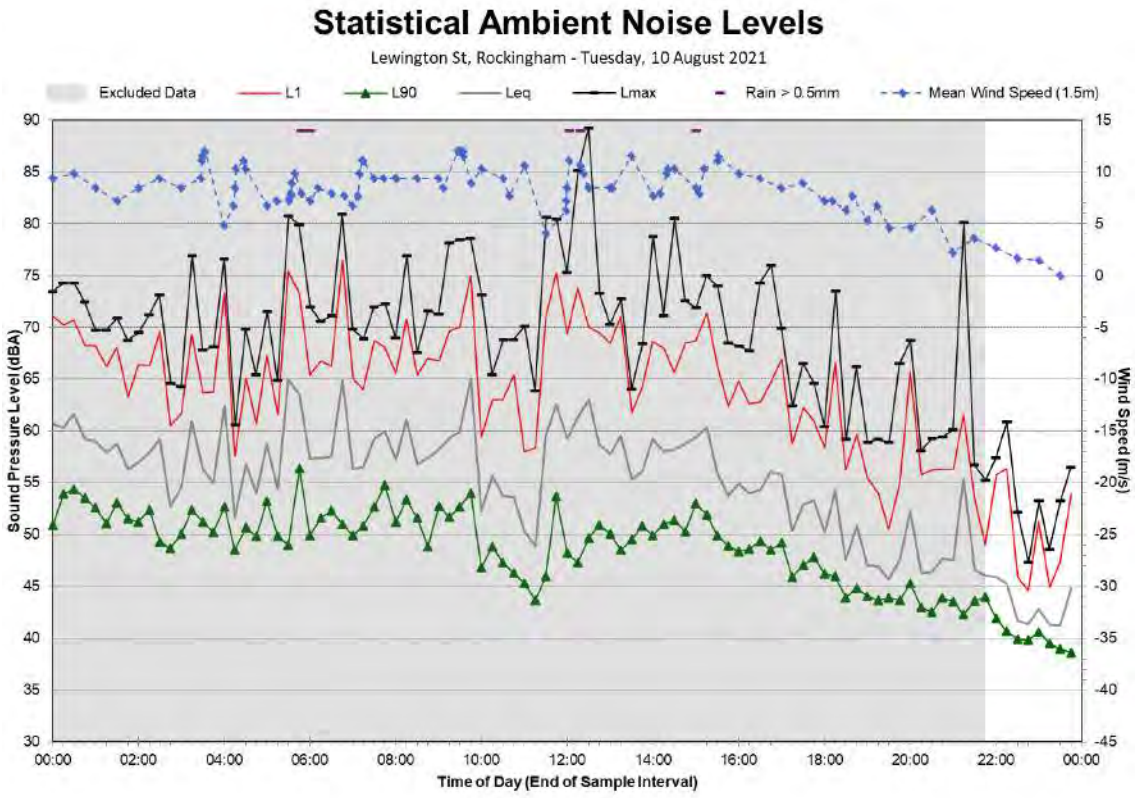


The term 'regenerated noise' is also used in other instances where energy is converted to noise away from the primary source. One example would be a fan blowing air through a discharge grill. The fan is the energy source and primary noise source. Additional noise may be created by the aerodynamic effect of the discharge grill in the airstream. This secondary noise is referred to as regenerated noise.

APPENDIX B

Baseline measurements daily result figures


Statistical Ambient Noise Levels
Lewington St, Rockingham - Monday, 9 August 2021
Excluded Data
L1
L90
Leq
Lmax
Rain > 0.5mm
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)


Statistical Ambient Noise Levels
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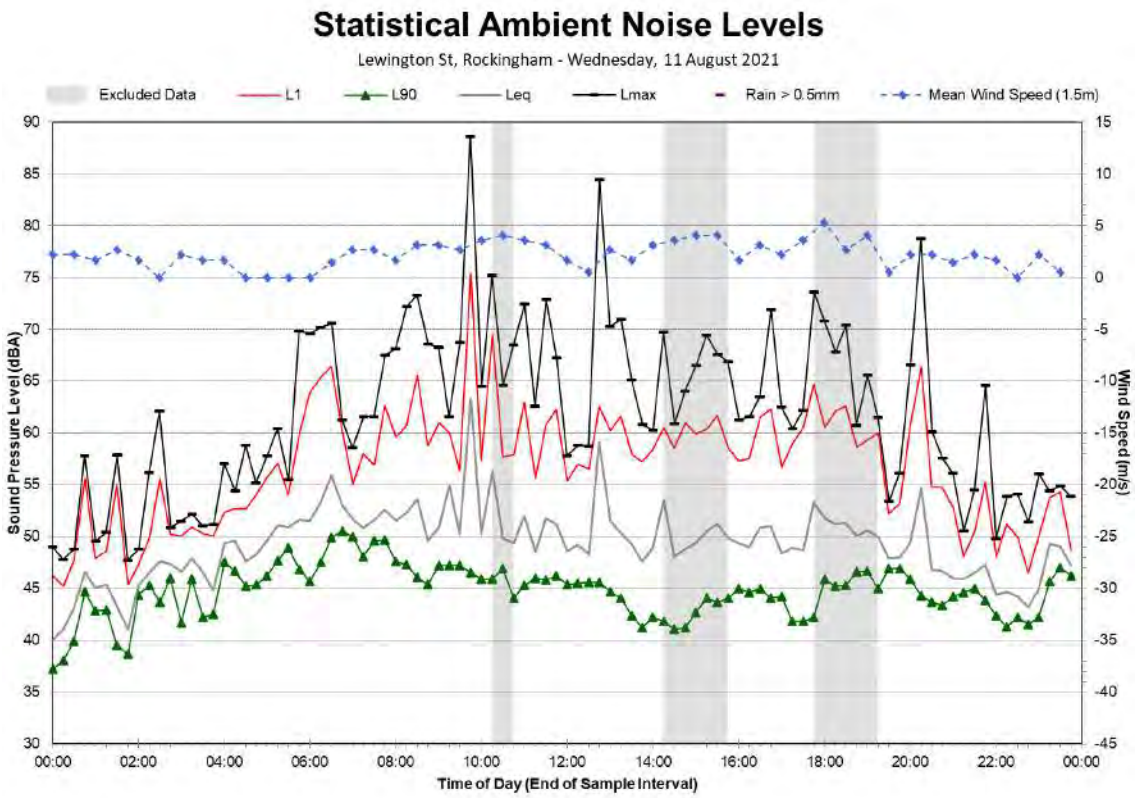
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)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Lewington St, Rockingham - Wednesday, 11 August 2021
Excluded Data
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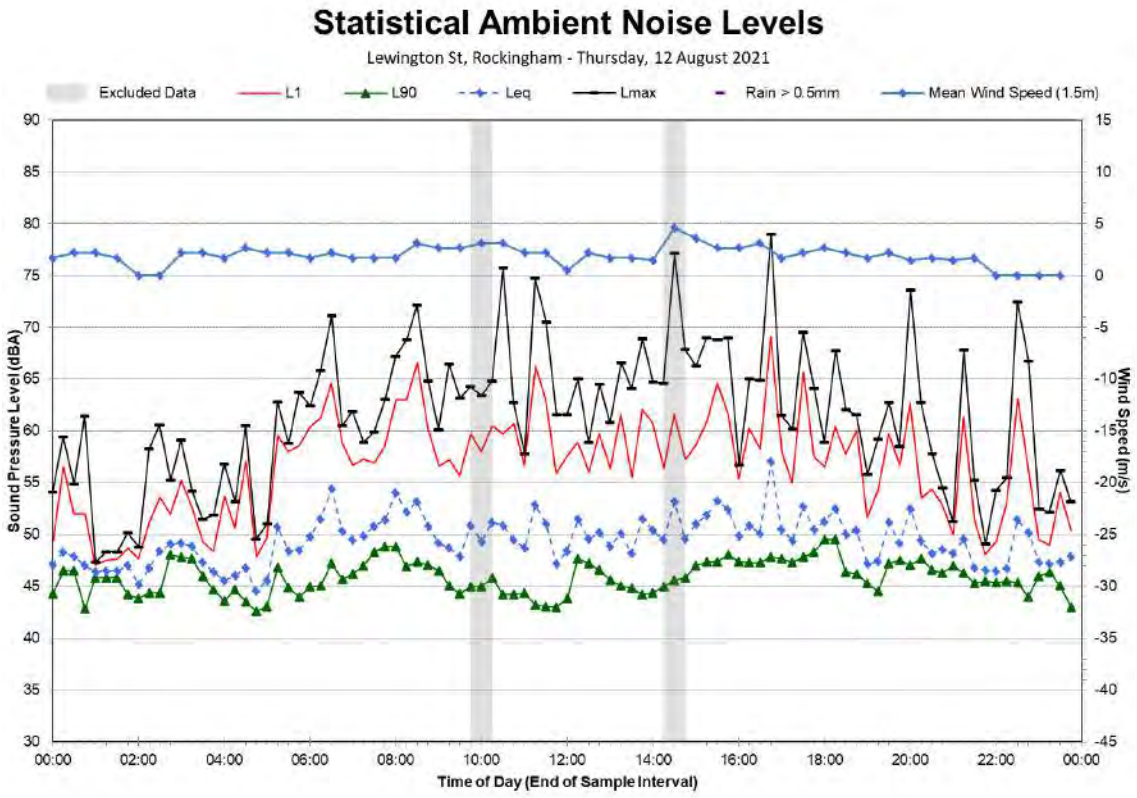
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)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Lewington St, Rockingham - Thursday, 12 August 2021
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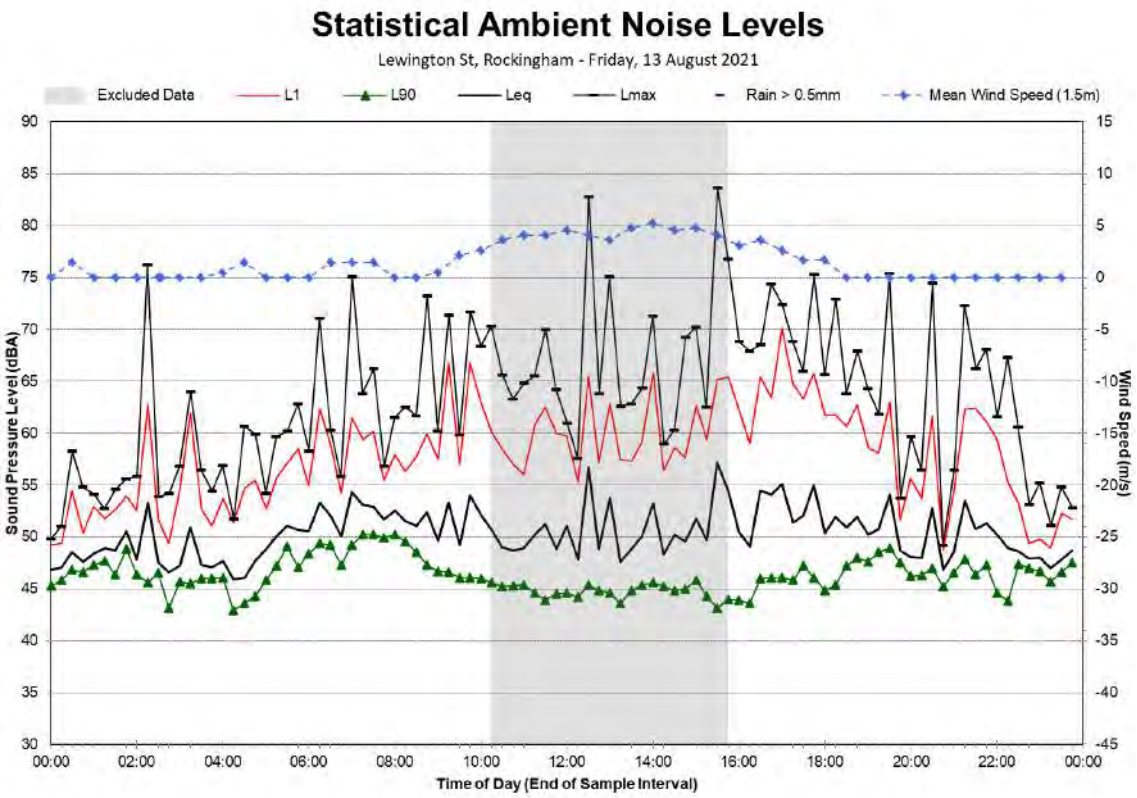
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)


Statistical Ambient Noise Levels
Lewington St, Rockingham - Friday, 13 August 2021
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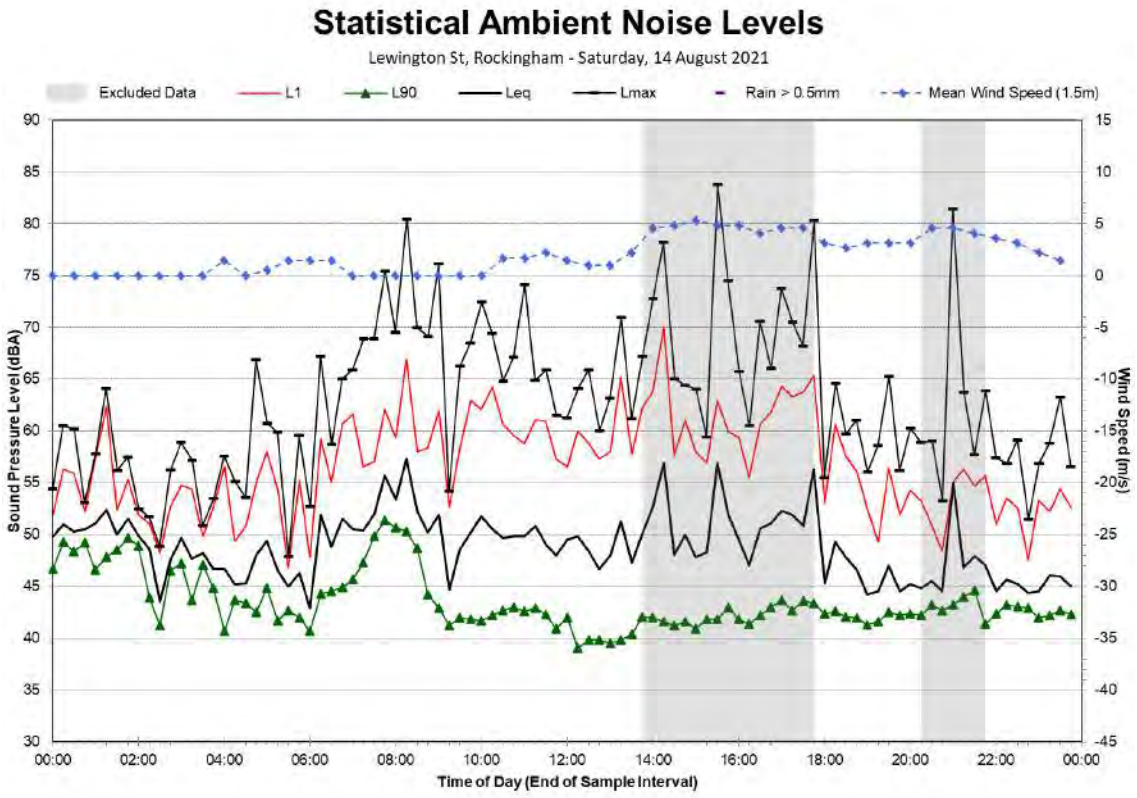
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)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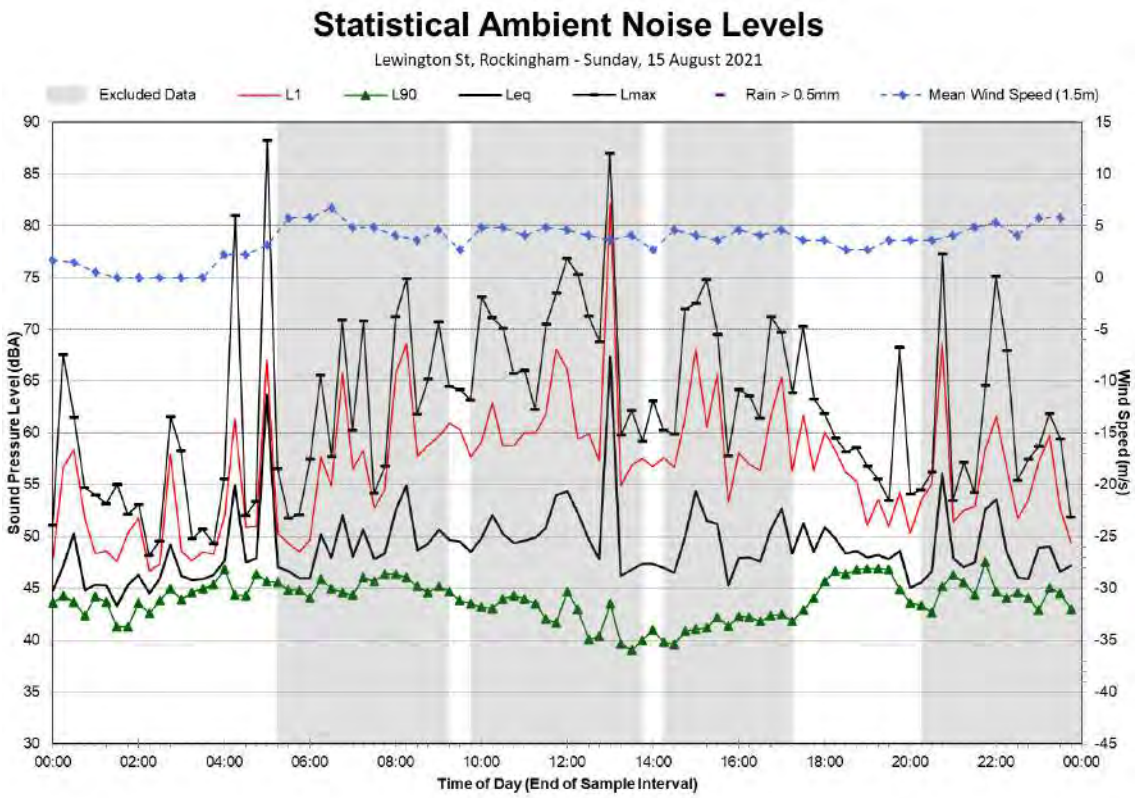
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)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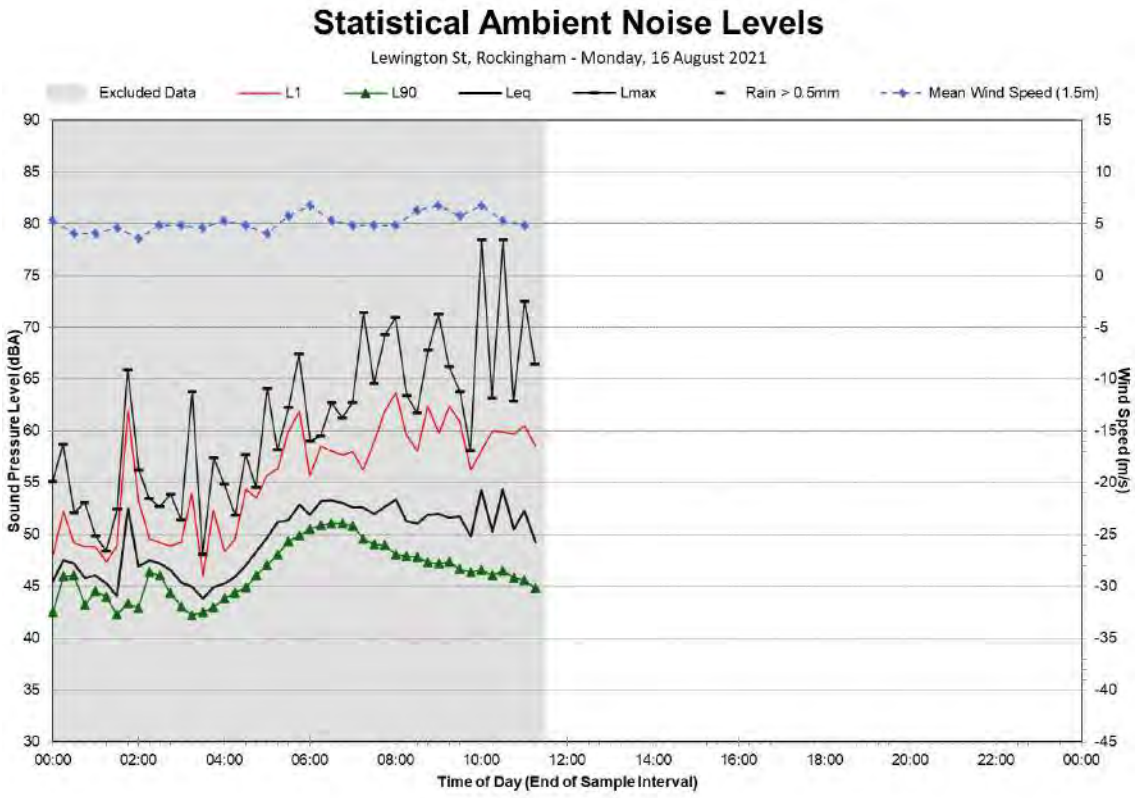
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)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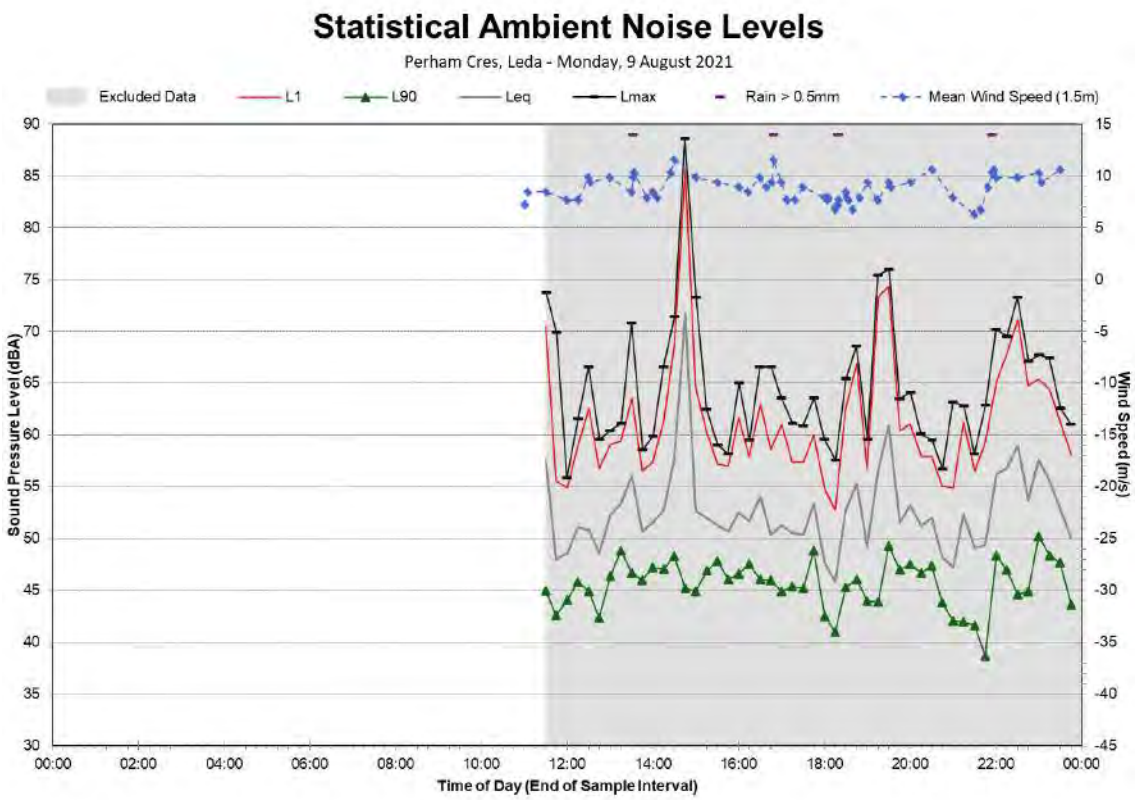
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)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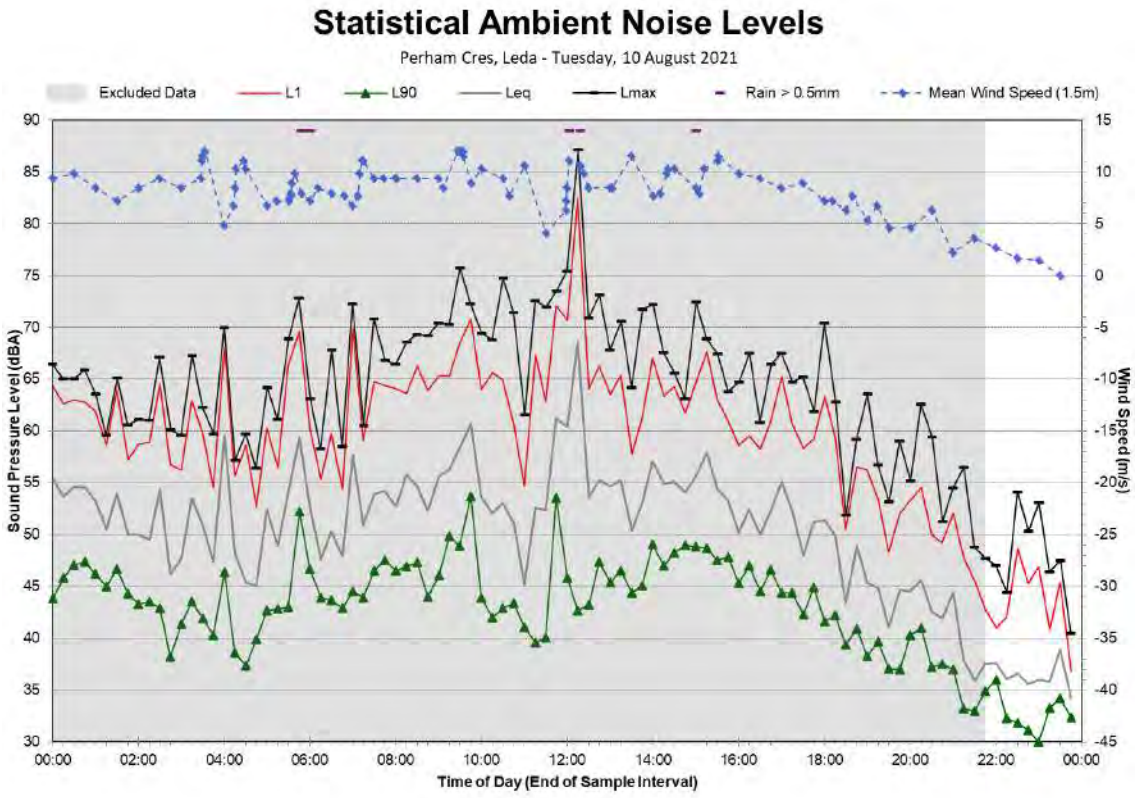
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)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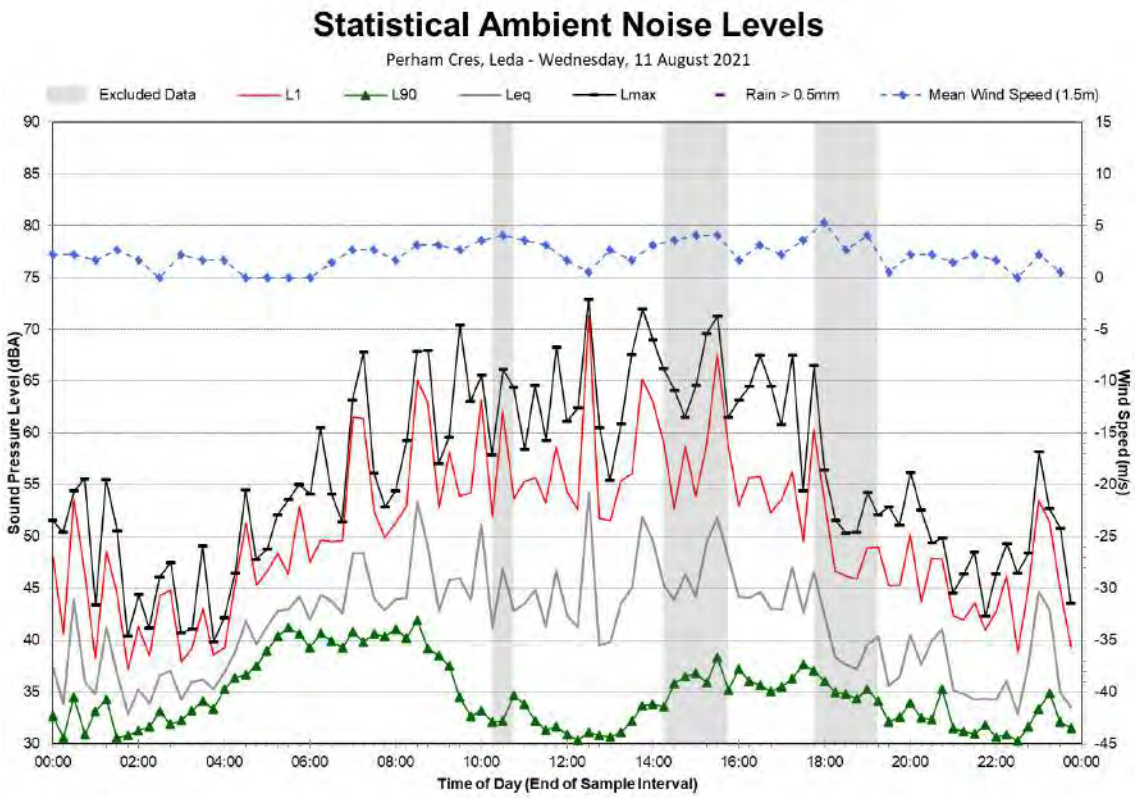
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)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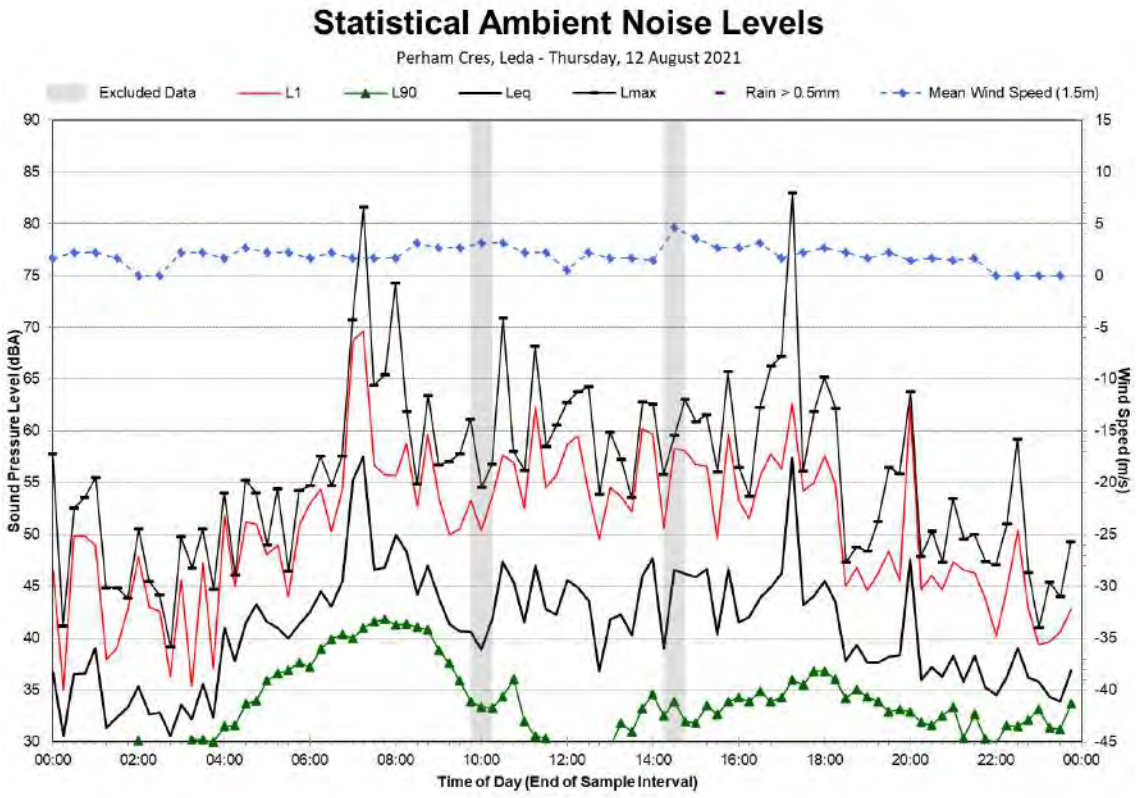
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)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Excluded Data
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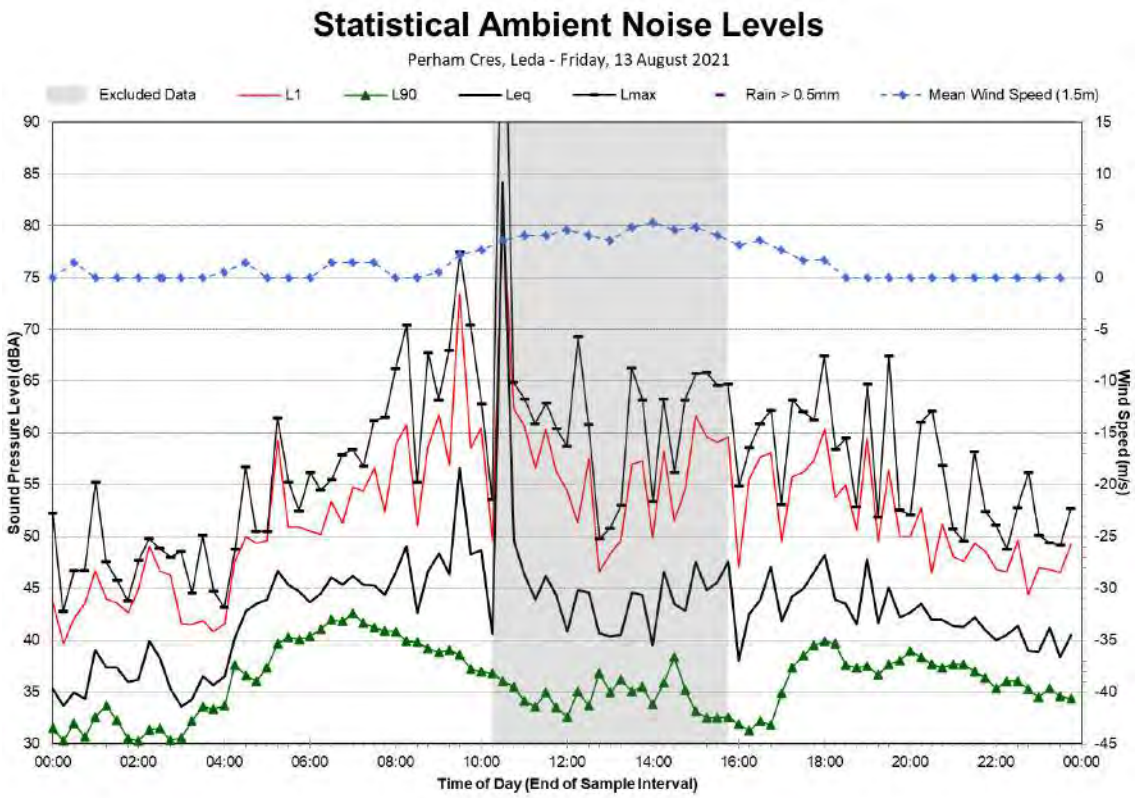
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)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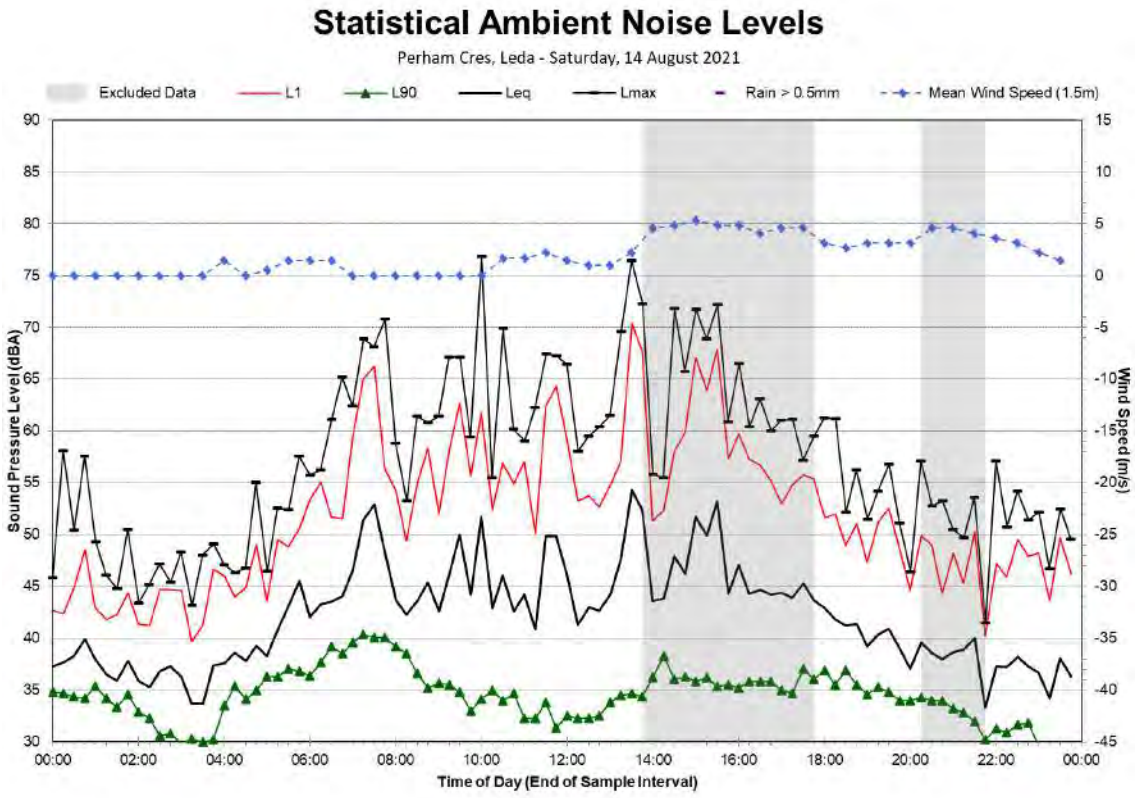
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)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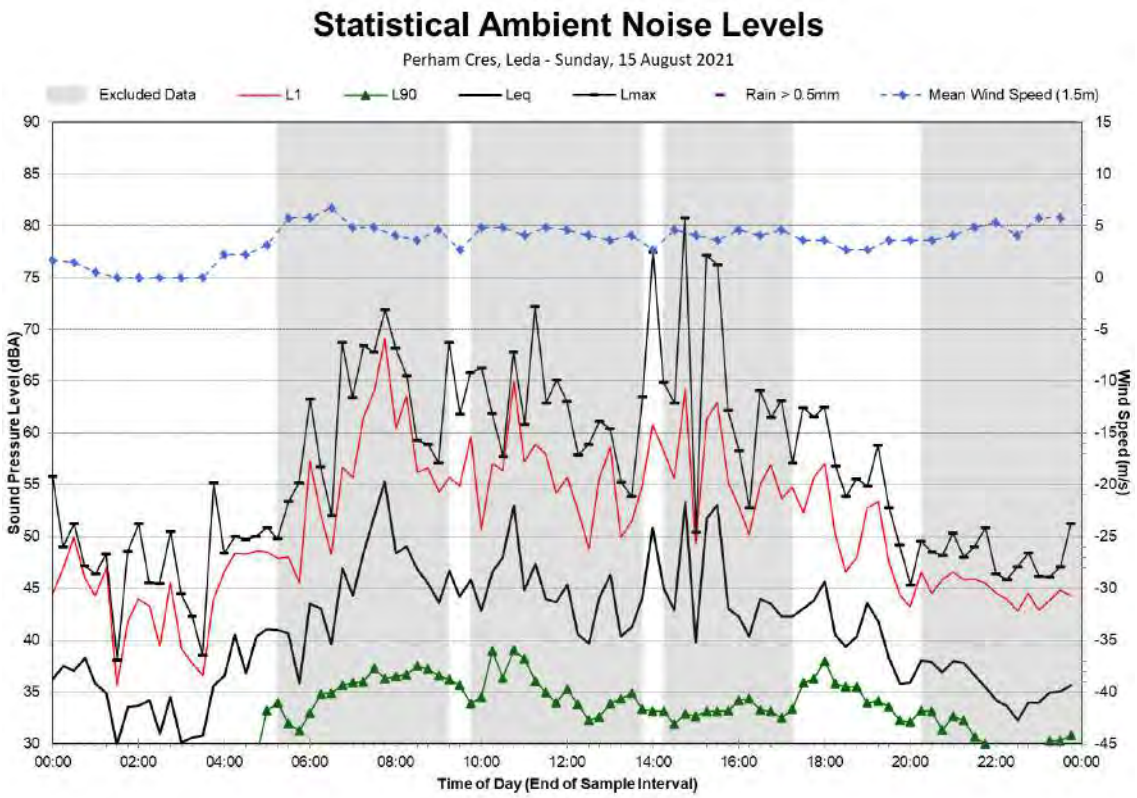
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)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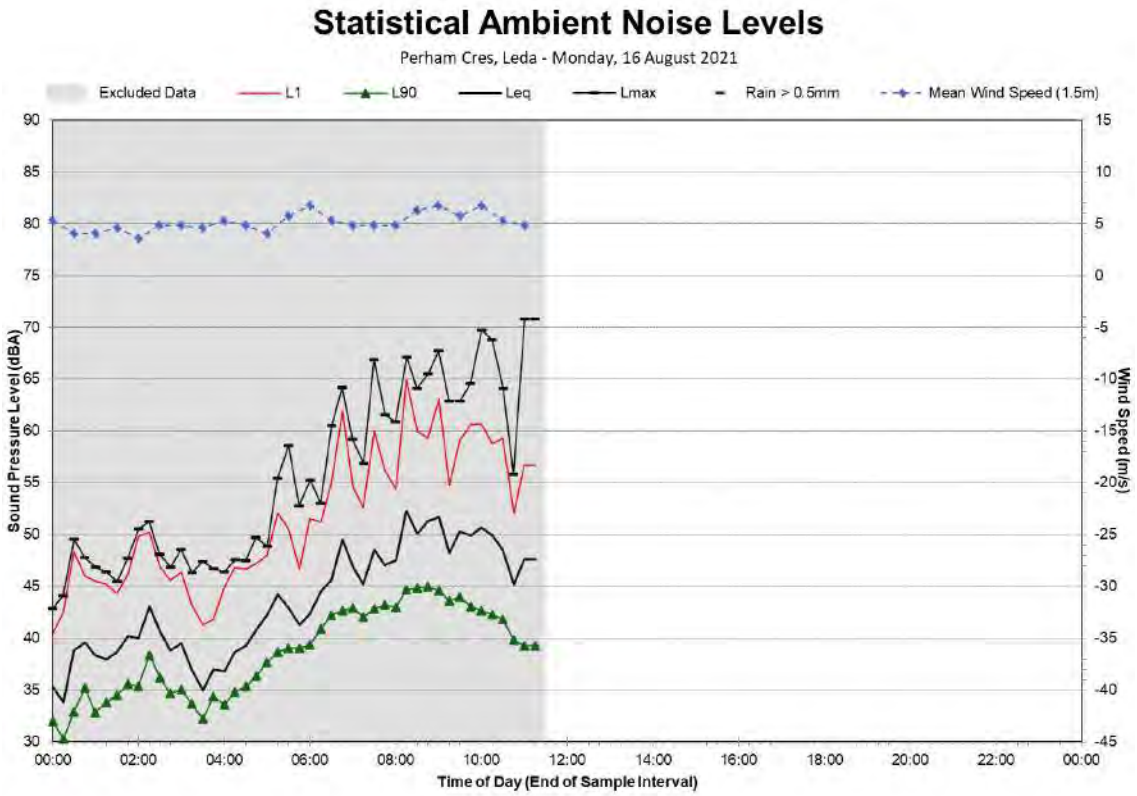
Wind Speed (m/s)
Time of Day (End of Sample Interval)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Excluded Data
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Leq
Lmax
Rain > 0.5mm
Mean Wind Speed (1.5m)
Sound Pressure Level (dBA)
Wind Speed (m/s)
Time of Day (End of Sample Interval)

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Appendix I – Site Feature Survey

IT SHOULD BE NOTED THAT ALL UNDERGROUND SERVICES NEED TO BE VERIFIED BY THE RELEVANT AUTHORITY PRIOR TO ANY DEMOLITION, EXCAVATION, DESIGN AND/OR CONSTRUCTION. THEREFORE, NO RESPONSIBILITY IS TAKEN FOR SERVICE LOCATIONS. THE CERTIFICATE OF TITLE SHOULD BE CHECKED FOR EASEMENTS AND ENCUMBRANCES.

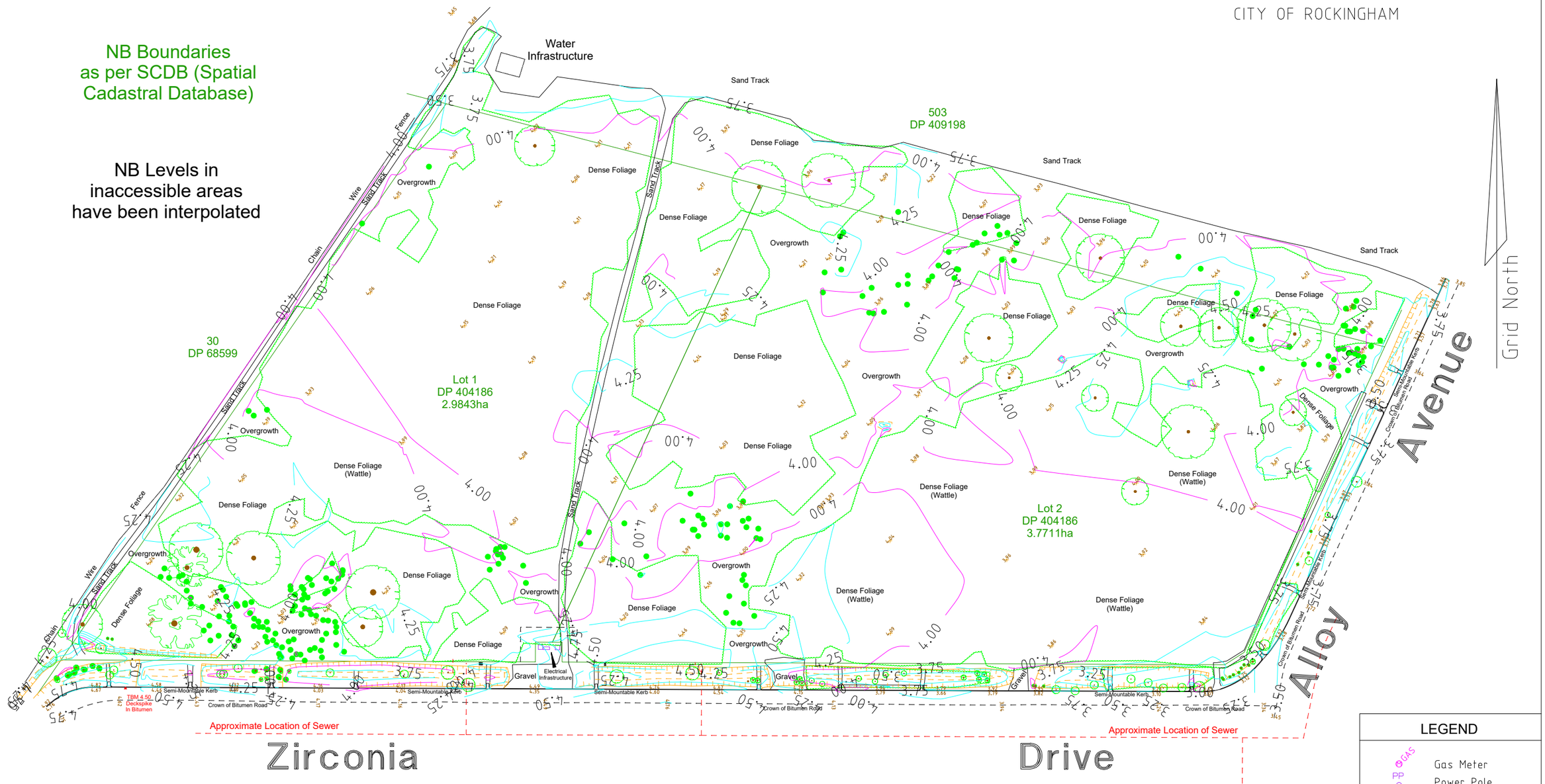
0 30 60 90 120 150

SCALE – 1:1500 @A3

LOCAL AUTHORITY:
CITY OF ROCKINGHAM

NB Boundaries as per SCDB (Spatial Cadastral Database)

NB Levels in inaccessible areas have been interpolated



THIS PLAN IS ACCURATE AT TIME OF SURVEY. HORIZON SURVEYS ACCEPTS NO RESPONSIBILITY FOR THE ACCURACY OF ANY INFORMATION ADDED. AREA AND DIMENSIONS SUBJECT TO SURVEY, DIMENSIONS AS PER CERTIFICATE OF TITLE OR SURVEY PLAN. ALL CADASTRAL INFORMATION SHOWN IS THE RESULT OF THE LOCATION OF LIMITED SURVEY MARKS AND AS SUCH BOUNDARY LOCATIONS COULD VARY UPON FINAL SURVEY.

LEGEND

- Gas Meter
- Power Pole
- Light Pole
- Power Dome
- Telecom Pit
- Clothes Hoist
- Sewer Vent
- Sewer Manhole
- Gully Trap
- Water Meter
- Water Bore
- Tree

HORIZON SURVEYS
2 / 14 JERSEY STREET, JOLIMONT WA 6014
PH 9387 8226 Mob 0407 080 073
Email admin@horizonsurveys.com.au

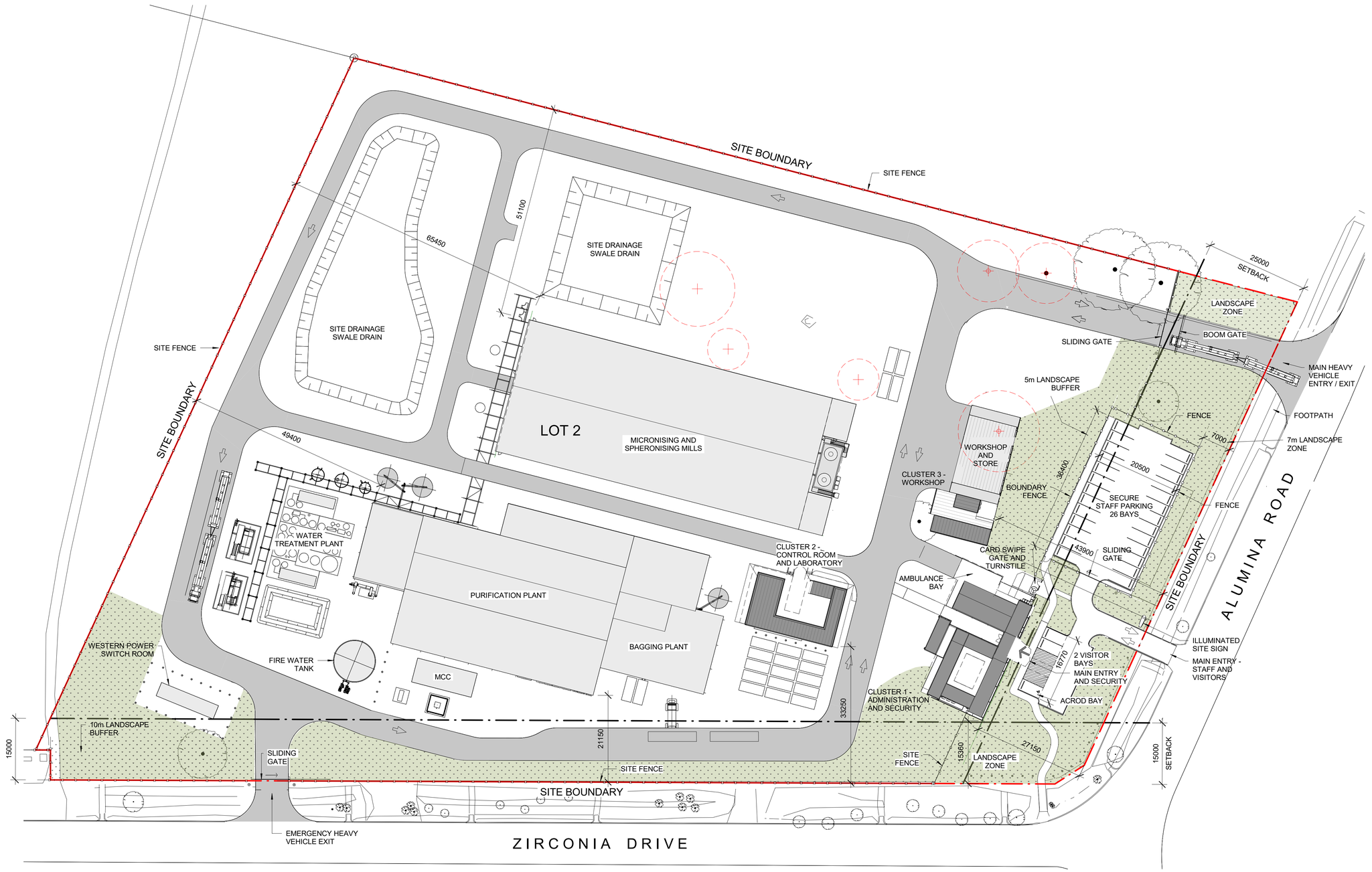
INCREVA PTY LTD

FEATURE SURVEY
LOT 1 & 2 ZIRCONIA DRIVE, EAST ROCKINGHAM
(LOT 1 & 2 on DEPOSITED PLAN 404186)

REV	DETAILS	BY	DATE
1	DET 1	BY 1	DD/MM/YY
2	DET 2	BY 2	DD/MM/YY
3	DET 3	BY 3	DD/MM/YY

SURVEYED ABS/MF	DATE 14/12/2021	HORIZONTAL DATUM PCG 2021
COMPUTED ABS	16/12/2021	VERTICAL DATUM AHD (ex ALLDAYRTK)
DRAWN ABS	16/12/2021	FIELD NOTES HS 790
JOB NUM 210233	DRAWING No. 210233_FS_V1	

Appendix J – Non-Process Infrastructure (NPI) Architectural Drawings



1 SITE PLAN
1 : 500

LEGEND

- MODULAR BUILDINGS
- IN-SITU CONSTRUCTION BUILDINGS
- LANDSCAPE ZONE - REFER LANDSCAPE PLAN
- SEALED BITUMEN ROAD
- EXISTING TREE TO BE PROTECTED AND RETAINED
- TREE TO BE REMOVED
- SITE BOUNDARY FENCE. 2.4m HIGH, BLACK PVC COATED CHAIN MESH WITH BLACK POSTS

HUNT ARCHITECTS
ABN 67 297 805 649
Level 2 / 1 Ord Street, West Perth WA 6005
T + 61 8 9322 6033
office@huntarchitects.com.au

CLIENT
ECOGRAF

PROJECT
ECOGRAF BATTERY ANODE MATERIAL FACILITY

NOTES
1. Do not scale drawing.
2. All dimensions are in milimeters unless noted otherwise.
3. All dimensions shall be verified on site before proceeding with the work. **Hunt Architects** shall be notified in writing of any discrepancies.
4. This drawing must be read in conjunction with all relevant contracts, specifications and drawings.

REV.	DESCRIPTION	DATE
A	DRAFT ISSUE FOR COMMENT AND COORDINATION	12-01-2022
B	DRAFT ISSUE FOR COMMENT AND COORDINATION	13-01-2022
C	DRAFT ISSUE FOR COORDINATION	18-01-2022
D	DRAFT ISSUE FOR COORDINATION	24-01-2022
E	DRAFT ISSUE	25-01-2022
F	ISSUE FOR D. A.	28-01-2022

NORTH

SCALE 1:500 @ A1
0m 10m 20m 30m 40m 50m

STATUS
DEVELOPMENT APPLICATION

DRAWING TITLE
SITE PLAN

DRAWN BY
TC

APPROVED
SAS

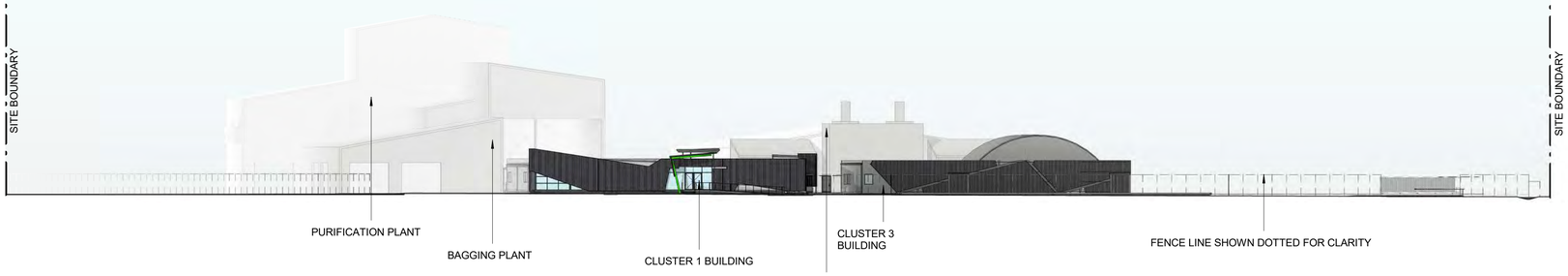
PROJECT No.
2164

DRAWING No.
DA-001

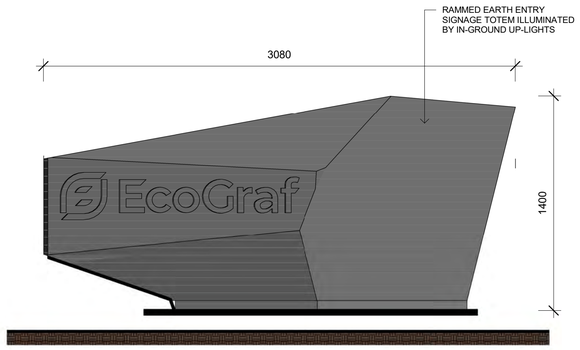
REV No.
F

DATE
27/01/2022

1 STREET ELEVATION - ZIRCONIA
1 : 350



2 STREETSCAPE - ALUMINA ROAD
1 : 350



4 ENTRY SIGNAGE DETAIL - FRONT VIEW
1 : 20

HUNT ARCHITECTS
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Level 2 / 1 Ord Street, West Perth WA 6005
T + 61 8 9322 6033
office@huntarchitects.com.au

CLIENT
ECOGRAF

PROJECT
ECOGRAF BATTERY ANODE MATERIAL FACILITY

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REV.	DESCRIPTION	DATE
A	ISSUE FOR D. A.	28-01-2022

STATUS
DEVELOPMENT APPLICATION

DRAWING TITLE
STREETSCAPE ELEVATION

DRAWN BY

APPROVED
SAS

PROJECT No.
2164

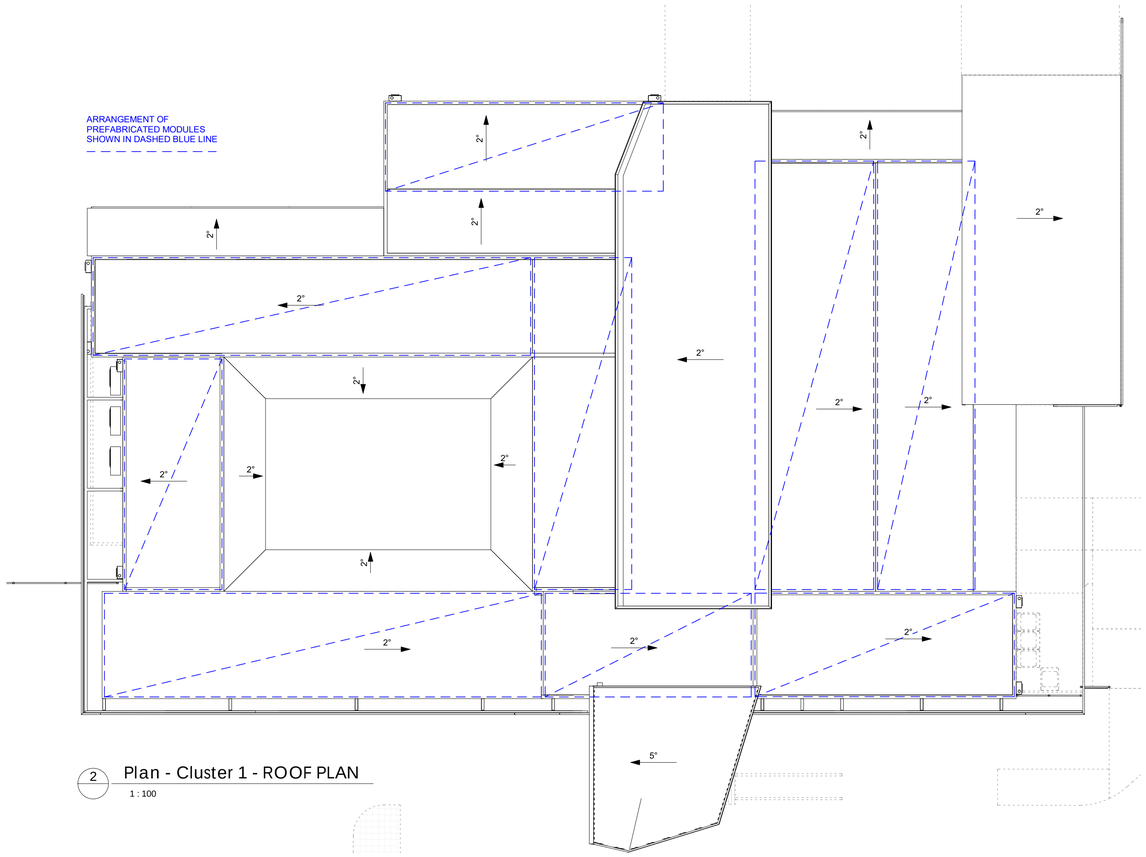
DRAWING No.
DA-002

REV No.
A

DATE
01/27/22

1 DA-102 PLAN - CLUSTER 1 - ADMINISTRATION AND SECURITY

1 : 100



2 Plan - Cluster 1 - ROOF PLAN

1 : 100

HUNT ARCHITECTS

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PROJECT
ECOGRAF BATTERY ANODE MATERIAL FACILITY

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REV.	DESCRIPTION	DATE
A	DRAFT ISSUE	25-01-2022
B	ISSUE FOR D. A.	28-01-2022

NORTH

SCALE 1:100 @ A1

0m 2m 4m 6m 8m 10m

STATUS
DEVELOPMENT APPLICATION

DRAWING TITLE
CLUSTER 1 - SHEET 1

DRAWN BY
Author

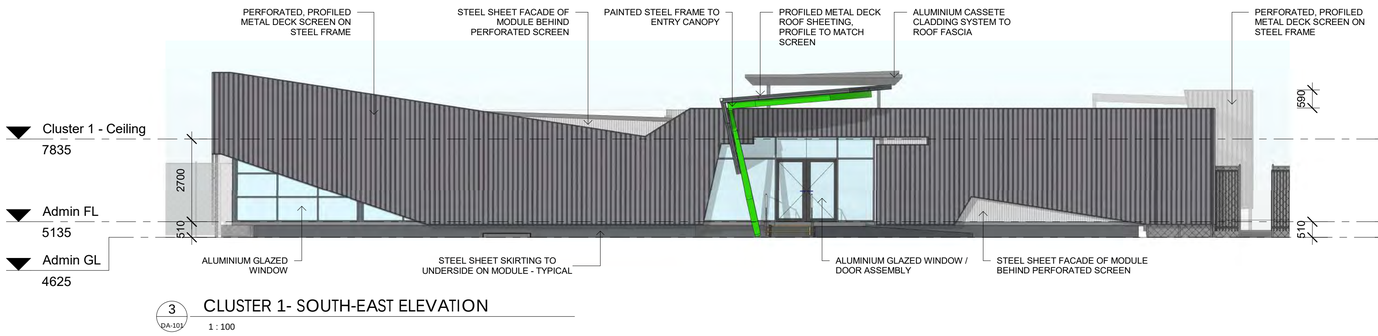
APPROVED
SAS

PROJECT No.
2164

DRAWING No.
DA-101

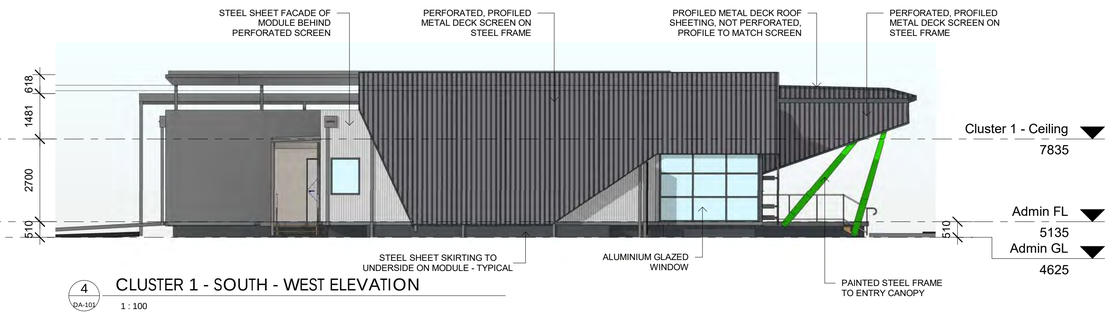
REV No.
B

DATE
01/27/22



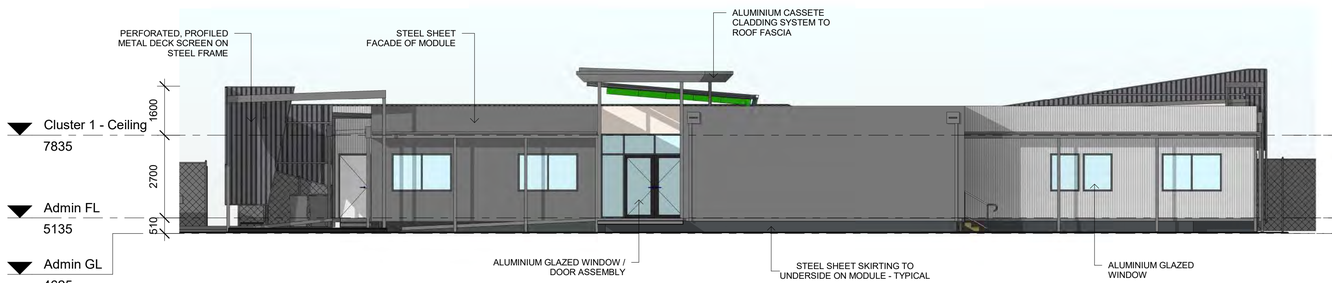
3 DA-101 CLUSTER 1- SOUTH-EAST ELEVATION

1 : 100



4 DA-101 CLUSTER 1 - SOUTH - WEST ELEVATION

1 : 100

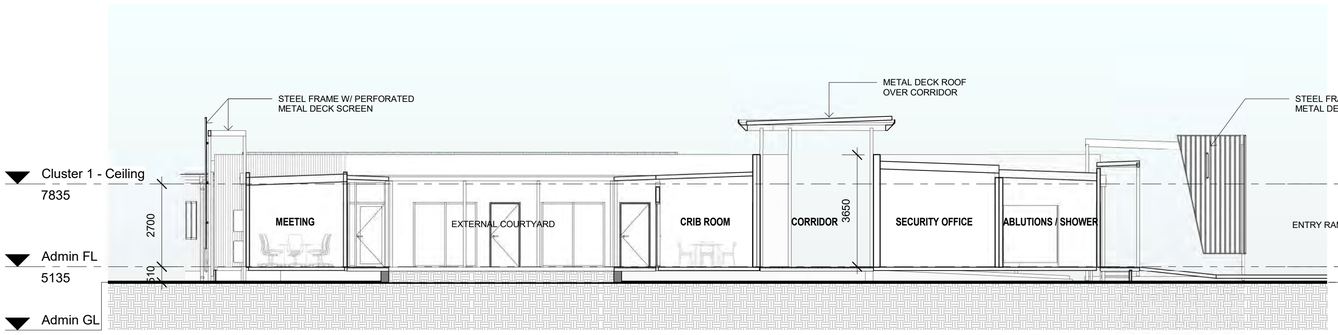


5 DA-101 CLUSTER 1 - NORTH - WEST ELEVATION

1 : 100

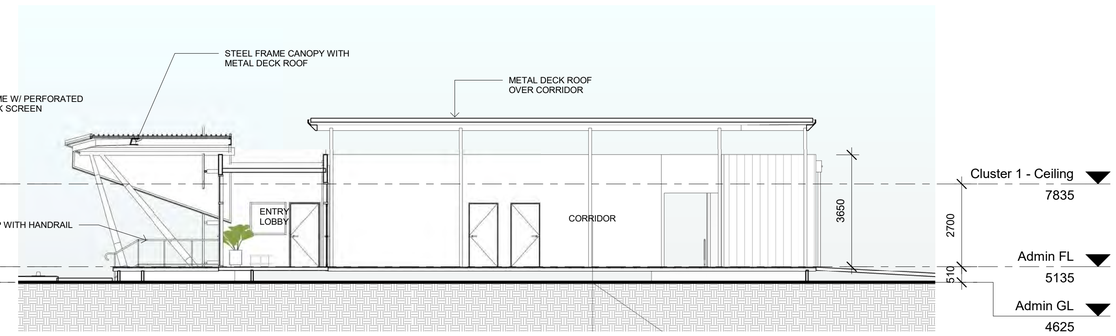
6 DA-101 CLUSTER 1 - NORTH - EAST ELEVATION

1 : 100



1 DA-101 SECTION 1

1 : 100



2 DA-101 SECTION 1

1 : 100

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REV.	DESCRIPTION	DATE
A	DRAFT ISSUE	25-01-2022
B	ISSUE FOR D. A.	28-01-2022

NORTH

SCALE 1:200 @ A1

0m 4m 8m 12m 16m 20m

STATUS
DEVELOPMENT APPLICATION

DRAWING TITLE
CLUSTER 1 - SHEET 2

DRAWN BY
Author

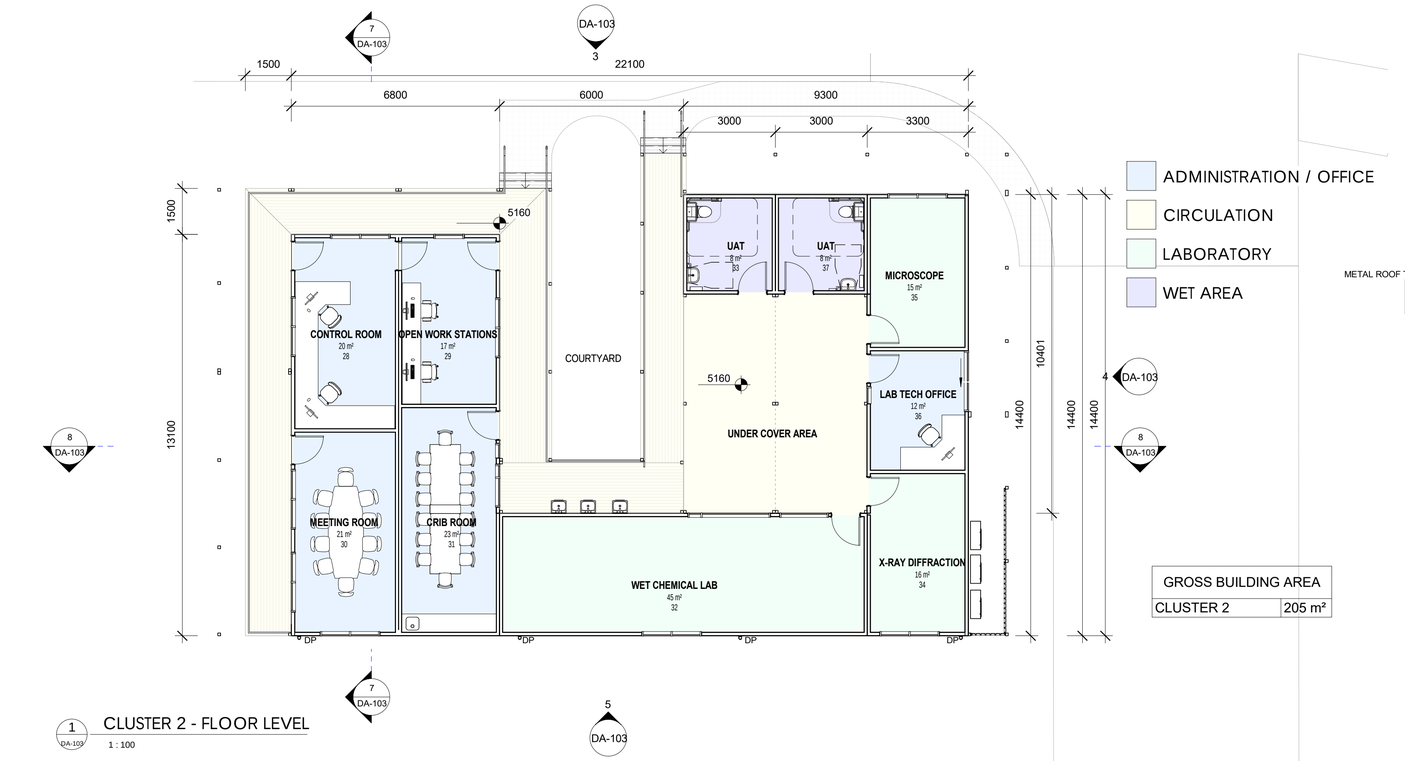
APPROVED
Approver

PROJECT No.
2164

DRAWING No.
DA-102

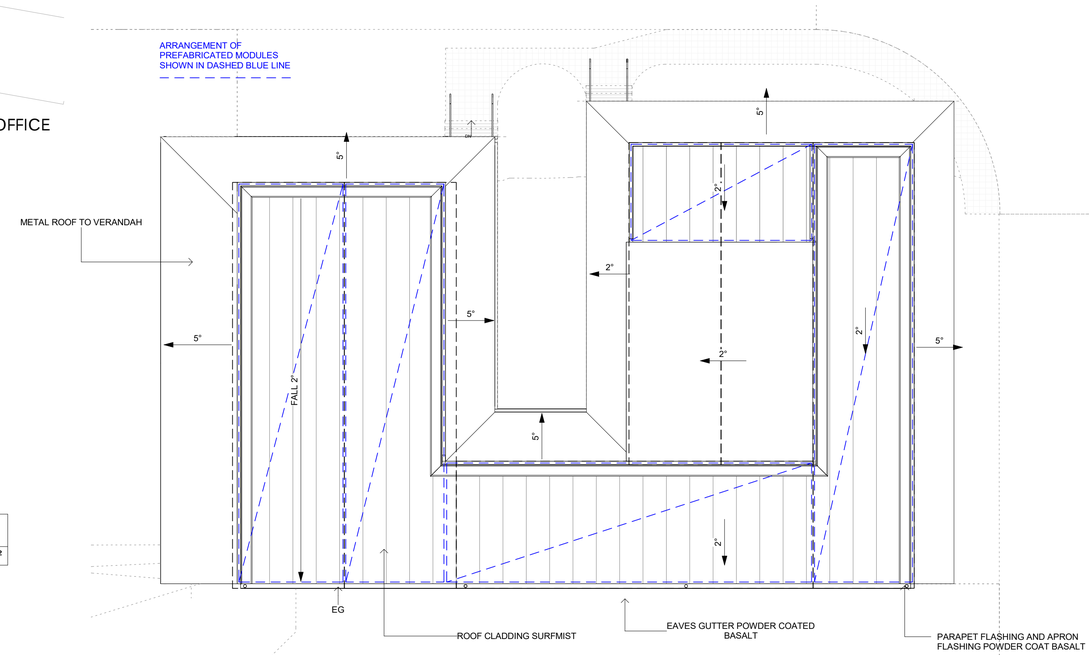
REV No.
B

DATE
01/12/22

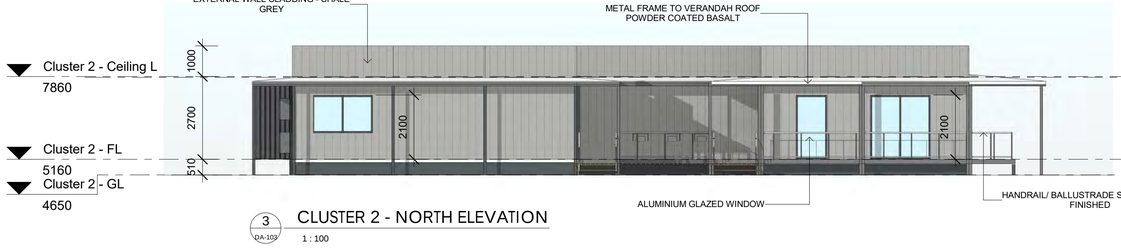


GROSS BUILDING AREA	
CLUSTER 2	205 m²

1 DA-103 CLUSTER 2 - FLOOR LEVEL
1 : 100

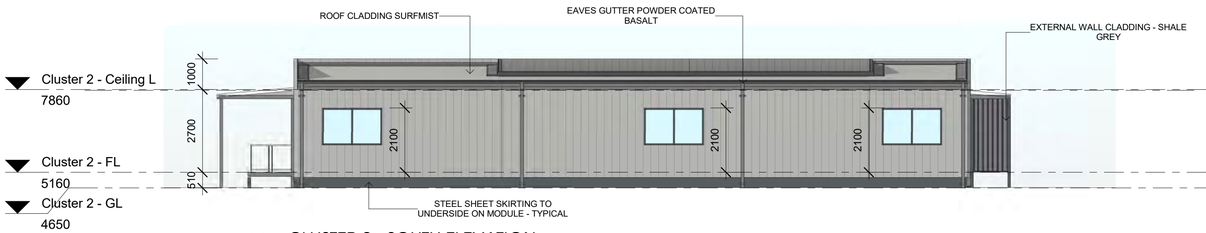


2 DA-103 CLUSTER 2 - ROOF PLAN
1 : 100

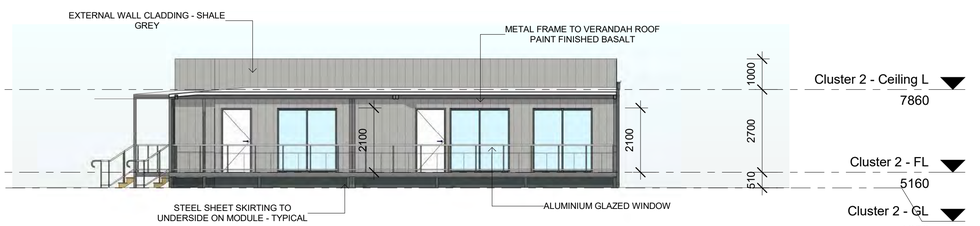


3 DA-103 CLUSTER 2 - NORTH ELEVATION
1 : 100

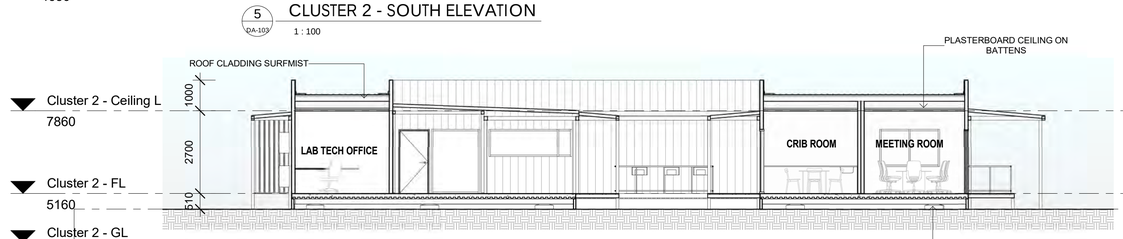
4 DA-103 CLUSTER 2 - EAST ELEVATION
1 : 100



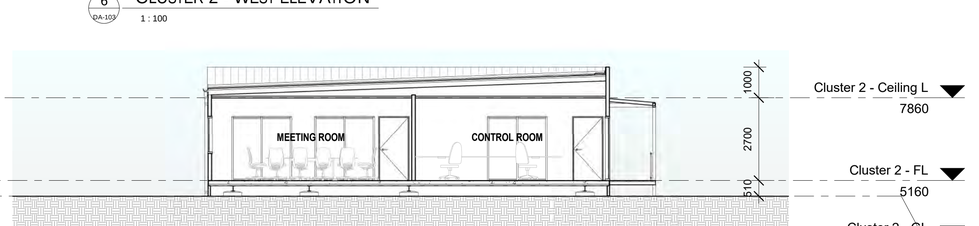
5 DA-103 CLUSTER 2 - SOUTH ELEVATION
1 : 100



6 DA-103 CLUSTER 2 - WEST ELEVATION
1 : 100



8 DA-103 SECTION 1
1 : 100



7 DA-103 SECTION 2
1 : 100

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A	DRAFT ISSUE	25-01-2022
B	ISSUE FOR D. A.	28-01-2022

NORTH

SCALE 1:100 @ A1
0m 2m 4m 6m 8m 10m

STATUS
DEVELOPMENT APPLICATION

DRAWING TITLE
CLUSTER 2

DRAWN BY
AR

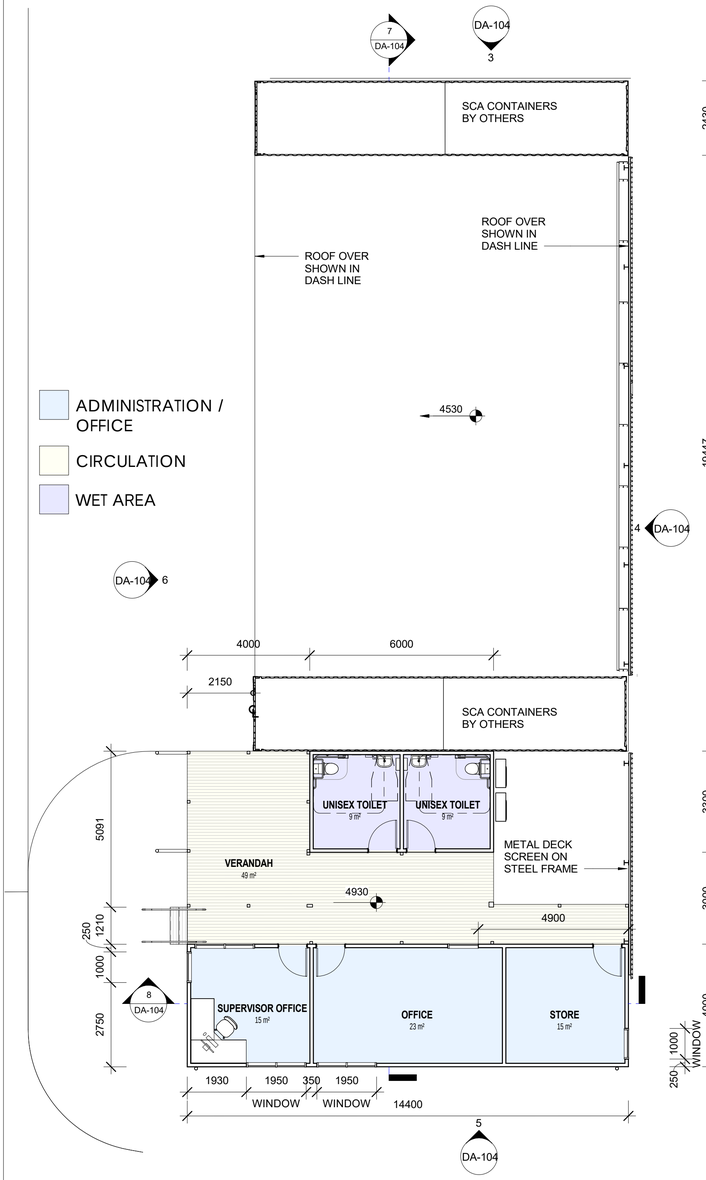
APPROVED
SAS

PROJECT No.
2164

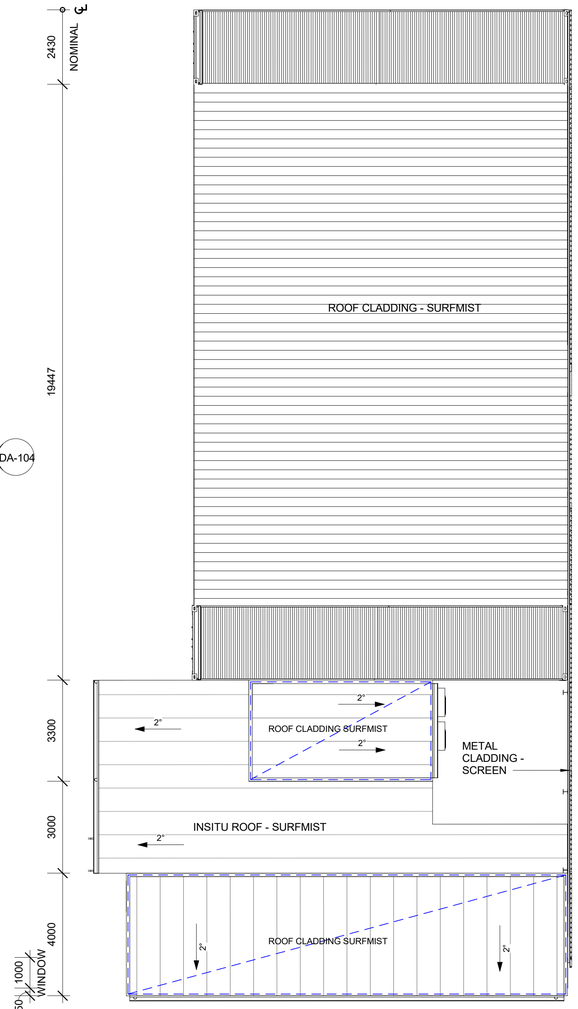
DRAWING No.
DA-103

REV No.
B

DATE
01/12/22



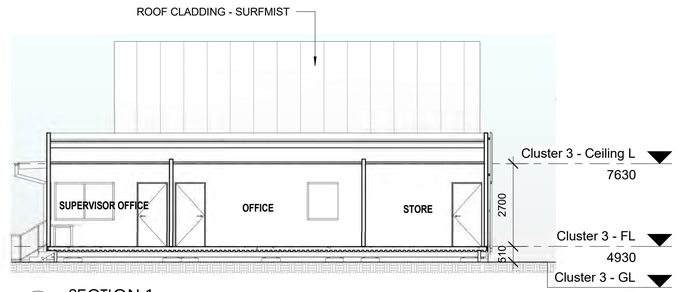
9 DA-104 PLAN - CLUSTER 3 - WORKSHOP
1 : 100



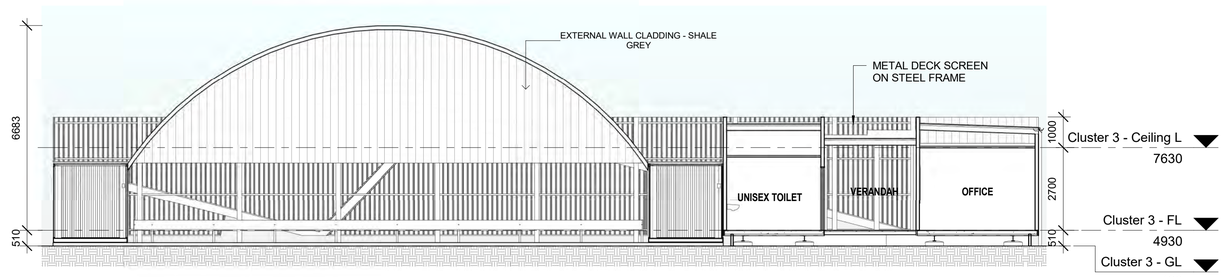
1 DA-104 ROOF PLAN - CLUSTER 3
1 : 100

BUILDING GROSS AREA

FLOOR AREA:	78sqm
VERANDAH:	49sqm



8 DA-104 SECTION 1
1 : 100



7 DA-104 SECTION 2
1 : 100

3 DA-104 CLUSTER 3 - NORTH ELEVATION
1 : 100

5 DA-104 CLUSTER 3 - SOUTH ELEVATION
1 : 100

4 DA-104 CLUSTER 3 - EAST ELEVATION
1 : 100

6 DA-104 CLUSTER 3 - WEST ELEVATION
1 : 100

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REV.	DESCRIPTION	DATE
A	DRAFT ISSUE	25-01-2022
B	ISSUE FOR D. A.	28-01-2022

NORTH

SCALE 1:100 @ A1
0m 2m 4m 6m 8m 10m

STATUS
DEVELOPMENT APPLICATION

DRAWING TITLE
CLUSTER 3

DRAWN BY
ZI

APPROVED
SAS

PROJECT No.
2164

DRAWING No.
DA-104

REV No.
B

DATE
01/12/22

VIEW FROM ALUMINA ROAD

VIEW FROM CAR PARK

VIEW FROM ZIRCONIA ROAD

VIEW FROM CAR PARK

HUNT ARCHITECTS

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REV.	DESCRIPTION	DATE
A	ISSUE FOR D. A.	28-01-2022

STATUS
DEVELOPMENT APPLICATION

DRAWING TITLE
3D VIEWS

DRAWN BY
Author

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SAS

PROJECT No.
2164

DRAWING No.
DA-105

REV No.
A

DATE
01/27/22

Appendix K – Process Infrastructure (PI) Drawings

NORTH

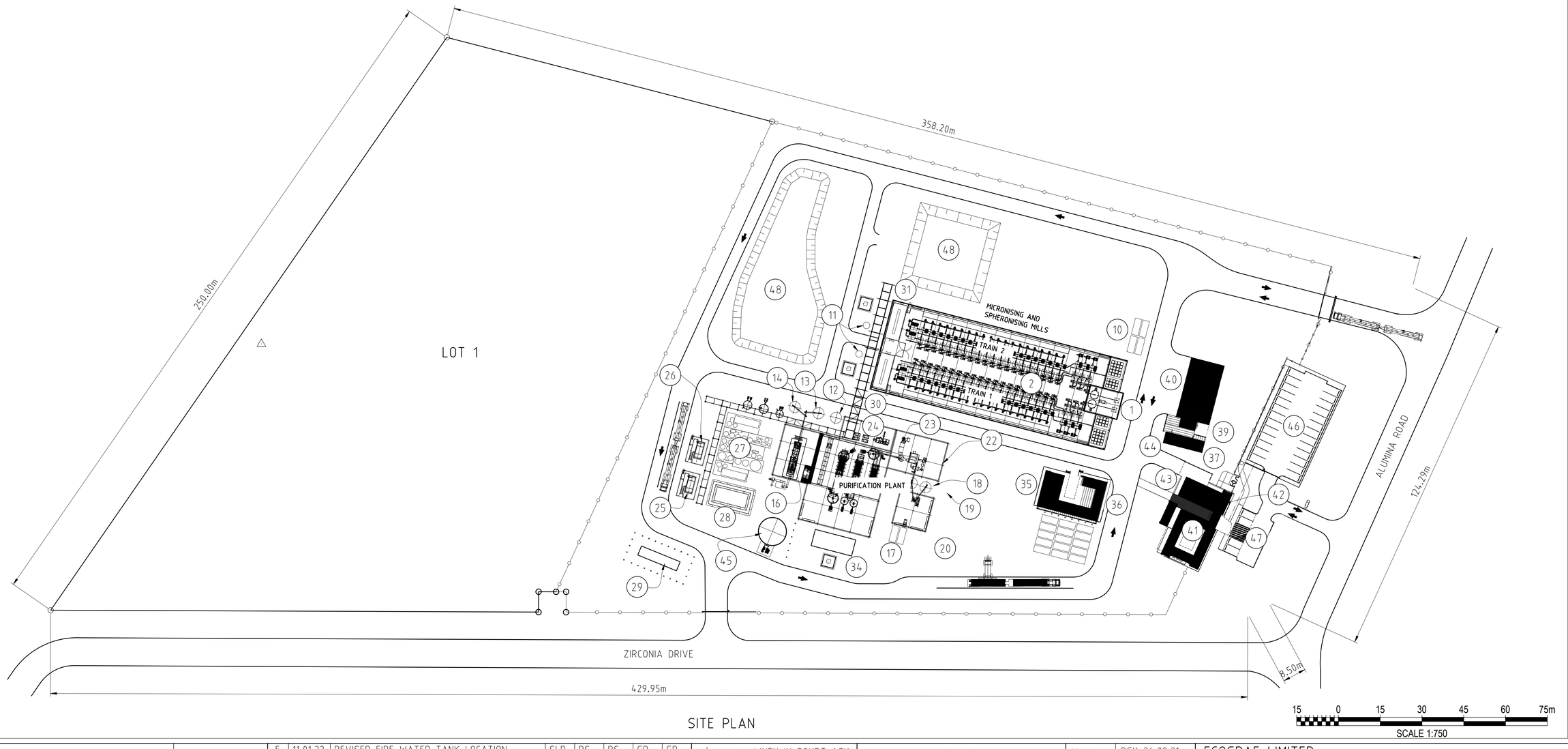
44977.640
229323.870
R.L 4.079m
△ DATUMN POINT

ITEM LIST	
ITEM	DESCRIPTION
1	MICRONISING FEED BIN & BAG SPLITTER TRAIN 1 & 2
2	MICRONISING AND SPHERONISING TRAINS 1 & 2
3	STAGE 2
4	STAGE 2
5	STAGE 2
6	STAGE 2
7	STAGE 2
8	STAGE 2
9	STAGE 2
10	FLAKE GRAPHITE BULK BAG UNLOADING
11	BY-PRODUCT 1 (SILOS 1 & 2)
12	OFF SPEC SILO

ITEM LIST	
ITEM	DESCRIPTION
13	SPG 10 SILO
14	SPG 16 SILO
15	CONTAINER PRODUCT BULK BAG LOADING
16	NaOH BAKE KILN
17	PURIFICATION BUILDING
18	PRODUCT SILO
19	FINES SILO
20	SPG BAGGING PLANT
21	STAGE 2
22	SPIRAL FLASH DRYER
23	STEAM BOILER
24	PLANT AIR COMPRESSORS, FILTERS, DRYERS & RECIEVERS

ITEM LIST	
ITEM	DESCRIPTION
25	SULPHURIC ACID ISO CONTAINER
26	CAUSTIC ISO CONTAINER
27	WATER TREATMENT PLANT
28	WASTE WATER PIT
29	WESTERN POWER 22kV SWITCH ROOM
30	MCC 01
31	MCC 02
32	STAGE 2
33	STAGE 2
34	MCC 03
35	CONTROL ROOM
36	ANALYTICAL & METALLURGICAL LABORATORY

ITEM LIST	
ITEM	DESCRIPTION
37	INDUCTION & TRAINING ROOM
38	STAGE 2
39	STORE & OFFICE
40	WORKSHOP & OFFICE
41	ADMINISTRATION OFFICE C/W M/F TOILETS
42	SECURITY OFFICE
43	FIRST AID ROOM & LUNCH ROOM
44	PLANT CHANGE ROOMS C/W ABLUTION & SHOWERS
45	FIRE WATER TANK
46	WORKERS CAR PARK
47	VISITORS CAR PARK
48	SITE DRAINAGE SWALE DRAIN



SITE PLAN

REFERENCE DRAWINGS	DWG No	REV	DATE	REVISIONS	DRN	CHK	DSGN	TECH APP	PROJ APP
		F	11.01.22	REVISED FIRE WATER TANK LOCATION	SLR	PS	PS	GR	GR
		E	07.12.21	PRELIMINARY DRAINAGE CLEARANCE MODIFIED	PGK	PS	PS	GR	GR
		D	06.12.21	PRELIMINARY INCORP'ED CLIENTS COMMENTS	PGK	PS	PS	GR	GR
		C	08.11.21	PRELIMINARY ADDED INFILTRATION BASIN	PGK	PS	PS	GR	GR
		B	05.11.21	PRELIMINARY	PGK	PS	PS	GR	GR
REF		G	25.01.22	REVISED ARCHITECT'S NPI BUILDINGS	SLR	PS	PS	GR	GR

WHEN IN DOUBT-ASK DO NOT SCALE

GR ENGINEERING SERVICES LTD
ENGINEERING CONSULTANTS AND CONTRACTORS
179 Great Eastern Highway, Belmont ACN 121 542 738
Western Australia. 6104
Phone: (08) 6272 6000
Fax: (08) 6272 6001

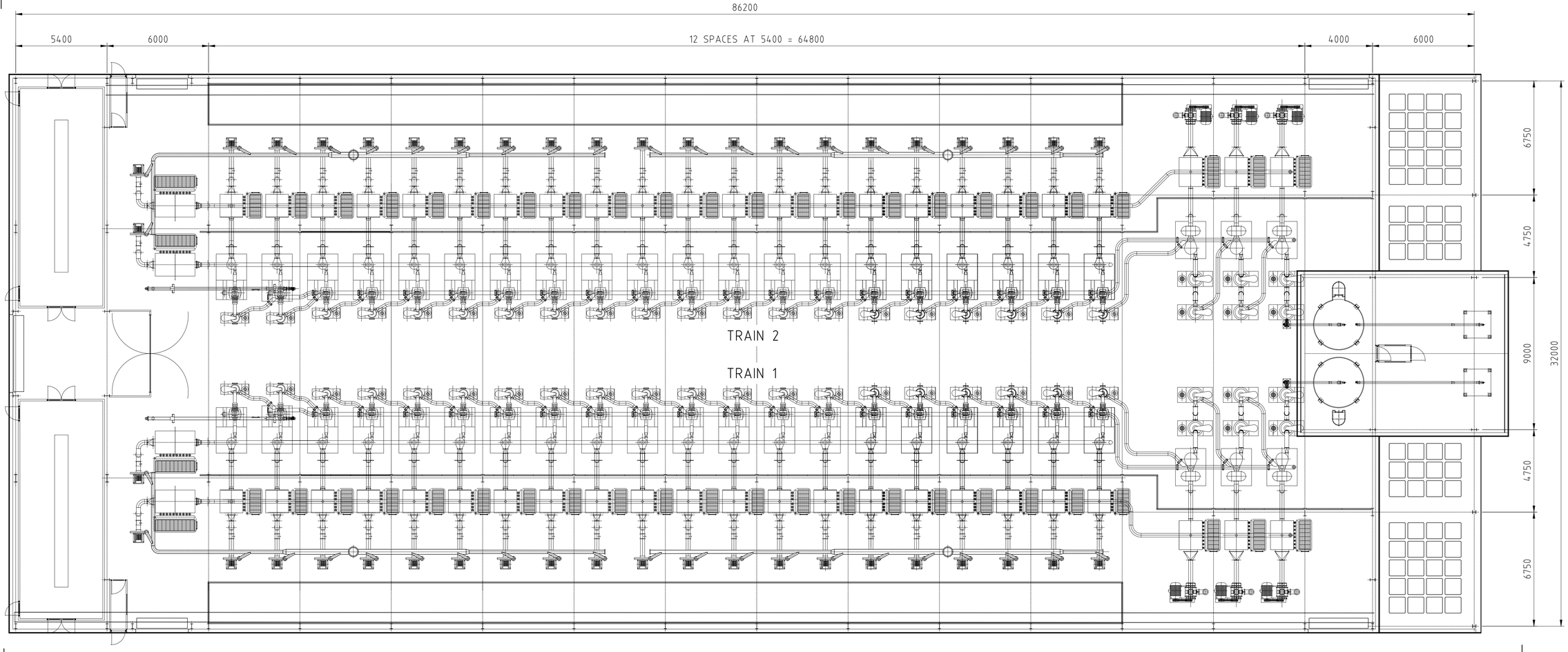
DRAWN	PGK 24.09.21
CHECKED	
DESIGNED	
TECH APP	
PROJ APP	
CLIENT APP	

ECOGRAF LIMITED
ECOGRAF DEMONSTRATION PLANT FACILITY
GENERAL ARRANGEMENT SITE PLAN - STAGE 1
PLAN

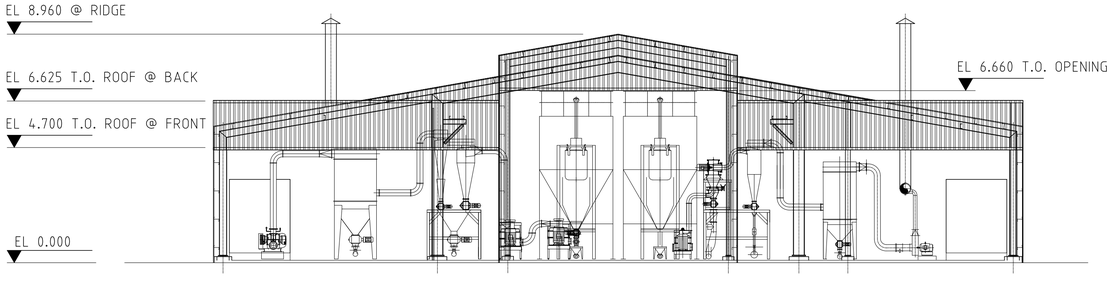
A1	SCALE 1:750	JOB No 12332.K	DRG No 12332-L-021	REV G

M:\1-PROJECT STUDIES\12332 - Epanko Downstream Processing\Miscellaneous\Layouts\12332L021.dwg - 27/01/2022 - 11:07am - steve.reed

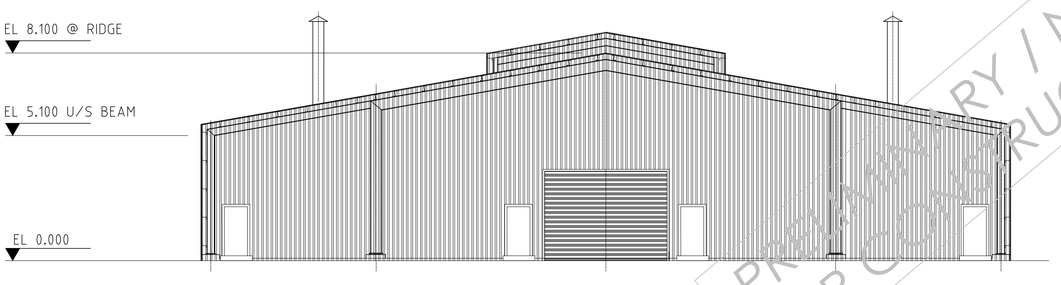
NORTH



PLAN



SECTION A



SECTION B

REFERENCE DRAWINGS	DWG No	REV	DATE	REVISIONS	DRN	CHK	DSGN	TECH APP	PROJ APP
		D	28.01.22	REVISED FOR DEMONSTRATION PLANT	SLR	PS	PS	GR	GR
		C	06.12.21	PRELIMINARY INCORP'ED CLIENT COMMENTS	PK	PS	PS	GR	GR
		B	08.11.21	PRELIMINARY	PK	PS	PS	GR	GR
REF		A	30.09.21	PRELIMINARY	PK	PS	PS	RK	GR

GR ENGINEERING SERVICES LTD
ENGINEERING CONSULTANTS AND CONTRACTORS
71 Daly Street, Ascot
Western Australia. 6104
ACN 121 542 738
Phone: (08) 6272 6000
Fax: (08) 6272 6001

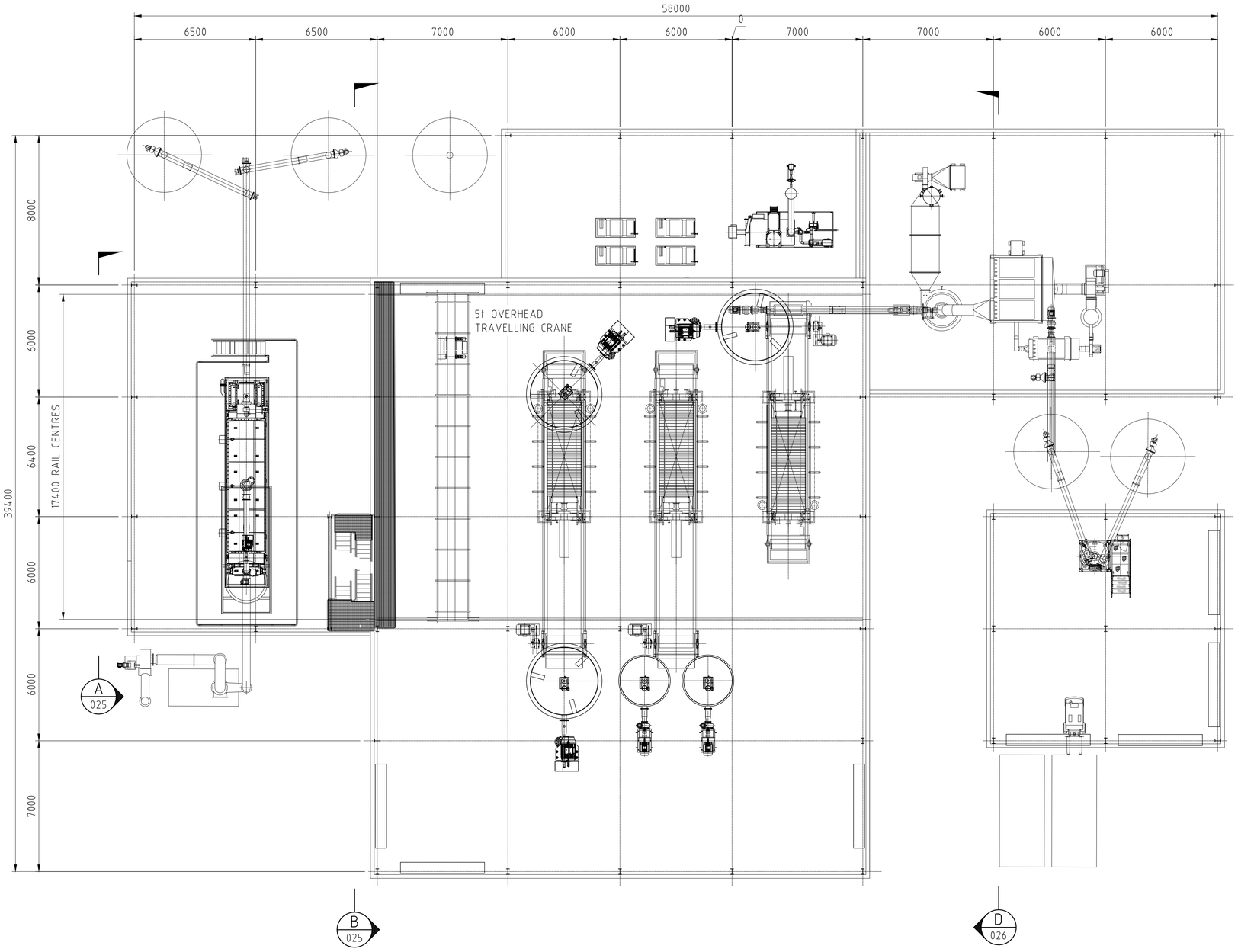
DRAWN	PGK 15-09-2021
CHECKED	
DESIGNED	
TECH APP	
PROJ APP	
CLIENT APP	

ECOGRAF LIMITED
ECOGRAF DEMONSTRATION PLANT FACILITY
MICRONISING & SPHERONISING MILL BUILDING
PLAN

A1	SCALE 1:125	JOB No 12332.K	DRG No 12332-L-023	REV D

M:\1-PROJECT STUDIES\12332 - Epanko Downstream Processing\Miscellaneous\Layouts\12332L023.dwg - 27/01/2022 - 11:12am - steve.reed

NORTH



PRELIMINARY / NOT FOR CONSTRUCTION

REFERENCE DRAWINGS	DWG No	REV	DATE	REVISIONS	DRN	CHK	DSGN	TECH APP	PROJ APP
		B	28.01.22	REVISED FOR DEMONSTRATION PLANT	SLR	PS	PS	RK	GR
REF		A	30.09.21	PRELIMINARY	PK	PS	PS	RK	GR

WHEN IN DOUBT-ASK DO NOT SCALE

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ENGINEERING CONSULTANTS AND CONTRACTORS
71 Daly Street, Ascot
Western Australia, 6104
Phone: (08) 6272 6000
Fax: (08) 6272 6001
ACN 121 542 738

DRAWN	PGK 15-09-2021
CHECKED	
DESIGNED	
TECH APP	
PROJ APP	
CLIENT APP	

ECOGRAF LIMITED
ECOGRAF DEMONSTRATION PLANT FACILITY
PURIFICATION AND BAGGING BUILDING
PLAN

A1	SCALE 1:125	JOB No 12332.K	DRG No 12332-L-024	REV B

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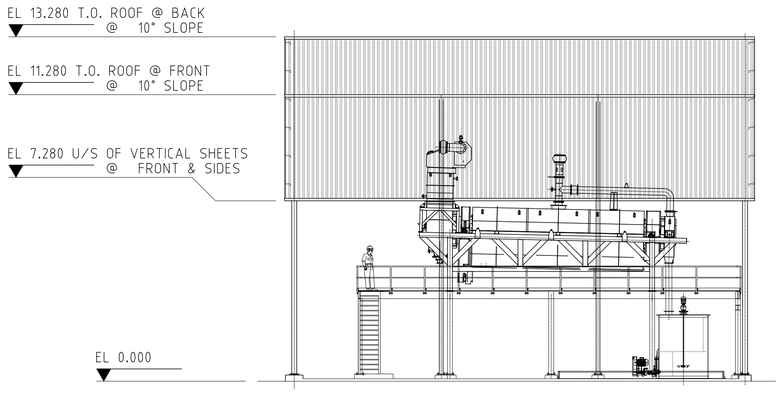
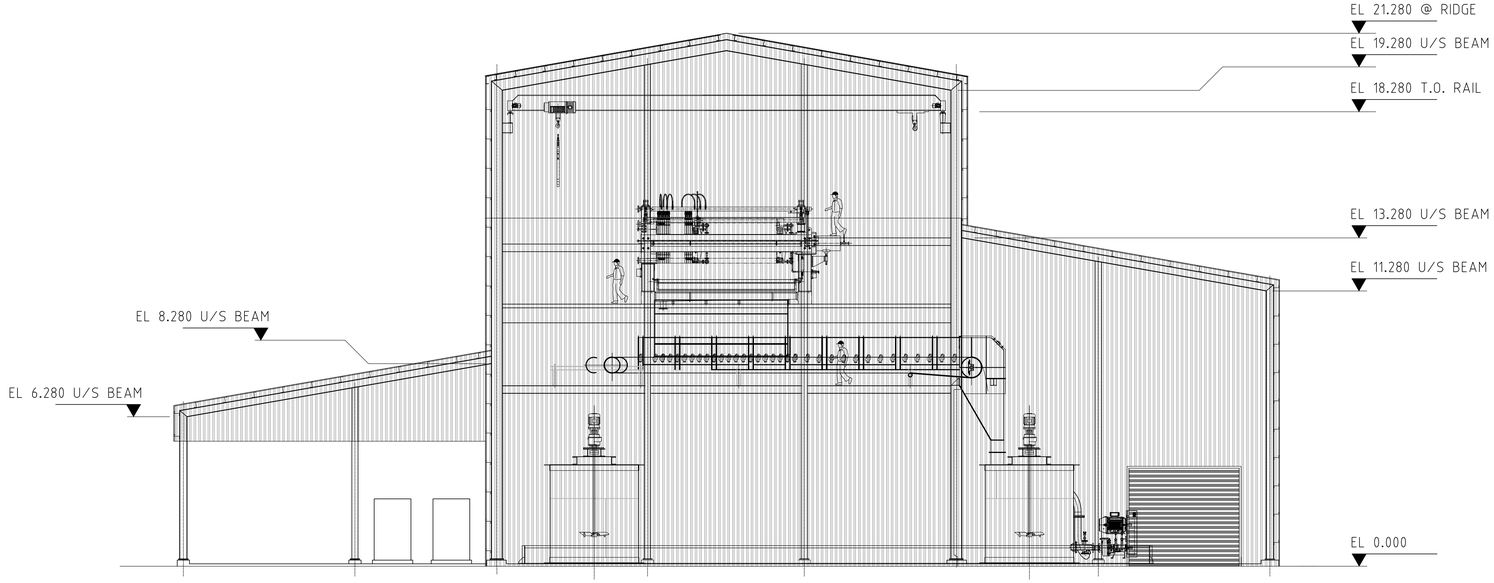


SECTION A 024



SECTION B 024

PRELIMINARY / NOT FOR CONSTRUCTION

2.5 0 2.5 5 7.5 10 12.5m
SCALE 1:125

REF		B	28.01.22	REVISED FOR DEMONSTRATION PLANT	SLR	PS	PS	RK	GR
		A	30.09.21	PRELIMINARY	PK	PS	PS	RK	GR
REFERENCE DRAWINGS	DWG No	REV	DATE	REVISIONS	DRN	CHK	DSGN	TECH APP	PROJ APP

WHEN IN DOUBT-ASK
DO NOT SCALE

GR ENGINEERING SERVICES LTD
ENGINEERING CONSULTANTS AND CONTRACTORS
71 Daly Street, Ascot ACN 121 542 738
Western Australia, 6104
Phone: (08) 6272 6000
Fax: (08) 6272 6001

DRAWN	PGK 15-09-2021
CHECKED	
DESIGNED	
TECH APP	
PROJ APP	
CLIENT APP	

ECOGRAF LIMITED
ECOGRAF DEMONSTRATION PLANT FACILITY
PURIFICATION BUILDING
SECTIONS

A1	SCALE 1:125	JOB No 12332.K	DRG No 12332-L-025	REV B

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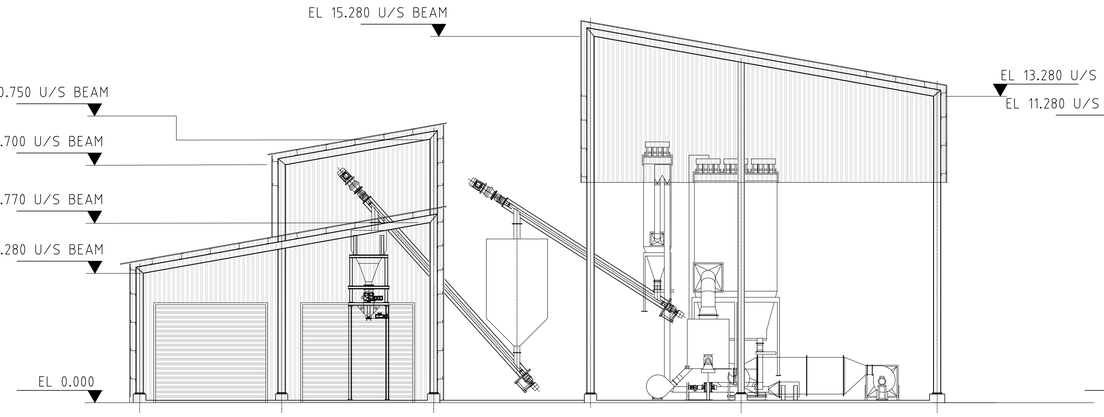

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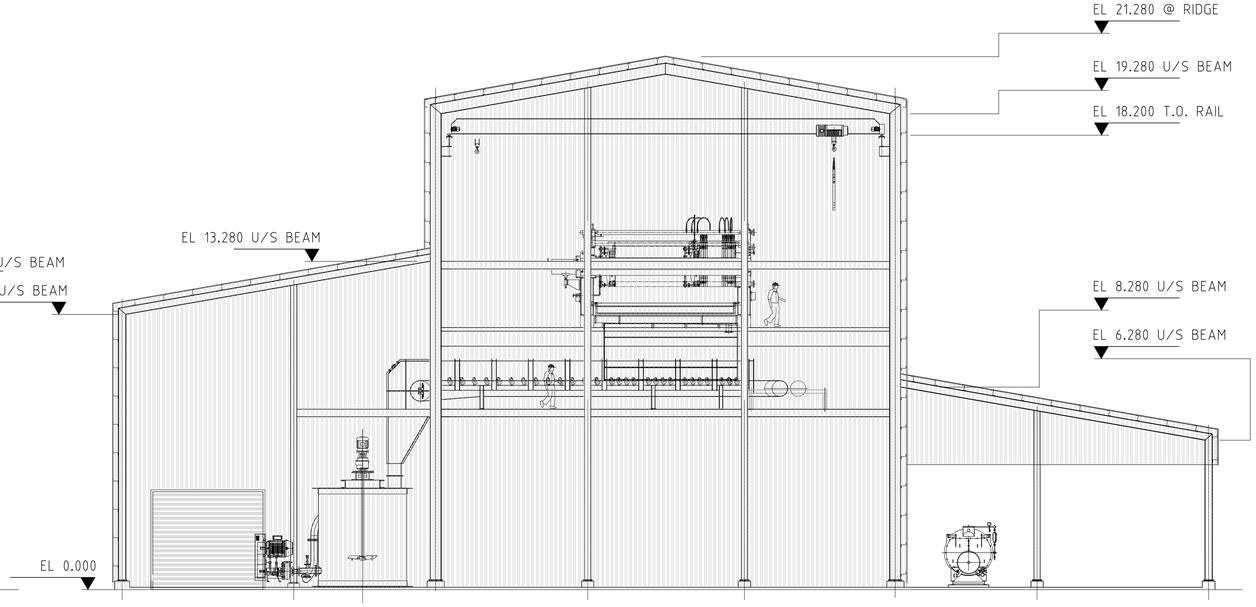

SECTION D 024

PRELIMINARY / NOT FOR CONSTRUCTION

25 0 25 50 75 100 125m
SCALE 1:125

REFERENCE DRAWINGS	DWG No	REV	DATE	REVISIONS	DRN	CHK	DSGN	TECH APP	PROJ APP
		B	28.01.22	REVISED FOR DEMONSTRATION PLANT	SLR	PS	PS	RK	GR
REF		A	30.09.21	PRELIMINARY	PK	PS	PS	RK	GR

WHEN IN DOUBT-ASK DO NOT SCALE

GR ENGINEERING SERVICES LTD
ENGINEERING CONSULTANTS AND CONTRACTORS
71 Daly Street, Ascot ACN 121 542 738
Western Australia, 6104
Phone: (08) 6272 6000
Fax: (08) 6272 6001

DRAWN	PGK 15-09-2021
CHECKED	
DESIGNED	
TECH APP	
PROJ APP	
CLIENT APP	

ECOGRAF LIMITED
ECOGRAF DEMONSTRATION PLANT FACILITY
PURIFICATION BUILDING
SECTIONS

A1	SCALE 1:125	JOB No 12332.K	DRG No 12332-L-026	REV B

M:\1-PROJECT STUDIES\12332 - Epanko Downstream Processing\Miscellaneous\Layouts\12332L026.dwg - 27/01/2022 - 10:31am - steve.reed

NORTH

ITEM LIST		
ITEM	DESCRIPTION	
1	CCTV CAMERA	
2	SECURITY CARD ACCESS	⊕

SITE PLAN

REFERENCE DRAWINGS	DWG No	REV	DATE	REVISIONS	DRN	CHK	DSGN	TECH APP	PROJ APP
-	.-	A	28.01.22	PRELIMINARY	JB				

GR ENGINEERING SERVICES LTD
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Western Australia, 6104
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Fax: (08) 6272 6001

DRAWN	JB	27.01.22
CHECKED		
DESIGNED		
TECH APP		
PROJ APP		
CLIENT APP		

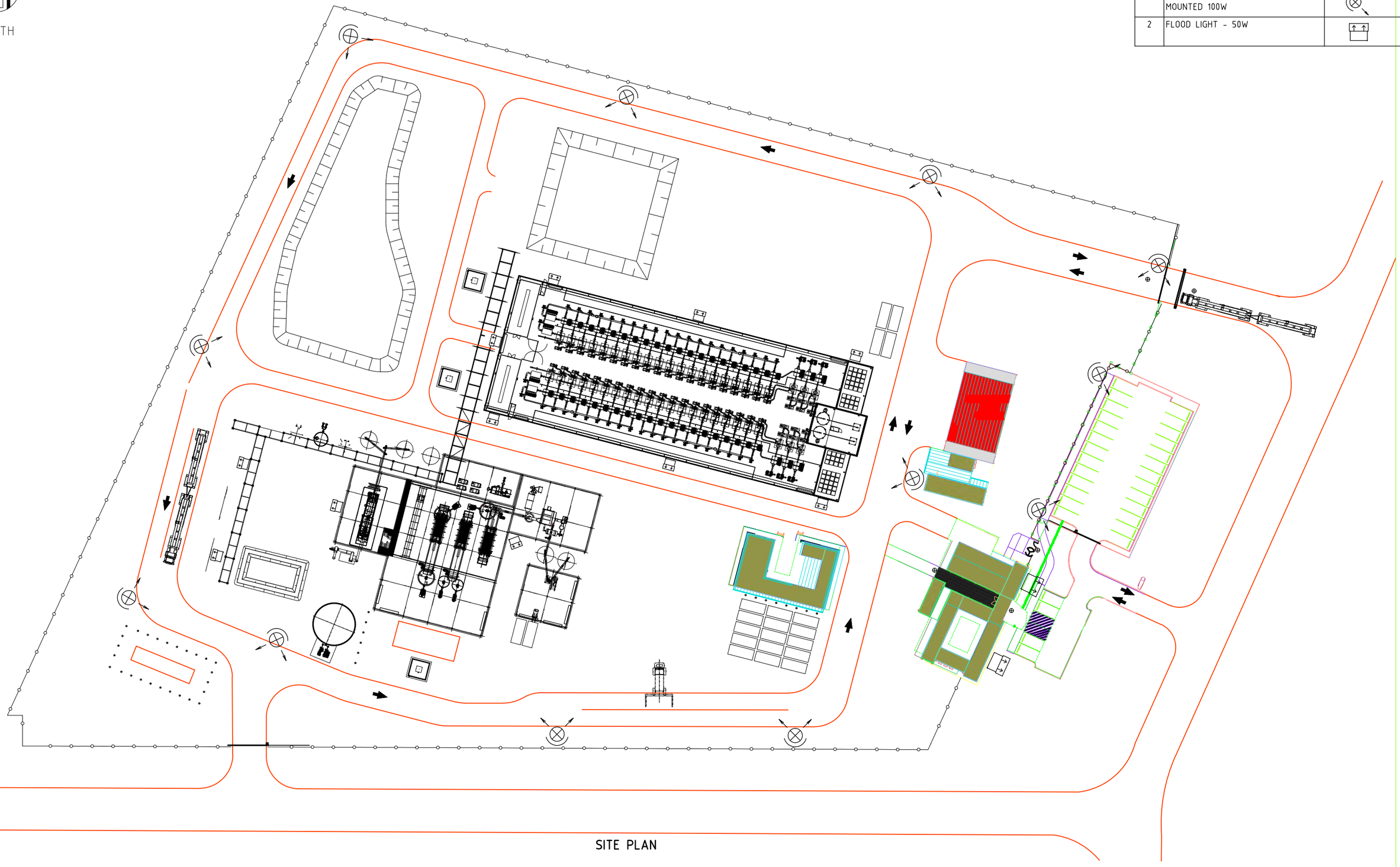
ECOGRAF LIMITED
ECOGRAF DEMONSTRATION PLANT FACILITY
GENERAL ARRANGEMENT SITE PLAN - STAGE 1
SECURITY & CAMERA LAYOUT

A1	SCALE 1:300	JOB No 12332.K	DRG No 12332-E-041	REV A

M:\1-PROJECT STUDIES\12332 - Epanko Downstream Processing\Drawings\Elec\12332E041.dwg - 28/01/2022 - 9:52am - justin.bailey

NORTH

ITEM LIST		
ITEM	DESCRIPTION	
1	ROADWAY LIGHT - POLE MOUNTED 100W	
2	FLOOD LIGHT - 50W	



SITE PLAN

REFERENCE DRAWINGS	DWG No	REV	DATE	REVISIONS	DRN	CHK	DSGN	TECH APP	PROJ APP
-	-	A		PRELIMINARY	JB				

GR ENGINEERING SERVICES LTD
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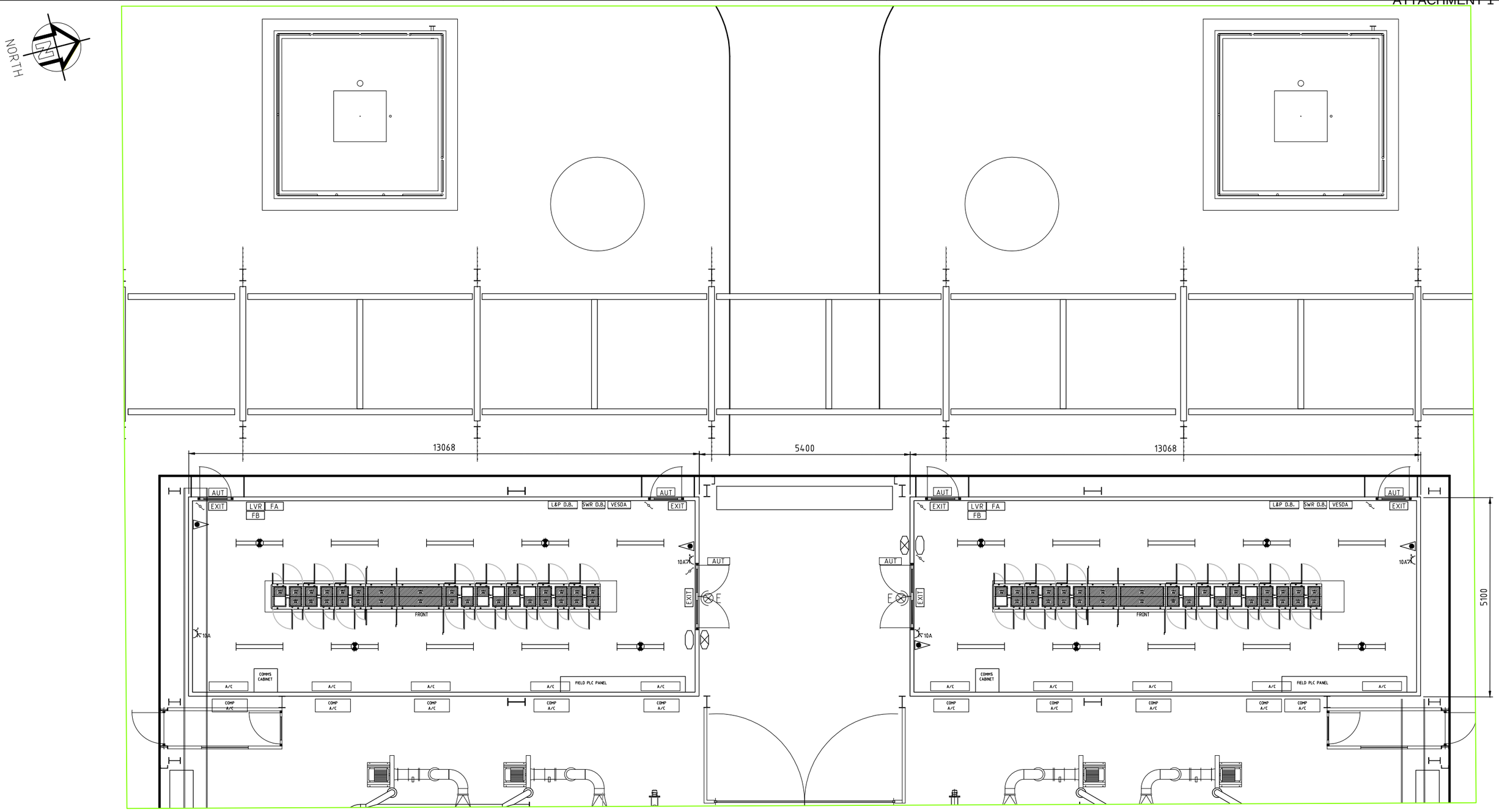
Western Australia. 6104
Phone: (08) 6272 6000
Fax: (08) 6272 6001

DRAWN	JB	27.01.22
CHECKED		
DESIGNED		
TECH APP		
PROJ APP		
CLIENT APP		

ECOGRAF LIMITED
ECOGRAF DEMONSTRATION PLANT FACILITY
GENERAL ARRANGEMENT SITE PLAN - STAGE 1
ELECTRICAL LIGHTING PLAN

A1	SCALE 1:450	JOB No 12332.K	DRG No 12332-E-042	REV A

ATTACHMENT 1



- FLUORESCENT LIGHT TWIN 36 WATT
- EMERGENCY FLUORESCENT LIGHT TWIN 36 WATT (with 2hr battery backup)
- EXIT - EMERGENCY EXIT LIGHT (with 2hr battery backup)
- E - IP65 BULKHEAD LIGHT FITTING TWIN 18W FLUORESCENT (with 2hr battery backup)
- LIGHT SWITCH
- 10A - 2 GANG 10A SWITCH SOCKET
- AUT - DANGER HIGH VOLTAGE AUTHORISED PERSONNEL ONLY
- D.B. - DISTRIBUTION BOARD
- A/C - A/C SPLIT SYSTEM
- CO2 FIRE EXTINGUISHER
- LVR - RESCUE KIT
- FB - FIRE BLANKET
- FA - FIRST AID KIT
- FIRE ALARM STROBE
- FIRE ALRAM STROBE

SITE PLAN

REFERENCE DRAWINGS	DWG No	REV	DATE	REVISIONS	DRN	CHK	DSGN	TECH APP	PROJ APP
-	.-	A	28.01.22	PRELIMINARY	JB				

GR ENGINEERING SERVICES LTD
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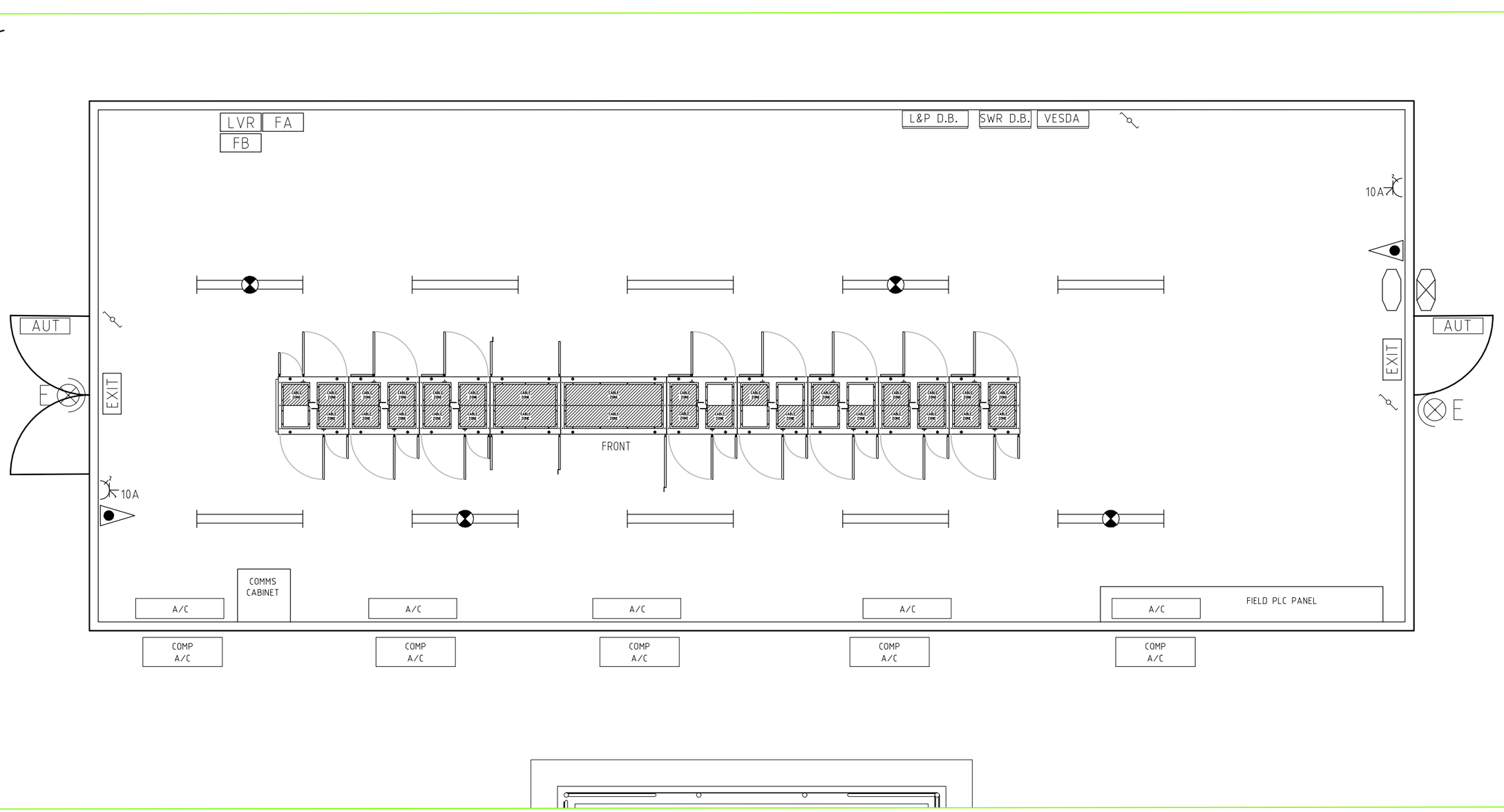
179 Great Eastern Highway, Belmont ACN 121 542 738
Western Australia. 6104
Phone: (08) 6272 6000
Fax: (08) 6272 6001

DRAWN	JB	27.01.22
CHECKED		
DESIGNED		
TECH APP		
PROJ APP		
CLIENT APP		

ECOGRAF LIMITED
ECOGRAF DEMONSTRATION PLANT FACILITY
GENERAL ARRANGEMENT SITE PLAN - STAGE 1
MILLS SWITCHROOM LAYOUT

A1	SCALE NTS	JOB No 12332.K	DRG No 12332-E-043	REV A

M:\1-PROJECT STUDIES\12332 - Epanko Downstream Processing\Drawings\Elec\12332E043.dwg - 28/01/2022 - 9.53am - justin.bailey



- FLUORESCENT LIGHT TWIN 36 WATT
- EMERGENCY FLUORESCENT LIGHT TWIN 36 WATT (with 2hr battery backup)
- EXIT - EMERGENCY EXIT LIGHT (with 2hr battery backup)
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- LVR - RESCUE KIT
- FB - FIRE BLANKET
- FA - FIRST AID KIT
- FIRE ALARM STROBE
- FIRE ALRAM STROBE

SITE PLAN

REFERENCE DRAWINGS	DWG No	REV	DATE	REVISIONS	DRN	CHK	DSGN	TECH APP	PROJ APP
-	.-	A	28.01.22	PRELIMINARY	JB				

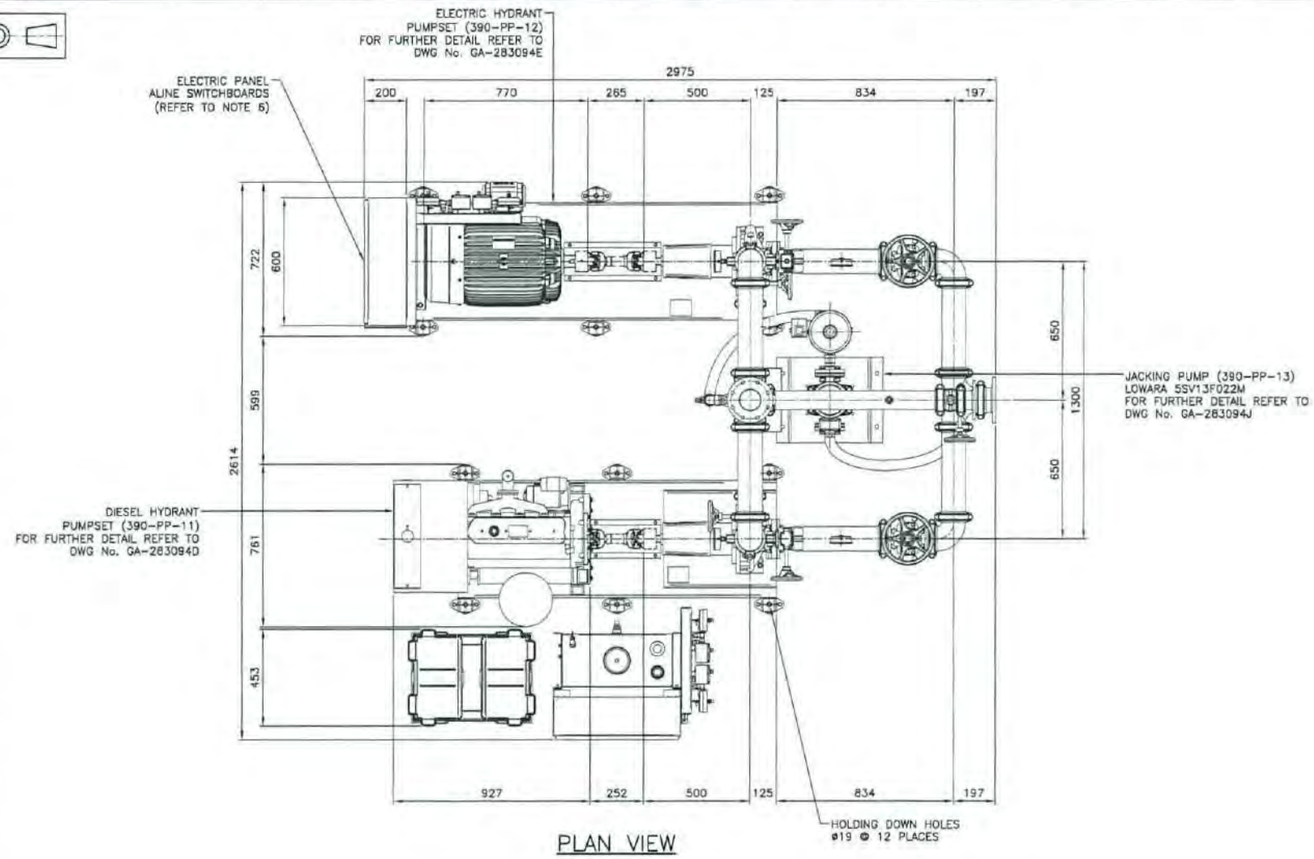
WHEN IN DOUBT-ASK
DO NOT SCALE

GR ENGINEERING SERVICES LTD
ENGINEERING CONSULTANTS AND CONTRACTORS
179 Great Eastern Highway, Belmont ACN 121 542 738
Western Australia. 6104
Phone: (08) 6272 6000
Fax: (08) 6272 6001

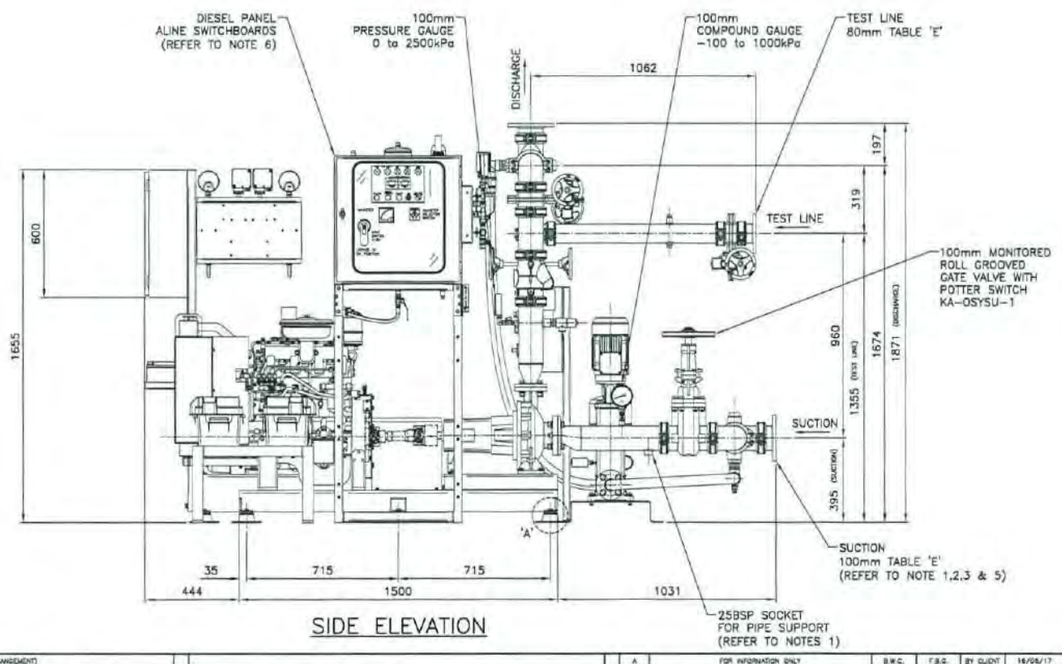
DRAWN	JB 27.01.22
CHECKED	
DESIGNED	
TECH APP	
PROJ APP	
CLIENT APP	

ECOGRAF LIMITED
ECOGRAF DEMONSTRATION PLANT FACILITY
GENERAL ARRANGEMENT SITE PLAN - STAGE 1
PURIFICATION SWITCHROOM LAYOUT

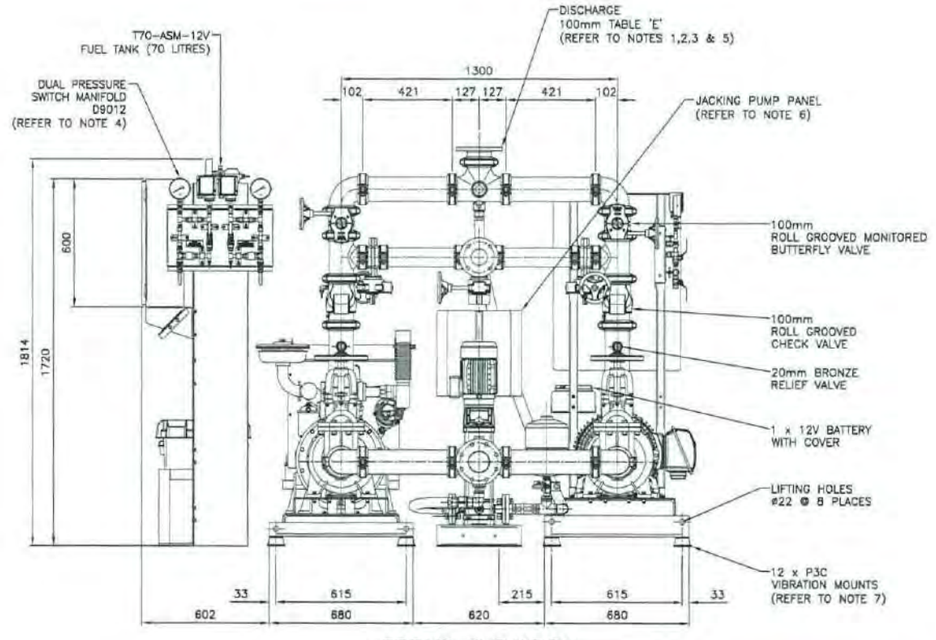
A1	SCALE NTS	JOB No 12332.K	DRG No 12332-E-044	REV A



PLAN VIEW



SIDE ELEVATION



FRONT ELEVATION

PUMP TAG No	390-PP-11
EQUIP DESC	DIESEL HYDRANT PUMPSET

PUMP TAG No	390-PP-12
EQUIP DESC	ELECTRIC HYDRANT PUMPSET

PUMP TAG No	390-PP-13
EQUIP DESC	5SV13 JACKING PUMP

PUMP DUTY	20L/s @ 80m HEAD
FLUID PUMPED	WATER
ELEC. PUMPSET WGT.	400kg APPROX.
DIESEL PUMPSET WGT.	800kg APPROX.
JACKING PUMP WGT.	80kg APPROX.
PANEL STAND WGT.	100kg APPROX.
FUEL TANK WGT.	100kg APPROX.
BATTERY STAND WGT.	50kg APPROX.
PIPEWORK WGT.	370kg APPROX.
GROSS WEIGHT	1700kg APPROX.
SUCTION	100mm TABLE 'E'
DISCHARGE	100mm TABLE 'E'
TEST LINE	80mm TABLE 'E'
ELEC. PUMP MODEL	SOUTHERN CROSS ISO SOVEREIGN 80x50-250 (252mm IMPELLER)
DIESEL PUMP MODEL	SOUTHERN CROSS ISO SOVEREIGN 80x50-250 (FULL IMPELLER)
JACKING PUMP	LOWARA 5SV13F022M
ELECTRIC DRIVER	TECO MAXE3 0200L IP66 37kW, 2960rpm, 415V/3ø/50Hz
DIESEL DRIVER	W&C 490N-RAD-FIRE13 39kW, 2800rpm, 12V
ELEC. TRANSMISSION	DRIVESHAFT 1310-250
DIESEL TRANSMISSION	DRIVESHAFT 1310-250
PAINT SPEC.	KELAIR STANDARD RED
COUPLING GUARD	ALUMINIUM UNPAINTED
PAINT SPEC.	ZINC PLATED
GALVANISING	BASE PLATE & PIPEWORK

GR Engineering Services Limited

Approved ☑
Approved as noted, submit final drawings ☐
Not Approved ☐
Signed _____ Date 10/7/17

NOTES:

1. PIPEWORK NOT SUPPORTED BY KELAIR.
2. ALL PIPEWORK IS ROLL GROOVED.
3. ALL PIPEWORK TO BE GALVANISED.
4. ALL PRESSURE SWITCH MANIFOLDS TO BE LABELED.
5. SUCTION AND DISCHARGE PIPEWORK TO BE LOOSE SUPPLIED.
6. CONTROL PANEL SCHEMATICS SHALL BE SUPPLIED IN EACH PANEL WITH PLASTIC SLEEVE.
7. VIBRATION MOUNTS UNDER BASE FRAME TO BE LOOSE SUPPLIED.
8. PUMPSETS BUILT IN ACCORDANCE WITH AS2941-2013.

DETAIL 'A'

GR ENGINEERING SERVICES

DRAWING NUMBER MMP-390-V-CP013-018 REV B

EQUIPMENT NUMBER 390-PP-11,12,13

REFERENCES

GA-283094D (390-PP-11 DIESEL HYDRANT PUMPSET GENERAL ARRANGEMENT)
GA-283094E (390-PP-12 ELECTRIC HYDRANT PUMPSET GENERAL ARRANGEMENT)
GA-283094J (390-PP-13 JACKING PUMP)
KA-283094PS (DUAL SUCTION PIPEWORK 100RS x 80STE)
KA-283094PD (DUAL DISCHARGE PIPEWORK 100RE x 80STE + 80RS TESTLINE)

REVISIONS

REV	DESCRIPTION	DRN	CHK	APPD	DATE
A	FOR INFORMATION ONLY	B.M.C.	F.B.G.	BY CLIENT	16/08/17
B	CHANGED SUCTION AND DISCHARGE PIPEWORK	B.M.C.	F.B.G.	BY CLIENT	21/08/17
C	CHANGED TO AS2941-2013 STANDARD	B.M.C.			03/07/17

TITLE

DUAL DIESEL/ELECTRIC HYDRANT PUMPSET (390-PP-11, 390-PP-12 & 390-PP-13) GENERAL ARRANGEMENT

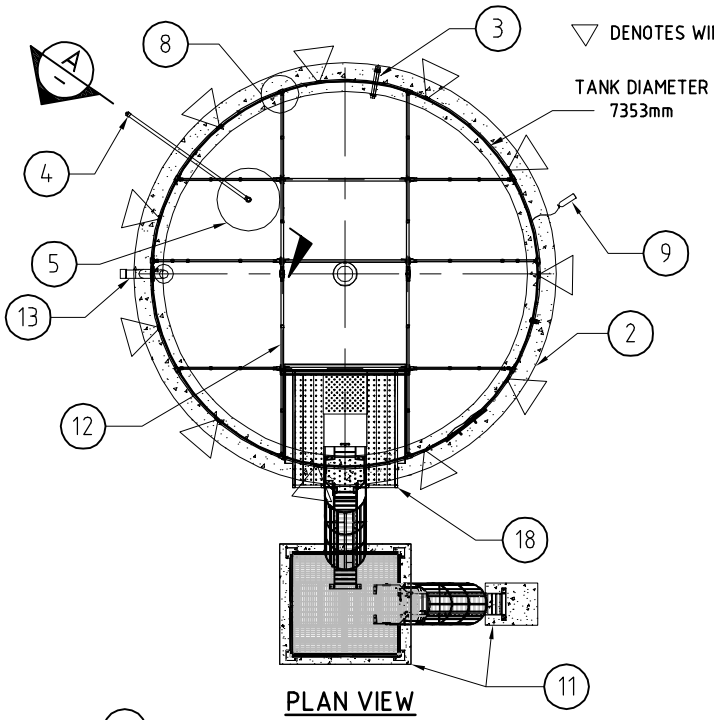
CLIENT	G R ENGINEERING SERVICES PTY. LTD.	DRAWN	B.M.C.
		CHECK	F.B.G.
ADDRESS	178 GREAT EASTERN HIGHWAY, BELMONT, WA 6104	APPROVED	BY CLIENT
		DATE	16/08/17
		SCALE	NTS
SITE	MT. MORGAN PROJECT WA	ALL DIMENSIONS IN mm DO NOT SCALE TOLERANCES UNLESS O.T.H.W. SPECIFIED ± 1	

KelairPumps

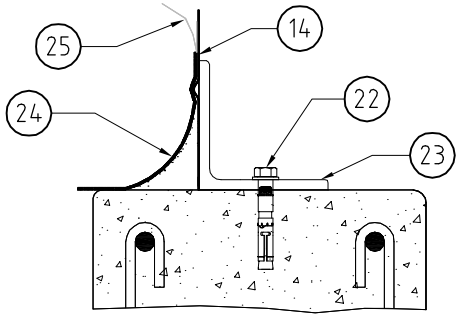
Head Office Sydney
Gateway Estate
215 Pickers Road
Arncliffe Park NSW 2145
Telephone: 61 2 9570 9466
Facsimile: 61 2 9570 9455
E-mail: kelair@kelairpumps.com.au
Web: www.kelairpumps.com.au

PART No. KP-283094P
DRAWING No. GA-283094P
A1
SHEET 1 OF 1

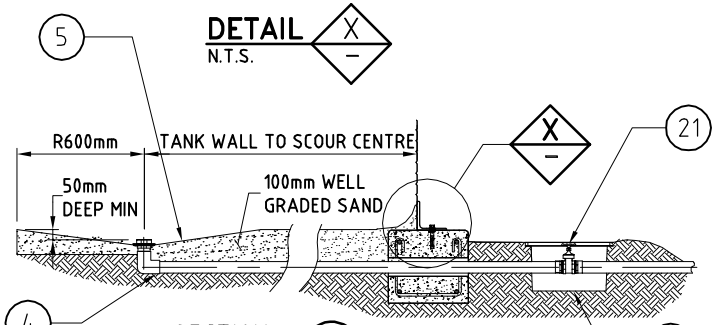
ATTACHMENT 1



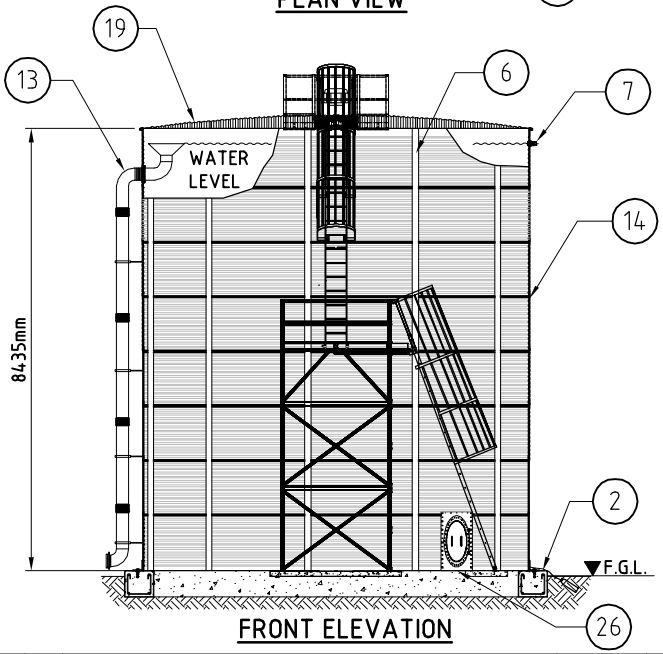
PLAN VIEW



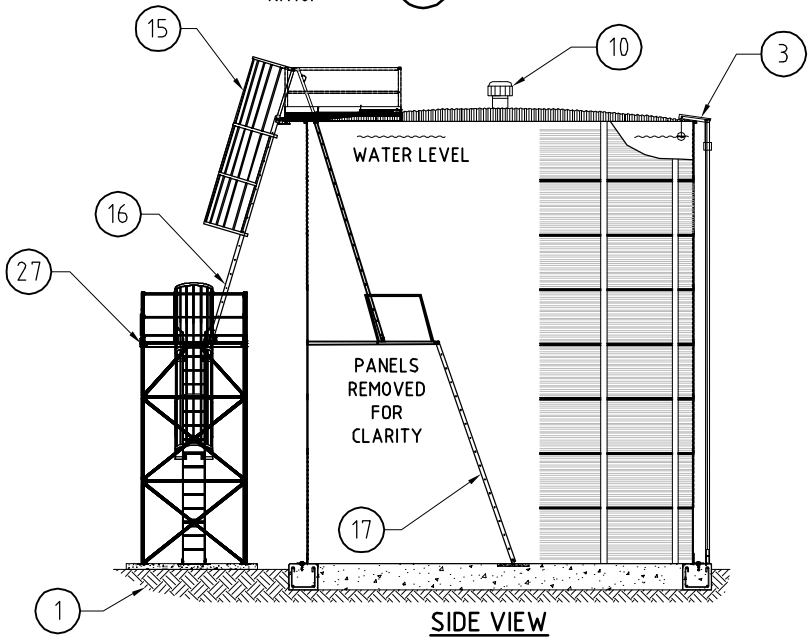
DETAIL X
N.T.S.



SECTION A
N.T.S.



FRONT ELEVATION



SIDE VIEW

PIONEER WATER TANK TECHNICAL DATA	
TANK WALL MATERIAL	ZINCALUME STEEL PANELS, GRADE 300 TO AS1397
TANK WALL THICKNESS	VARIES WITH TANK SIZE
PROTECTIVE COATING TYPE	ZINCALUME (ZINC AND ALUMINIUM ALLOY)
PROTECTIVE COATING CLASS	AZ 150 TO AS1397 (COLORBOND - OPTIONAL)
BOLT SIZING	M10 TO M16 DEPENDING ON TANK SIZE
BOLT SPECIFICATIONS	GRADE 8.8 HIGH STRENGTH STEEL BOLTS - AS1110 GALVANISED - AS1214
ROOF SHEETING	ZINCALUME CUSTOM ORB BMT - 0.42mm , G 550
LINER MATERIAL	INDUSTRATEX OR AQUALINER
LINER THICKNESS	0.6mm
LINER COLOUR	GREEN OR GREEN/BLACK

NOTE: SOME ITEMS SHOWN ARE OPTIONAL, DEPENDING ON CLIENT REQUIREMENTS.

ITEM	COMPONENT DESCRIPTION
27	INTERMEDIATE PLATFORM
26	SIDEWALL ACCESS HATCH
25	GEOTEXTILE
24	TANK LINER
23	HOLD DOWN BRACKET
22	MECHANICAL ANCHOR
21	SCOUR VALVE
20	SCOUR VALVE BOX
19	DOME ROOF SHEETS
18	COMMERCIAL ROOF PLATFORM
17	INTERNAL ACCESS LADDER
16	EXTERNAL LADDER
15	LADDER SAFETY CAGE
14	TANK WALL PANELS
13	OVERFLOW
12	HEAVY DUTY TRUSSES
11	CONCRETE APRON FOR LADDER
10	HURRICANE ROOF VENTILATOR
9	ANTI-CORROSION ANODE TAGS
8	TRUSS FOOT
7	INLET
6	PANEL CONNECTION WIND GIRTS
5	SCOUR BASIN
4	SCOUR DRAIN
3	COMMERCIAL LEVEL INDICATOR
2	RING BEAM
1	EARTHWORKS (BY OTHERS)

REVISIONS

DATE	REV	DESCRIPTION	GRID	BY	CHK	APP

DRAWN	WM
DATE	12 JAN 09
CHECKED	JE
DATE	13 MAY 09
APPROVD	LM
DATE	09 JUN 09

Pioneer Water Tanks
(Australia 94) Pty Ltd
A.C.N. 009 387 660
Telephone: 61-8-9274 4577
Fax: 61-8-9274 4588
Email: info@pwtaust.com
A BLUESCOPE WATER COMPANY

SCALE 1:1 PS
SHEET SIZE A3

TITLE
GENERAL ARRANGEMENT
COMMERCIAL TANK GALAXY XL20/08 HD

DWG NO. XL20-R8-64-001
REV -
CAD FILE SITE & MARKETING GAs\COMMERCIAL\XL20
NXT SHEET: -

Your ref: 20.2022.31; D22/52755

23 June 2022

Chief Executive Officer
City of Rockingham
PO Box 2142
ROCKINGHAM DC WA 6967

Attention: David Banovic – Senior Projects Officer

Proposed Industrial Graphite Processing Plant – Lot 2 Zirconia Drive, East Rockingham: Response to Request for Further Information

Dear Sir,

We refer to the City's correspondence dated 8 April 2022 regarding the above. GHD is pleased to provide this response to the information requested. For clarity and brevity, our response follows the same order in which the items have been presented in the City's correspondence. Our response has also numbered the main headings as follows for ease of reference:

1. Plans and Drawings
2. Gas, Dust and Odour Emissions
3. Urban Water Management / Surface Water Management Strategy (Appendix A)
4. Waste Management
5. Traffic, Access, Car Parking and Manoeuvrability
6. Bushfire, Landscaping and Stormwater
7. Tree Retention
8. Public Submissions

Our responses as presented in Table 1 below have been structured in the form:

– Referencing a supplementary document which we have prepared and appended as an attachment to this response; and / or
– Detailed response / justification to the information requested.

Table 1 Response Summary

Item	Title	Response
1	**Plans and Drawings**	Proposed earthwork levels for the stormwater basins and overall site are detailed in the Surface Water Management Strategy – refer Attachment 2. It is noted that the subject site and adjoining lots are generally flat with minimal variation in heights (i.e. <0.5m) as evident in the site feature surveyor – refer Attachment 1. As such, no significant fill or cut is proposed / required. Detailed finish ground levels will also form part of a future building permit submission.
2	**Gas, Dust and Odour Emissions**	An Air Quality Impact Assessment report was issued to the City on 10 May 2022 and supplementary information relating to odour issued via email on 19 May 2022. It is our understanding that the City is satisfied with the information submitted. The information issued previously to the City has not been attached as part of this response.
3	**Urban Water Management**	1. Surface water runoff oily water separator details – a triple interceptor oil water separator will be installed to manage site road run-off, the location of which will be finalised during detailed design. 2. Management of mosquito breeding in swales has been addressed in the Surface Water Management Strategy – refer Attachment 2.
	Surface Water Management Strategy Appendix A items	3. All items outlined have been addressed as part of the Surface Water Management Strategy addendum – refer Attachment 2. For brevity, the following responses are noted for the items listed in Appendix A: 2.11 – Stormwater Frequency Design Criteria Frequency Descriptor o meaning is ‘frequent’. 2.1.2 Modelling Parameters (Appendix B Geotechnical Investigation) o Storm water has been recalculated as part of the Surface Water Management Strategy addendum. 2.1.2 Modelling Parameters (Item 3 detention basin) o MGL has been revised in consultation with DWER. 2.2.1 Frequent / Small Event Management o Car parking and internal roads will all be treated via biofiltration. o Parabolic channel drains to be converted to biofiltration swales. o Biofiltration areas to be lined with amended soil with a min. PRI of 10 @ 300mm thickness. 2.2 Design Consideration o Detention basin amended to one only. Updated plan prepared. o Modelling summary table prepared.

Item	Title	Response
		o Inundation areas are contained within swales with 30cm freeboard for 1% AEP and consequently all less frequent events. 2.2.1 Frequent / Small Event Management o Section repeated – refer response above o Section repeated – refer responses above o Section repeated – refer responses above 2.2.2 Minor Event Management o Total effective basin depth is 0.93m at a holding capacity of 1,270(m^3) of water. o Basin areas are not required to be fenced under any regulatory requirements. Any safety requirements relating to the basin will be addressed through operational health and safety requirements. o Critical duration of 1% AEP is 3hrs. 10% and 20% AEP is 90 min. 63.2 AEP is 5 min. Corresponding basin empty times are less than 36hrs and 48 hrs. 2.2.3 Major Event Management o Empty time for 1% AEP is 3hrs. Basin fully drains in 45.6 hrs. Appendix C Calculations o Bottom summary table has been superseded with modelling results attached. Surface Water Modelling o Swales also act as drainage channels and provide 300mm min. freeboard for 1% AEP and all other, less frequent events. 3.2.2 Surface Water Drainage Structures o Vegetation within detention basins and drainage channels – refer 2.2.1 response above. o 3 drainage channels have been replaced with 3 branches – refer modelling results and supporting plan. o Detailed design of drainage channels – refer modelling results and supporting plan. 3.2.3 Other Infrastructure o Engineering plan with finished surface level and flow path – refer modelling results and supporting plan. Appendix D Drawings o Detailed design engineering drawings – detailed design drawings will be prepared post-DA stage (i.e. during building permit phase).

Item	Title	Response
		o Earthworks Isopach Plan – there are no low-lying areas with the subject site that are not designated swale areas. Additionally, stormwater drainage has been reassessed.
4	**Waste Management**	A waste management plan (WMP) has been prepared by Encycle Consulting – refer Attachment 3. The following detail / response is provided in the WMP: o Industrial solid waste volumes have been calculated and inform the waste bin type, number and collection frequency required – refer Table 3 of WMP. o Water Corporation wastewater discharge will be considered at the building permit stage. Whether the proposal will need to utilise the reticulated network and whether it is permitted to discharge into the network is subject to Water Corporation approval. o Detail on the type and volume of laboratory waste. o Detail on the type, quantities, storage and disposal method of any 'toxic' waste. o Waste type, quantities, location and waste receptacle details (refer Table 3 / Figure 3 of WMP).
5	**Traffic, Access, Car Parking and Manoeuvrability**	1. A traffic impact statement (TIS) addendum has been prepared by Onemilegrid Consultants based on the latest development plans which also form part of this correspondence – refer Attachment 4. 2. Development plans assessed as part of the TIS addendum have been based on updated development plans which form part of this correspondence. 3. Swept path analysis have been undertaken as part of the TIS addendum, demonstrating compliance. 4. Development plans have been updated demonstrating compliance with AS2890.1 – refer Attachment 1. 5. Car parking calculations are detailed in the TIS addendum. Development plans have also been updated illustrating additional bays. 6. Boom gate location has been revised – refer development plans (Attachment 1). The rationale for both sliding gate and boom gate is to manage unauthorised vehicular access when the sliding gate remains open, typically during daytime hours. 7. The switchroom is not a Western Power utility which requires access / egress by them. Reference to 'Western Power' has also been removed from the latest development plans.
6	**Bushfire, Landscaping and Stormwater**	An updated landscaping plan prepared by Plan E Landscape Architects, based on the latest development plans, forms part of this correspondence – refer Attachment 1. Stormwater plans have been prepared based on the latest development plans – refer Attachment 2.

Item	Title	Response
		The bushfire management plan (BMP) has been updated in response to the comments received and revised development plans – refer Attachment 5. The following comments are provided in response to the specific issues raised. 2. APZ location and language irregularity – the APZ extends to lot boundaries (refer Figure 3.2 / Table 6.1 no. 3). 3. The whole of the subject site is to be managed to a low bushfire threat state i.e. APZ requirements (refer Appendix 1 of BMP). It is understood that there is no Council requirement that the site (inclusive of landscaping within setback areas) cannot be managed to a low bushfire threat state. To this end, there is no requirement for the administration building to be relocated. 4. All vegetation within swale areas will be managed to a low bushfire threat state. 5. Surface stormwater treatment details have been clarified in the surface water management strategy addendum prepared by 360 Environmental - Attachment 2. <u>Landscaping</u> 6. An updated landscaping plan has been prepared addressing the items raised and appended as part of this correspondence – refer Attachment 1. Notably, the plans have undertaken the following revisions: o Landscaping proposed will be a combination of irrigated and non-irrigated areas. Details will be submitted at the future building permit phase. o Urban water sensitive solutions - drainage basin will be gravel. Refer surface water management strategy addendum with regard to urban water management. o Identifies areas where existing vegetation will be retained. It is noted that Grass Trees will be retained within landscape setback areas and where it satisfies the APZ requirement. Other areas where grass trees exist will be cleared to facilitate the development. The proponent would be happy to donate any Grass Trees to the City of Rockingham for use within their planting program. o Connection added between internal footpath and existing footpath along Alumina Road. o Staff parking area setback increased to 10m. o Planting palette updated in accordance with the City of Rockingham Planning Policy 3.3.8 East Rockingham Development Guidelines. o Perimeter fencing - fencing to Alumina Road has been relocated into the landscape buffer to assist with softening / greening of the streetscape. Due to site limitations, fencing along Zirconia Drive has been retained along the boundary line. To mitigate any adverse impacts to the streetscape, hardy WA Native Climbers such as Hardenbergia and Hibbertia are proposed to be

Item	Title	Response
		planted adjacent the Black PVC coated chain link fence to soften the appearance from the public realm.
7	**Tree Retention**	1. 3 x Tuart Trees adjacent to micronizing and spheronising mills – Whilst we acknowledge the desire to retain existing trees on site, Ecograf are permitted to remove all vegetation from the site as part of its proposed operations and in accordance with cl. 2 of the *Environmental Protection Act* Ministerial Statement 863. Nevertheless, Ecograf have committed to, and identified a number of locations where existing vegetation and mature trees, including Grass Trees, within the public realm will be retained where they do not conflict with the proposed use of the site, and add to the amenity of the streetscape. Any Tuart Trees identified for removal that are suitable for milling will be salvaged, logged, and supplied to a local Milling Contractor for re-use. Ecograf would be pleased to donate these trees to the City for use on their projects, if desired. 2. Site and landscape plans have been updated for consistency with respect to location and number of trees.
8	**Public Submissions Response**	
THEME 1	**Health impacts**	**Detrimental health effects of fine graphite particles to people in the area**
	Applicant response	As stated under item 2 above, it is our understanding that the City is satisfied with the Air Quality Impact Assessment report and supplementary information relating to odour that has been submitted. The information submitted concludes that the proposed development will result in no detrimental health impacts relating to any discharge of fine graphite particles. The information issued previously to the City has not been attached as part of this response.
THEME 2	**Siting / Location**	**The Environmental report, claims that the 1.5km distance from residences is sufficient to minimise exposure, but the strong coastal breezes will increase this impact** **Positioning of this site needs to be further isolated from residences**
	Applicant response	Refer response above.

Based on the abovementioned responses and the additional information that forms part of this correspondence, we consider the City now has the necessary information to continue assessment of the application in time for consideration at its forthcoming planning committee and, ordinary council meetings which are scheduled for the 15th and 23rd of October, respectively.

We eagerly await the City's favourable recommendation on our project and its determination by the Metro Outer Joint Development Assessment Panel.

Yours faithfully

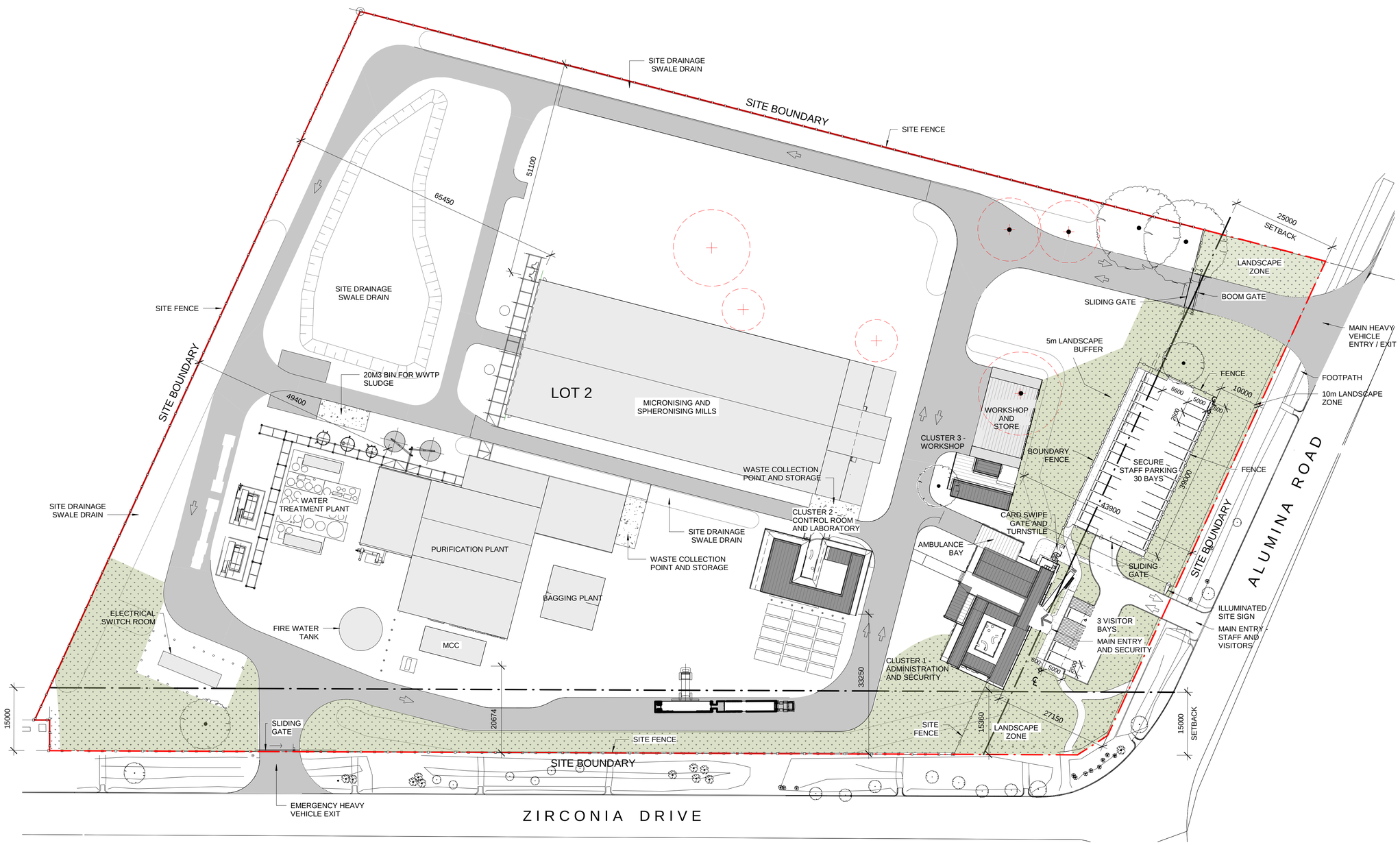
Shaun O'Neill
Executive Manager – Project Development

+61 428 112 815
soneill@ecograf.com.au

Enc.

Attachment 1

Development Plans & Landscape Plan



LEGEND

- NON-PROCESS INFRASTRUCTURE BUILDING (MODULAR)
- PROCESS INFRASTRUCTURE BUILDING (IN-SITU)
- LANDSCAPE ZONE - REFER LANDSCAPE PLAN
- NEW SEALED BITUMEN ROAD
- EXISTING TREE TO BE PROTECTED AND RETAINED
- TREE TO BE REMOVED
- SITE BOUNDARY FENCE. 2.4m HIGH, BLACK PVC COATED CHAIN MESH WITH BLACK POSTS

1 SITE PLAN
1 : 500

HUNT ARCHITECTS
ABN 67 297 805 649
Level 2 / 1 Ord Street, West Perth WA 6005
T + 61 8 9322 6033
office@huntarchitects.com.au

CLIENT
ECOGRAF

PROJECT
ECOGRAF BATTERY ANODE MATERIAL FACILITY

NOTES
1. Do not scale drawing.
2. All dimensions are in milimeters unless noted otherwise.
3. All dimensions shall be verified on site before proceeding with the work. **Hunt Architects** shall be notified in writing of any discrepancies.
4. This drawing must be read in conjunction with all relevant contracts, specifications and drawings.

REV.	DESCRIPTION	DATE
A	DRAFT ISSUE FOR COMMENT AND COORDINATION	12-01-2022
B	DRAFT ISSUE FOR COMMENT AND COORDINATION	13-01-2022
C	DRAFT ISSUE FOR COORDINATION	18-01-2022
D	DRAFT ISSUE FOR COORDINATION	24-01-2022
E	DRAFT ISSUE	25-01-2022
F	ISSUE FOR DEVELOPMENT APPLICATION	08-02-2022
G	ISSUED FOR COORDINATION	14-06-2022
H	ISSUE FOR DEVELOPMENT APPLICATION	20-06-2022

NORTH

SCALE 1:500 @ A1
0m 10m 20m 30m 40m 50m

STATUS
DEVELOPMENT APPLICATION

DRAWING TITLE
SITE PLAN

DRAWN BY
TC

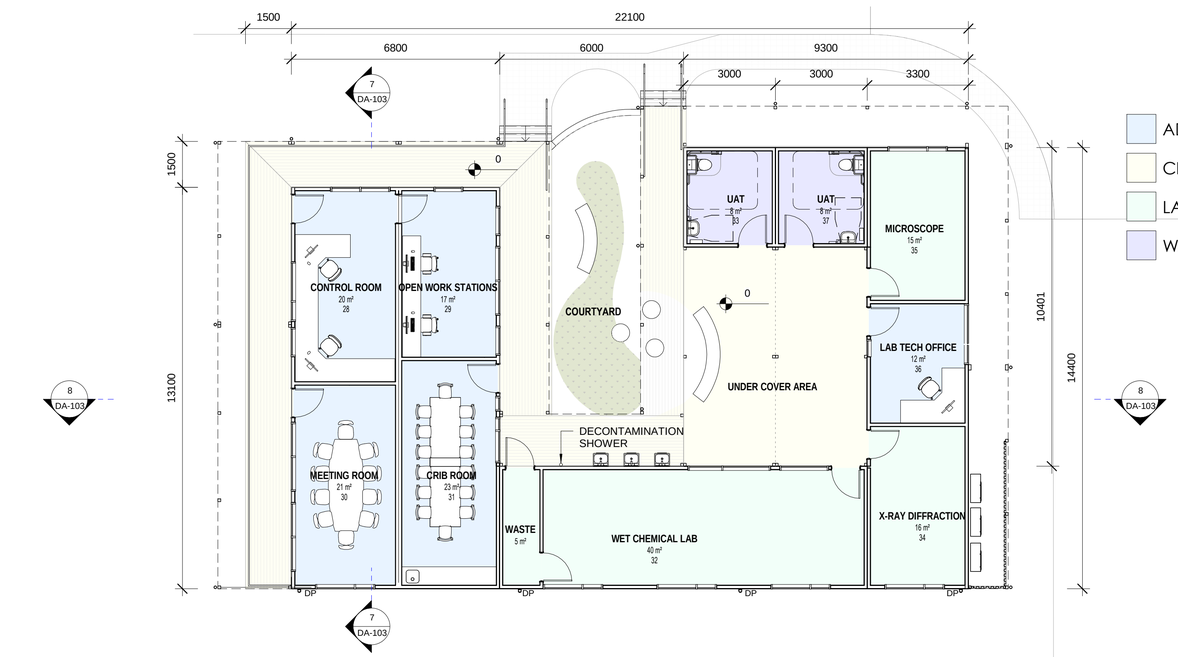
APPROVED
SAS

PROJECT No.
2164

DRAWING No.
DA-001

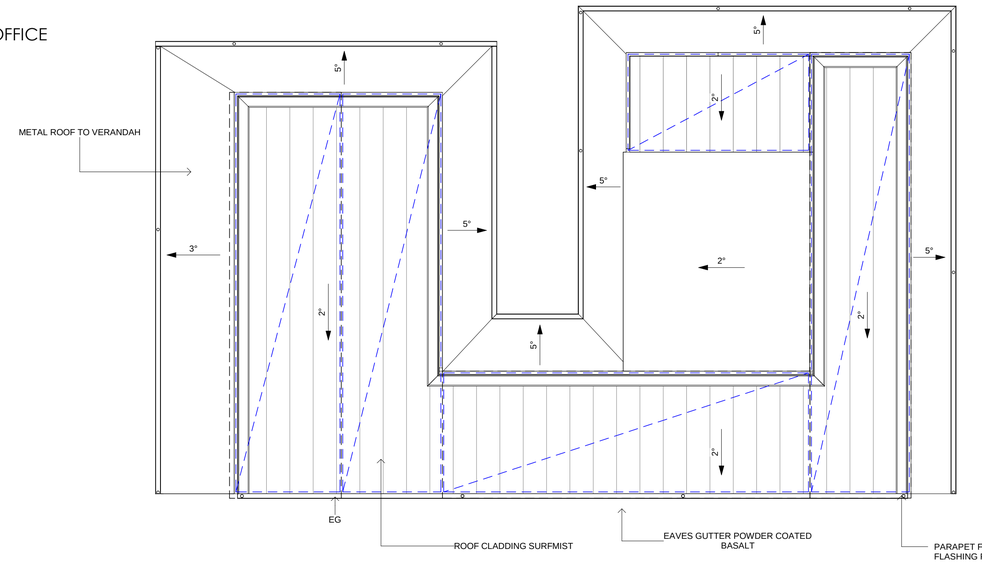
REV No.
H

DATE
27/01/2022

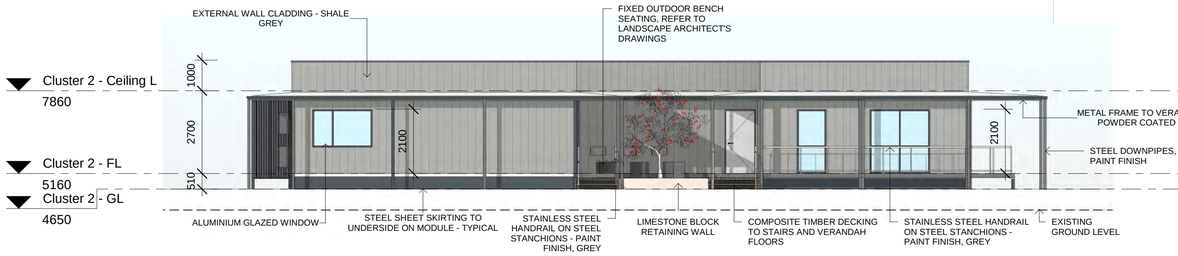


ADMINISTRATION / OFFICE
CIRCULATION
LABORATORY
WET AREA

ARRANGEMENT OF PREFABRICATED MODULES SHOWN IN DASHED BLUE LINE

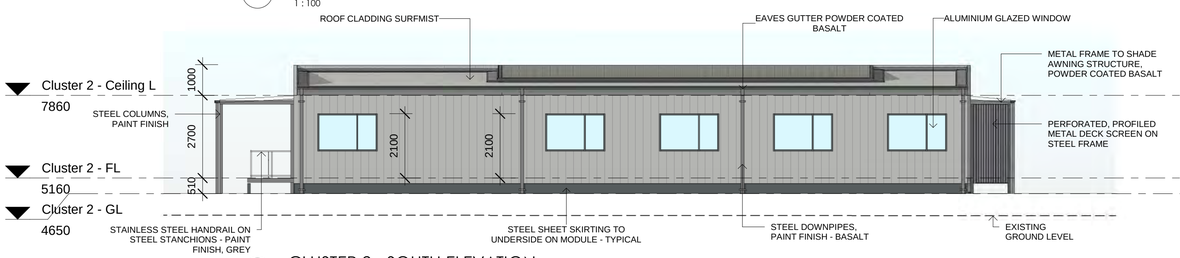


1 CLUSTER 2 - FLOOR LEVEL
1 : 100



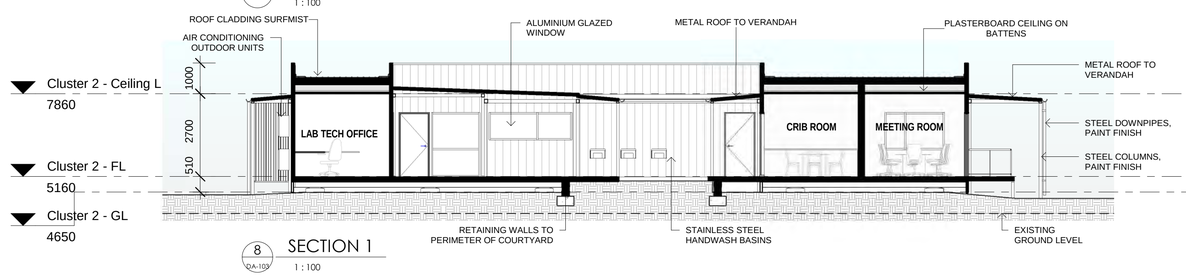
2 CLUSTER 2 - ROOF PLAN
1 : 100

3 CLUSTER 2 - NORTH ELEVATION
1 : 100

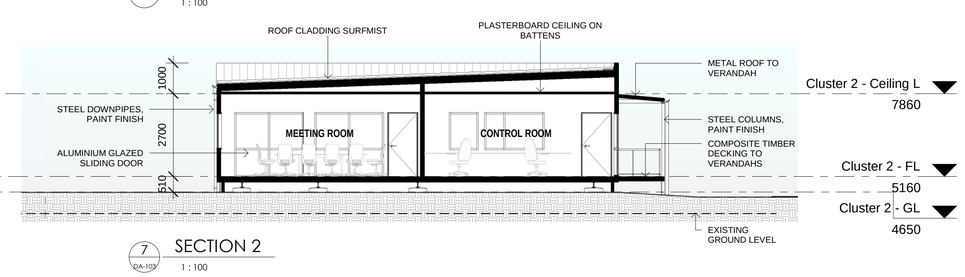


4 CLUSTER 2 - EAST ELEVATION
1 : 100

5 CLUSTER 2 - SOUTH ELEVATION
1 : 100



6 CLUSTER 2 - WEST ELEVATION
1 : 100



8 SECTION 1
1 : 100

7 SECTION 2
1 : 100

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REV.	DESCRIPTION	DATE
A	DRAFT ISSUE	25-01-2022
B	ISSUE FOR DEVELOPMENT APPLICATION	08-02-2022
C	ISSUE FOR DEVELOPMENT APPLICATION	20-06-2022

NORTH

SCALE 1:100 @ A1
0m 2m 4m 6m 8m 10m

STATUS
DEVELOPMENT APPLICATION

DRAWING TITLE
CLUSTER 2

DRAWN BY
AR

APPROVED
SAS

PROJECT No.
2164

DRAWING No.
DA-103

REV No.
C

DATE
01/12/22

Attachment 2

Surface Water Management Strategy Addendum

Our Ref: 5383AB_Rev1

22 June 2022

Cameron Spence
Project Engineer
EcoGraf
18 Richardson Street,
West Perth, WA, 6005
Via Email: cameron.spence@increva.com.au

Dear Cameron

EcoGraf Stormwater Model Response

360 Environmental Pty Ltd, part of SLR Consulting (360 Environmental) is pleased to provide EcoGraf with the revised stormwater model results for a proposed graphite processing plant located at Lot 2 Zirconia Drive, East Rockingham (the Site).

The scope of work completed by 360 Environmental involved addressing the comments on the previous stormwater results for the project by the City of Rockingham. This scope included modelling of the Site for the 1% and 10% annual exceedance probability (AEP) flood risks based on the design and layout of pervious and impervious surfaces, and the local drainage network.

360 Environmental provided storm water runoff and volumes for the drainage network and swales including maximum water levels during the different frequency storms using the modelling. 360 Environmental also wrote text responses in response to the City of Rockingham (CoR) comments on the DA application. We understand that these responses will be incorporated into EcoGraf's response document in relation to the DA comments.

We trust this meets your requirements. Should you have any questions or require further action please do not hesitate to contact Scott Bird on (08) 9388 8360.

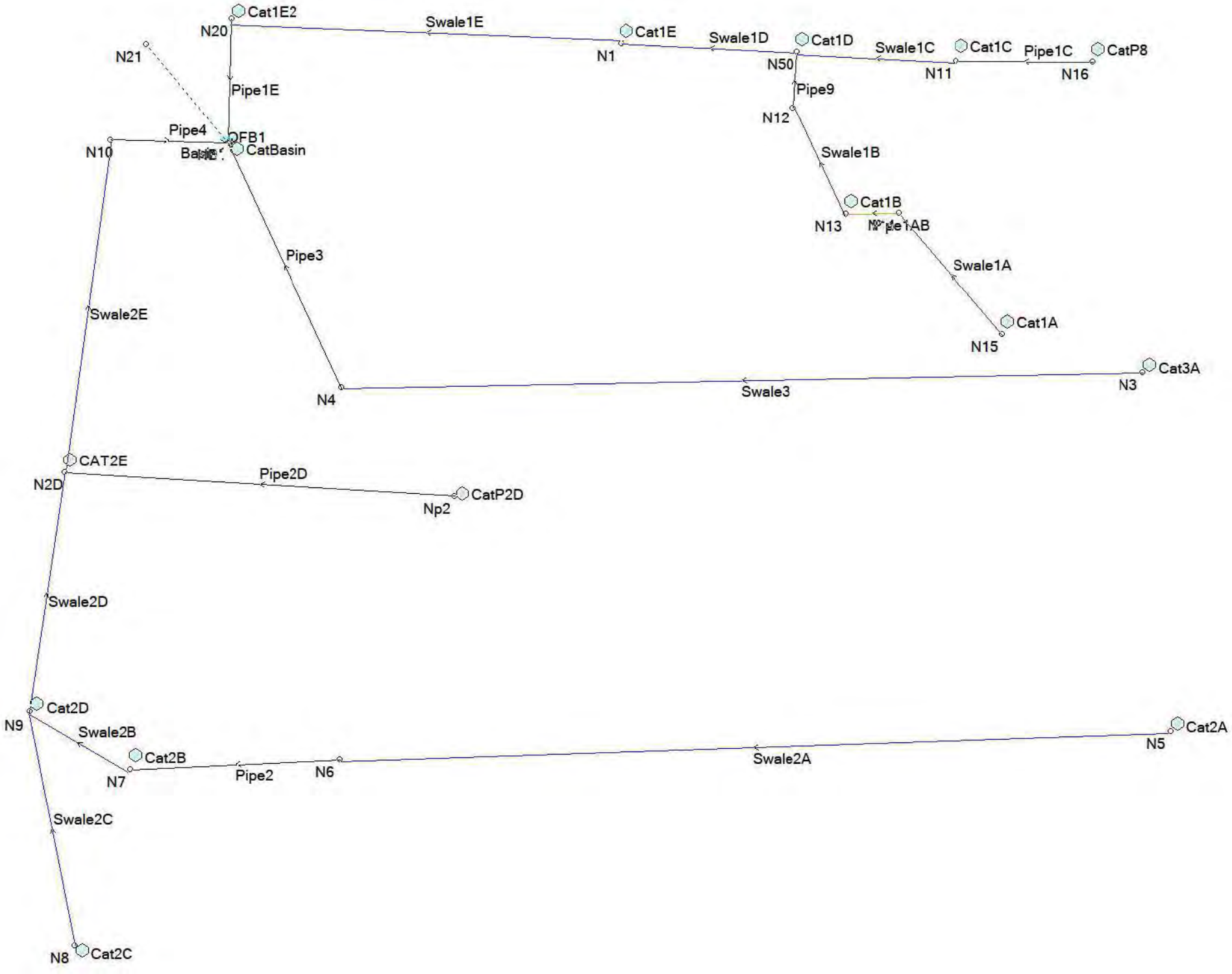
For and on behalf of 360 Environmental Pty Ltd

Scott Bird – Director

Ltr Ref	Item / FIR Request	Response (360 Environrmental / SLR)
City of Rockingham		
1	**Plans and Drawings**	
	FGL for stormwater basins & interface with neighbouring properties	
	Typical section details for: internal road, basin and adjacent property	
	Illustrate oil / water separator location	
	Swales – how will mosquito breeding be reduced	Water drains from swales in less than 24 hours for all events
3	**Urban Water Management**	
3.1	Illustrate oil / water separator location	
3.2	Swales – how will mosquito breeding be reduced	Water drains from swales in less than 24 hours for all events
3.3	Surface Water Management Strategy - Refer Appendix A comments	
	Stormwater Report / Plan	
6.3	Swales planted with vegetation – impact on stormwater?	Swales and infiltration basin are to be planted with vegetation to facilitate biofiltration and consequently reduce size and depth of infiltration basin.
6.4	Where surface stormwater treatment occurs? i.e. planted biofiltration areas? Plant base of swales?	Surface stormwater treatment occurs in swales and infiltration basin.
	What areas are rock pitched?	No areas are rock pitched.
Appendix A of City of Rockingham Letter		
2.1.1	***Storm Frequency Design Criteria Table 1 AR&R (2019) Design Criteria***	
	For 20% AEP, what does Frequency Descriptor "annually" mean? Is it supposed to be Frequent/Minor*? Please clarify.	It is supposed to be Frequent
2.1.2	***Modelling Parameters***	
	Appendix B Geotechnical Investigation Report by Douglas Partners in 2014 recommends a permeability value of 1.0 x 10-4 m/s for the design soakwells in medium dense sand and a value of 0.5 x 10-4 m/s in compacted sand. Item 2 states that this report adopted 2.6 x 10-4 m/s which is the derived permeability and is not supported by the City. The high groundwater level requires an accurate assessment of the infiltration capability of the site. The applicant is therefore required to carry out in-situ permeability testing or a falling head permeability test to determine a more realistic infiltration rate.	Modeling presented in Results.xlsx adopted value of 1.0 x 10-4 m/s, as recommended by Douglas Patners for medium dense send. In-situ permiability testing using the falling head method was performed in Lot1 by Douglas and Parthners, in proximity of proposed infiltration basin at a depth of 0.5 m. The test was performed in cased 110 mm diameter borehole drilled with a hand auger.Estimated permeability value of 2.1 x 10-4 (m/s) has been derived from the test data using the formula by Hvorslev (1951). A soil sample was also taken at the base of the borehole for subsequent classification testing. Permiability was assesed on this sample, using grading results from laboratory tersting using Hazen's formula at 1.4 x 10-4 (m/s).
2.1.2	Item 3 states that detention basin at 2mAHD and MGL based on Groundwater Atlas level at 1mAHD, giving the basin depth to MGL of 1m. The MGL of 1mAHD is from Perth Groundwater Atlas (2004), which is based on levels for May 2003 when MGL is lower. Department of Water and Environmental Regulation advises that Lower Serpentine Region Groundwater Contours records a historical MGL in the area of Lot 2 of between 2.5mAHD and 2.75mAHD grading towards west. According to City's Planning Procedure No. 1.8, the inverts of drainage basins and biofiltration basins should be a minimum 0.5m above the MGL. The soakwell inverts should be a minimum 0.3m above the MGL.	In consultation with DWER the MGL estimate was revised to be at 2.2-2.3m AHD, from west to east of the catchment.The proposed infiltration basin is positioned on the western boundary of the Lot2 at 2.8m AHD, which allows for 0.6m distance above MGL. To be on a safe side, recovery time modeling of the infiltration basin assumes MGL at 2.3m AHD.
2.2.1	***Frequent/Small Event Management***	

	The first 15mm of rainfall runoff from Carpark should be treated as well via biofiltration, not only the road runoff. The base of the detention basins should be vegetated to provide treatment via biofiltration for the first 15mm rainfall runoff. Please provide detailed design.	The base detention basin and swales are to be vegetated to provide treatment from carpark and access roads via biofiltration.
	The proposed parabolic channel drains can be converted to vegetated biofiltration swales rather than be lined with bituminous geomembrane. Vegetated biofiltration swales will increase at-source infiltration and potentially reduce the required size of drainage basins.	The proposed parabolic channel drains are to be converted to vegetated biofiltration swales which increases at-source infiltration and reduces the required size of drainage basins.
	Biofiltration areas should be lined with amended soil with a PRI of at least 10. The amended soil should have a minimum thickness of 300 mm.	Biofiltration areas are to be lined with amended soil with a PRI of at least 10 and a minimum thickness of 300 mm.
2.2	***Design Considerations***	
	Please provide a catchment plan showing the catchments managed by two detention basin and soakwells;	Only one detention basin is to be constructed. Aleks and Dominic to produce.
	Please provide a modelling summary table for the drainage basin at 63% AEP, 20% AEP, 10% AEP and 1% AEP storm events, including basin invert, modeling critical duration, water depth, top water level, storage volume, top water level area and emptying time;	refer results / calculations attached
	Please provide stormwater management plan and stormwater event plans showing inundation areas for the events above.	Inundation areas are contained within swales with 30cm freeboard for 1% AEP and consequently all less frequent events..
2.2.1	***Frequent/Small Event Management***	
	First 15mm of rainfall runoff from Carpark should be treated as well, not only the road runoff;	This comment is duplicated and should be deleted from the table. Refer response above.
	The base of the detention basins should be vegetated to provide treatment for the first 15mm rainfall runoff. Please provide detailed design.	This comment is duplicated and should be deleted from the table. Refer response above.
2.2.2	***Minor Event Management***	
	Storage volume 4100m3 for 1% AEP storm event does not match Appendix C result. Please clarify;	Refer response below for depth and volume
	The depth of basin is 2m, which is not supported. The basin design water depths are 0.5m, 0.9m and 1.2m respectively for 1EY, 20% and 1% AEP storm events;	The basin invert is at 2.8 (m AHD) and its top surface is at 3.77 (m AHD) on the NW corner; Sides have 1:3 slope; Total efective basin depth is 0.98 (m). Area varies from 1087 (m^2) to 1643 (m^2): Basin holding capacity is 1270 (m^3) of water.
	While this is private property it is recommended that the drainage basin be fenced and shown on Landscape Plans;	
	Please provide the critical duration for 20% and 10% AEP. The corresponding empty time should less than 36hrs and 48hrs respectively.	Critical duration for 1% AEP is 3 hours, 10% AEP and 20% is 90 min; 63.2 AEP is 5 minutes. Basin fully drains in 45.6 hours (1.9 days) for 1% AEP, in 160 minutes (<3 hours << 1 day) for 10% AEP event and even faster for less frequent events.
2.2.3	***Major Event Management***	
	Please provide the critical duration for 1% AEP. The corresponding empty time should be less than 96hrs.	Critical duration for 1% AEP is 3 hours Basin fully drains in 45.6 hours (< 2 days) for 1% AEP.
	Appendix C Calculations	
	The bottom summary table for various events have a reported duration of 24hr. Is this the critical duration for each storm event? Please clarify;	The bottom summary table has been superseeded with modeling results.
	Does 'Height' in the bottom summary table mean the water depth in the basin at corresponding storm event? The basin invert is the top water level minus water depth, but the basin inverts are different storm events. Please clarify.	The bottom summary table has been superseeded with modeling results.
3.2.1	***Surface Water Modelling***	
	Drainage channels should have 300mm freeboard for 1% AEP storm events.	Swales, which also act as drainage channels provide 300mm minimum freeboard for 1% AEP and all other, less freequent events.
3.2.2	***Surface Water Drainage Structures***	
	The current design has no vegetation proposed for both detention basins and drainage channels. Please provide treatment for the first 15mm rainfall runoff;	Refer response under 2.2.1 above

	Please show the locations for three proposed drainage channels on relevan stormwater plans;	Three proposed drainage channels are replaced with three branches - see plan and results.
	Please provide detailed design for these drainage channels such as engineering drawings and modelling information.	Modeling information is presented in Results.xlsx, Dom & Aleks to finalise plan and produce long sections.
3.2.3	***Other Infrastructure***	
	Please provide an engineering plan with finished surface level and flow path to detention basins for events greater than 10% AEP.	Refer results / calculations attached & updated plan
	Appendix D Drawings	
	Please provide detailed design engineering drawings, instead of Preliminary engineering drawings.	Refer results / calculations attached & updated plan
	Earthwork Isopach Plan shows a low lying area in the southern section. How will stormwater be managed for this area?	there are no low-lying areas with the subject site that are not designated swale areas. Additionally, stormwater drainage has been reassessed.
Department of Water and Environmental Regulation		
	Stormwater Management (Recommendation)	
	Apply requirements in 'Decision process for stormwater management in WA (DoW 2016)' & 'Stormwater Management Manual for Western Australia (DoW 2004–2007)'.	Historic MGL's are used when reassesing MGL. Previous information from DWER was based on modelling values, which largerly overestimated historic MGL in the vicinity of Lot 2.
	Using Perth Groundwater atlas to determine MGL not supported. Use historical MGLs.	Historic MGL's are used when reassesing MGL. Previous information from DWER was based on modelling values, which largerly overestimatec historic MGL in the vicinity of Lot 2.
	Integrate at-source infiltration of 15mm stormwater from carpark areas and undergo biofiltration	At-source infiltration of 15mm stormwater from carpark areas Integrated with biofiltration
	Parabolic channel drains - convert to vegetated biofiltration swales in order to reduce drainage basin size.	The proposed parabolic channel drains are to be converted to vegetated biofiltration swales.


Cat1E2
N20
Swale1E
Cat1E
N1
Swale1D
Cat1D
N50
Swale1C
Cat1C
N11
Pipe1C
CatP8
N16
N21
Pipe1E
Pipe9
N12
Pipe4
FB1
N10
CatBasin
Swale1B
Cat1B
N13
Pipe1AB
Pipe3
Swale1A
Cat1A
N15
Swale2E
Cat3A
N3
N4
Swale3
CAT2E
N2D
Pipe2D
CatP2D
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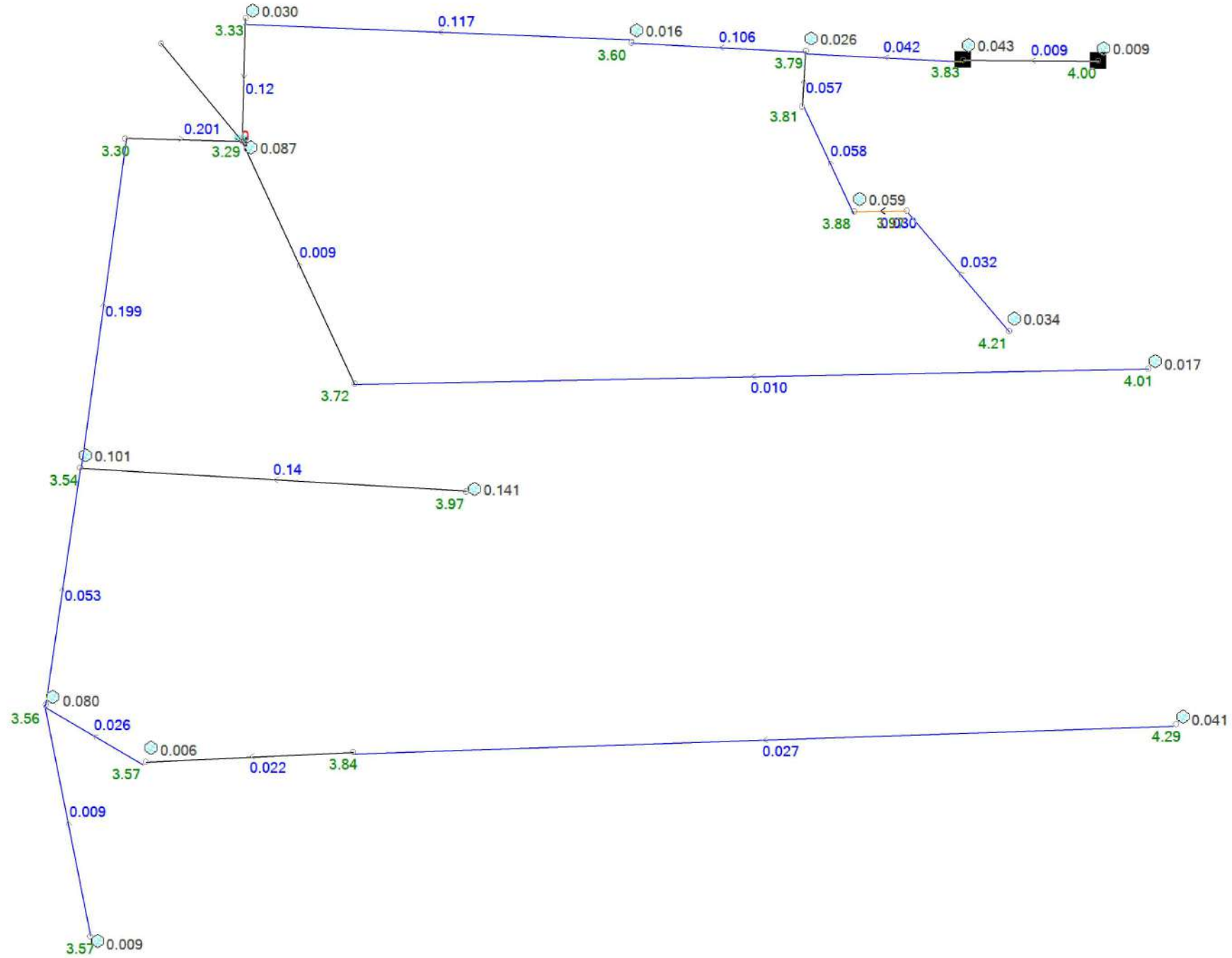
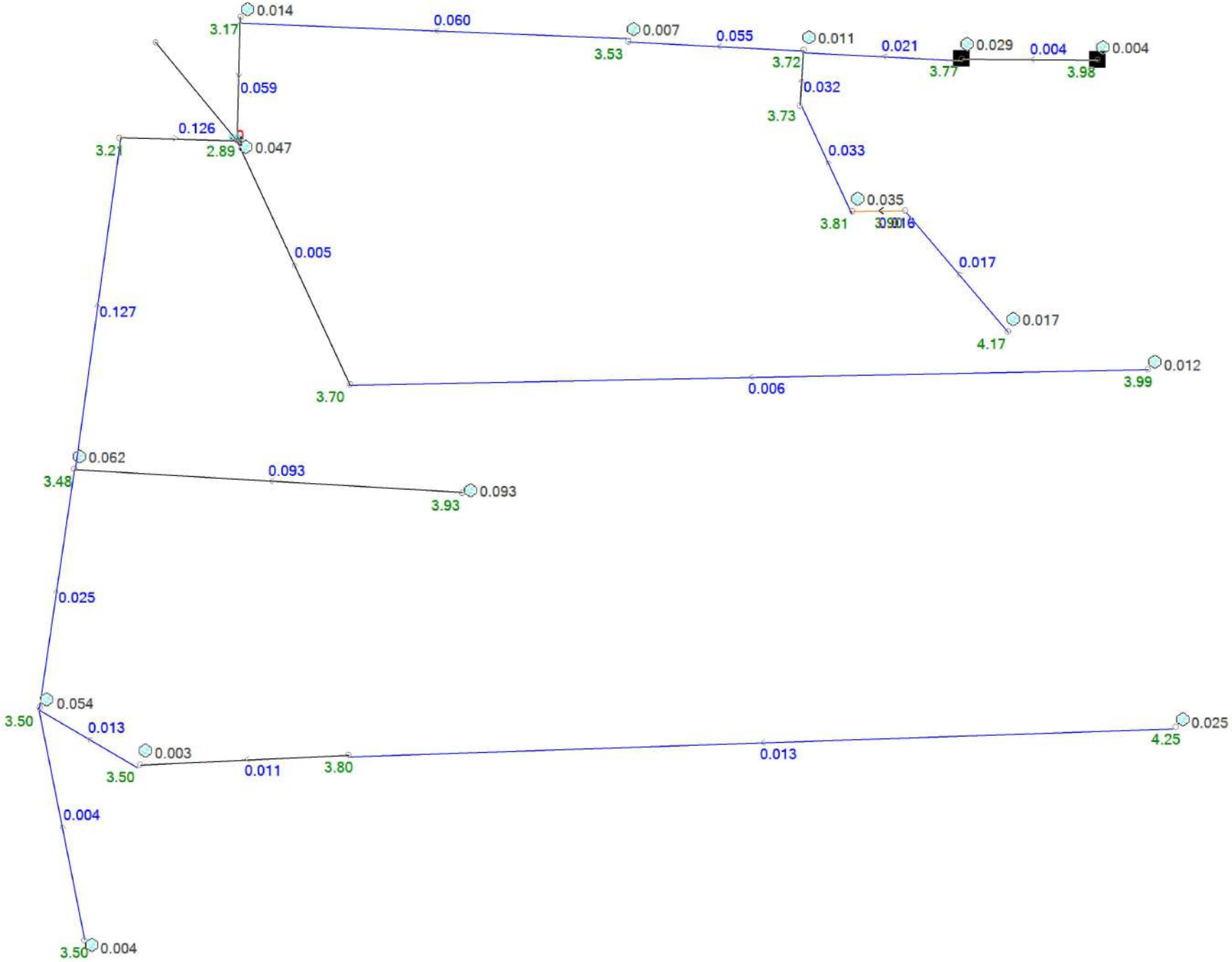
Cat2C



EcoGraph
Drains
WEC



EcoGraph
Drains
WEC

Modelling Framework		
Software	Drains, ver 2022.012	
Hydraulic model	Full unstready hydraulic model	
Hydrologic model	II-CL Initial Loss-Continuous Loss	
Overland flow	Kinematic wave equation	
Rainfall ensambles	ARR Hub, based on location	
Storm Losses	ARR Hub, based on location	
Pervious Area Initial Loss	30	(mm)
Pervious Area Continuous Loss	2.9	(mm/h)
Location (Lat, Long)	-32.2643	115.76
Software	Modret recovery	
Seepage from infiltration basin	Modflow96 and modified Green and Ampt equation	
Hydraulic conductivity	0.0001	(m/s)

1% AEP					
PIPE DETAILS					
Name	**Max Q**	**Max V**	**Max U/S**	**Max D/S**	**Due to Storm**
	(cu.m/s)	**(m/s)**	**HGL (m)**	**HGL (m)**	
Pipe3	0.009	1.55	3.717	3.294	1% AEP, 1.5 hour burst, Storm 8
Pipe2	0.022	1.02	3.837	3.568	1% AEP, 2 hour burst, Storm 5
Pipe4	0.201	1.48	3.3	3.294	1% AEP, 20 min burst, Storm 6
Pipe1C	0.009	0.74	4.005	3.831	1% AEP, 1.5 hour burst, Storm 2
Pipe1E	0.12	1.31	3.333	3.294	1% AEP, 1.5 hour burst, Storm 6
Pipe1AB	0.03	0.83	3.974	3.875	1% AEP, 1 hour burst, Storm 3
Pipe9	0.057	0.63	3.81	3.79	1% AEP, 30 min burst, Storm 8
Pipe2D	0.14	1.63	3.965	3.535	1% AEP, 20 min burst, Storm 9

CHANNEL DETAILS					
Name	**Max Q**	**Max V**	**Max U/S**	**Max D/S**	**Due to Storm**
	(cu.m/s)	**(m/s)**	**HGL (m)**	**HGL (m)**	
Swale1A	0.032	0.15	4.210	3.975	1% AEP, 45 min burst, Storm 3
Swale1B	0.058	0.13	3.875	3.810	1% AEP, 1 hour burst, Storm 1
Swale1C	0.042	0.11	3.837	3.808	1% AEP, 1.5 hour burst, Storm 9
Swale1D	0.106	0.18	3.790	3.601	1% AEP, 2 hour burst, Storm 6
Swale1E	0.117	0.53	3.601	3.333	1% AEP, 2 hour burst, Storm 6
Swale2A	0.027	0.17	4.294	3.837	1% AEP, 1.5 hour burst, Storm 8
Swale2B	0.026	0.08	3.568	3.568	1% AEP, 2 hour burst, Storm 4
Swale2C	0.009	0.04	3.565	3.565	1% AEP, 1.5 hour burst, Storm 3
Swale2D	0.053	0.12	3.562	3.535	1% AEP, 2 hour burst, Storm 2
Swale2E	0.199	0.6	3.535	3.300	1% AEP, 20 min burst, Storm 6
Swale3	0.01	0.15	4.001	3.720	1% AEP, 1.5 hour burst, Storm 9

1% AEP

Distance from u/s node (m)	Water level (mAHD)	Swale centreline elevation (mAHD)	Depth of water (m)	Surface elevation	Swale depth	Maximum alowable height
Swale1A Maximum Water Levels - 1% AEP, 45 min burst, Storm 3						
					0.5	0.2
0	4.2098	4.05	0.1598	4.55		
19.6	4.13232	3.976	0.15632			
39.2	4.05439	3.902	0.15239			
58.8	3.97511	3.828	0.14711	4.328		

Swale1B Maximum Water Levels - 1% AEP, 1 hour burst, Storm 1						
					0.6	0.3
0	3.87543	3.652	0.22343	3.652		
33.5	3.81015	3.577	0.23315	3.577		

Swale1C Maximum Water Levels - 1% AEP, 1.5 hour burst, Storm 9						
					0.625	0.325
0	3.83728	3.635	0.20228	3.635		
39.33	3.80812	3.517	0.29112	3.517		

Swale1D Maximum Water Levels - 1% AEP, 2 hour burst, Storm 6						
					0.625	0.325
0	3.79012	3.517	0.27312	3.517		
20.6667	3.72521	3.453	0.27221			
41.3333	3.6619	3.389	0.2729			
62	3.60058	3.325	0.27558	3.325		

Swale1E Maximum Water Levels - 1% AEP, 2 hour burst, Storm 6						
					0.625	0.325
0	3.60058	3.325	0.27558	3.325		
19.6	3.52787	3.26167	0.2662			
39.2	3.44	3.19833	0.24167			
58.8	3.33275	3.135	0.19775	3.135		

1% AEP

Distance from u/s node (m)	Water level (mAHD)	Swale centreline elevation (mAHD)	Depth of water (m)	Surface elevation	Swale depth	Maximum alowable height
Swale2A Maximum Water Levels - 1% AEP, 1.5 hour burst, Storm 8						
					0.625	0.325
0	4.29441	4.125	0.16941	4.125		
30.76	4.20227	4.0446	0.15767			
61.52	4.11273	3.9642	0.14853			
92.28	4.02522	3.8838	0.14142			
123.04	3.93797	3.8034	0.13457			
153.8	3.83728	3.723	0.11428	3.723		
Swale2B Maximum Water Levels - 1% AEP, 2 hour burst, Storm 4						
					0.75	0.45
0	3.56849	3.395	0.17349	3.395		
9.847	3.56818	3.355	0.21318	3.355		
Swale2C Maximum Water Levels - 1% AEP, 1.5 hour burst, Storm 3						
			0.75		0.75	0.45
0	3.56499	3.41	0.15499	3.41		
19.4	3.56499	3.355	0.20999	3.355		
Swale2D Maximum Water Levels - 1% AEP, 2 hour burst, Storm 2						
					0.75	0.45
0	3.56168	3.355	0.20668	3.355		
16.69	3.53503	3.30567	0.22936			
33.38	3.53503	3.25633	0.2787			
50.07	3.53503	3.207	0.32803	3.207		
Swale2E Maximum Water Levels - 1% AEP, 20 min burst, Storm 6						
					0.75	0.45
0	3.53503	3.207	0.32803	3.207		
47.784	3.30004	3.07	0.23004	3.07		
Swale3 Maximum Water Levels - 1% AEP, 1.5 hour burst, Storm 9						
					0.5	0.2
0	4.00064	3.905	0.09564	3.905		
23.5233	3.91335	3.82	0.09335			
47.0467	3.82584	3.735	0.09084			
70.57	3.7197	3.65	0.0697	3.65		

1% AEP

INFILTRATION BASIN DETAILS

Name	Max WL	MaxVol	Base	Base of aquifer	HGL	K	TotVol
	(m AHD)	(cu.m)	(m AHD)	(m AHD)	(m AHD)	(m/day)	(cu.m)
Basin1	3.294	620.5	2.8	-20	2.3	8.64	1712
	(feet)	(cu.feet)	(feet)	(feet)	(feet)	(feet/day)	(cu.feet)
	10.81	21913	9.19	-65.6	7.55	28.3	60452

BASIN EMPTYING TIME

Time to Peek	Recovery time	Total time	
hours			Days
3.32	42.25	45.56	1.90

CONVERSION

m to feet	cum.m to cu.feet
3.28	35.31

RECOVERY RESULTS

Time	Pond Water Level	Time	Pond Bottom Level	Time	Pond Water Level
(days)	(feet)	(hours)	(feet)	(min)	(m AHD)
0	10.81	0.00	9.19	0	3.294
0.010	10.66	0.25	9.19	15	3.250
0.052	10.45	1.25	9.19	75	3.186
0.094	10.34	2.25	9.19	135	3.152
0.135	10.26	3.25	9.19	195	3.126
0.177	10.19	4.25	9.19	255	3.105
0.219	10.13	5.25	9.19	315	3.087
0.260	10.07	6.25	9.19	375	3.070
0.302	10.02	7.25	9.19	435	3.055
0.344	9.98	8.25	9.19	495	3.041
0.385	9.94	9.25	9.19	555	3.029
0.427	9.90	10.25	9.19	615	3.017
0.469	9.86	11.25	9.19	675	3.005
0.510	9.82	12.25	9.19	735	2.995
0.552	9.79	13.25	9.19	795	2.984
0.594	9.76	14.25	9.19	855	2.975
0.635	9.729	15.25	9.186	915	2.966
0.677	9.700	16.25	9.19	975	2.957
0.719	9.67	17.25	9.19	1035	2.948
0.760	9.65	18.25	9.19	1095	2.940
0.802	9.62	19.25	9.19	1155	2.932
0.844	9.59	20.25	9.19	1215	2.924
0.885	9.57	21.25	9.19	1275	2.917
0.927	9.55	22.25	9.19	1335	2.910
0.969	9.52	23.25	9.19	1395	2.903
1.010	9.50	24.25	9.19	1455	2.896
1.052	9.48	25.25	9.19	1515	2.890
1.094	9.46	26.25	9.19	1575	2.883
1.135	9.44	27.25	9.19	1635	2.877
1.177	9.42	28.25	9.19	1695	2.871
1.219	9.40	29.25	9.19	1755	2.865

1.260	9.38	30.25	9.19	1815	2.859
1.302	9.36	31.25	9.19	1875	2.854
1.344	9.34	32.25	9.19	1935	2.848
1.385	9.33	33.25	9.19	1995	2.843
1.427	9.31	34.25	9.19	2055	2.838
1.469	9.29	35.25	9.19	2115	2.833
1.510	9.28	36.25	9.19	2175	2.828
1.552	9.26	37.25	9.19	2235	2.823
1.594	9.25	38.25	9.19	2295	2.818
1.635	9.23	39.25	9.19	2355	2.813
1.677	9.21	40.25	9.19	2415	2.809
1.719	9.20	41.25	9.19	2475	2.804
1.760	9.19	42.25	9.19	2535	2.800
1.802	9.17	43.25	9.19	2595	2.795
1.844	9.16	44.25	9.19	2655	2.791
1.885	9.14	45.25	9.19	2715	2.787
1.927	9.13	46.25	9.19	2775	2.783
1.969	9.12	47.25	9.19	2835	2.779
2.010	9.10	48.25	9.19	2895	2.775
2.052	9.09	49.25	9.19	2955	2.771
2.094	9.08	50.25	9.19	3015	2.767
2.135	9.07	51.25	9.19	3075	2.763
2.177	9.05	52.25	9.19	3135	2.760
2.219	9.04	53.25	9.19	3195	2.756
2.260	9.03	54.25	9.19	3255	2.753
2.302	9.02	55.25	9.19	3315	2.749
2.344	9.01	56.25	9.19	3375	2.746
2.385	9.00	57.25	9.19	3435	2.742
2.427	8.99	58.25	9.19	3495	2.739
2.469	8.97	59.25	9.19	3555	2.735
2.510	8.96	60.25	9.19	3615	2.732
2.552	8.95	61.25	9.19	3675	2.729
2.594	8.94	62.25	9.19	3735	2.726
2.635	8.93	63.25	9.19	3795	2.723
2.677	8.92	64.25	9.19	3855	2.720
2.719	8.91	65.25	9.19	3915	2.717
2.760	8.90	66.25	9.19	3975	2.714
2.802	8.89	67.25	9.19	4035	2.711
2.844	8.88	68.25	9.19	4095	2.708
2.885	8.87	69.25	9.19	4155	2.705
2.927	8.87	70.25	9.19	4215	2.702
2.969	8.86	71.25	9.19	4275	2.699
3.010	8.85	72.25	9.19	4335	2.697

1% AEP							
SUB-CATCHMENT DETAILS							
Name	**Max**	**EIA**	**Remaining**	**EIA**	**RIA**	**PA**	**Due to Storm**
	Flow Q	**Max Q**	**Max Q**	**Tc**	**Tc**	**Tc**	
	(cu.m/s)	**(cu.m/s)**	**(cu.m/s)**	**(min)**	**(min)**	**(min)**	**(min)**
Cat1A	0.034	0	0.034	0	5.21	26.21	1% AEP, 45 min burst, Storm 3
Cat1B	0.059	0.005	0.056	4.34	0	18.51	1% AEP, 20 min burst, Storm 9
Cat1C	0.043	0.043	0	3.67	4.78	23.9	1% AEP, 5 min burst, Storm 1
Cat1D	0.026	0.014	0.023	2.73	0	42.13	1% AEP, 1.5 hour burst, Storm 1
Cat1E	0.016	0.009	0.015	5.69	0	38.19	1% AEP, 1.5 hour burst, Storm 1
Cat1E2	0.03	0.007	0.026	4.32	0	7.26	1% AEP, 30 min burst, Storm 9
Cat2A	0.041	0.041	0	4.81	0	7.74	1% AEP, 5 min burst, Storm 1
Cat2B	0.006	0	0.006	0	2.74	24.24	1% AEP, 45 min burst, Storm 3
Cat2C	0.009	0	0.009	0	0	22.59	1% AEP, 1 hour burst, Storm 2
Cat2D	0.08	0.08	0	4.1	0	20.03	1% AEP, 5 min burst, Storm 1
CAT2E	0.101	0.101	0	4.76	0	10.62	1% AEP, 5 min burst, Storm 1
Cat3A	0.017	0.017	0	4.15	0	9.74	1% AEP, 5 min burst, Storm 1
CatBasin	0.087	0	0.087	0	14.34	45.39	1% AEP, 1 hour burst, Storm 3
CatP2D	0.141	0.14	0	18.36	0	54.31	1% AEP, 20 min burst, Storm 9
CatP8	0.009	0	0.009	0	0	13.2	1% AEP, 1.5 hour burst, Storm 2

1% AEP

PIT / NODE DETAILS		
Name	**Max HGL**	**Max Surface Flow Arriving**
	(m AHD)	**(cu.m/s)**
N3	4.01	0.018
N4	3.72	0.014
N5	4.29	0.054
N6	3.84	0.036
N7	3.57	0.008
N9	3.56	0.071
N2D	3.54	0.119
N10	3.3	0.215
N8	3.57	0.012
N16	4	0.014
N11	3.83	0.053
N50	3.79	0.085
N1	3.6	0.152
N20	3.33	0.155
N15	4.21	0.041
N14	3.97	0.04
N13	3.88	0.062
N12	3.81	0.072
Np2	3.97	0.143

10% AEP							
INFILTRATION BASIN DETAILS							
Name	**Max WL**	**MaxVol**	**Base**	**Base of aquifer**	**HGL**	**K**	**TotVol**
	(m AHD)	**(cu.m)**	**(m AHD)**	**(m AHD)**	**(m AHD)**	**(m/day)**	**(cu.m)**
Basin1	2.895	111	2.8	-20	2.3	8.64	777
	(feet)	**(cu.feet)**	**(feet)**	**(feet)**	**(feet)**	**(feet/day)**	**(cu.feet)**
	9.498	3920	9.19	-65.6	7.55	28.3	27439

BASIN EMPTYING TIME			
Time to Peek	**Recovery time**	**Total time**	
min			**Days**
111.90	47.5	159.35	0.11

CONVERSION	
m to feet	**cum.m to cu.feet**
3.28	35.31

RECOVERY RESULTS					
Time	**Pond Water Level**	**Time**	**Pond Bottom Level**	**Time**	**Pond Water Level**
(days)	**(feet)**	**(hours)**	**(feet)**	**(min)**	**(m AHD)**
0	9.50	0.000	9.190	0	2.895
0.010	9.35	0.246	9.190	15	2.851
0.052	9.054	1.246	9.190	75	2.760
0.094	8.902	2.246	9.190	135	2.713
0.135	8.792	3.246	9.190	195	2.680
0.177	8.703	4.246	9.190	255	2.653
0.219	8.628	5.246	9.190	315	2.630
0.260	8.564	6.246	9.190	375	2.610
0.302	8.507	7.246	9.190	435	2.593
0.344	8.457	8.246	9.190	495	2.578
0.385	8.412	9.246	9.190	555	2.564
0.427	8.370	10.246	9.190	615	2.551
0.469	8.333	11.246	9.190	675	2.540
0.510	8.299	12.246	9.190	735	2.529
0.552	8.267	13.246	9.190	795	2.520
0.594	8.237	14.246	9.190	855	2.511
0.635	8.210	15.246	9.190	915	2.502
0.677	8.185	16.246	9.190	975	2.495
0.719	8.161	17.246	9.190	1035	2.487
0.760	8.139	18.246	9.190	1095	2.481
0.802	8.119	19.246	9.190	1155	2.475
0.844	8.100	20.246	9.190	1215	2.469
0.885	8.083	21.246	9.190	1275	2.464
0.927	8.066	22.246	9.190	1335	2.459
0.969	8.050	23.246	9.190	1395	2.454
1.010	8.035	24.246	9.190	1455	2.449
1.052	8.021	25.246	9.190	1515	2.445
1.094	8.007	26.246	9.190	1575	2.441
1.135	7.994	27.246	9.190	1635	2.437
1.177	7.982	28.246	9.190	1695	2.433
1.219	7.970	29.246	9.190	1755	2.429

1.260	7.959	30.246	9.190	1815	2.426
1.302	7.948	31.246	9.190	1875	2.423
1.344	7.938	32.246	9.190	1935	2.419
1.385	7.928	33.246	9.190	1995	2.416
1.427	7.918	34.246	9.190	2055	2.414
1.469	7.909	35.246	9.190	2115	2.411
1.510	7.901	36.246	9.190	2175	2.408
1.552	7.892	37.246	9.190	2235	2.406
1.594	7.884	38.246	9.190	2295	2.403
1.635	7.877	39.246	9.190	2355	2.401
1.677	7.869	40.246	9.190	2415	2.399
1.719	7.862	41.246	9.190	2475	2.396
1.760	7.855	42.246	9.190	**2535**	**2.394**
1.802	7.849	43.246	9.190	2595	2.392
1.844	7.842	44.246	9.190	2655	2.390
1.885	7.836	45.246	9.190	2715	2.388
1.927	7.830	46.246	9.190	2775	2.387
1.969	7.824	47.246	9.190	2835	2.385
2.010	7.819	48.246	9.190	2895	2.383
2.052	7.813	49.246	9.190	2955	2.382
2.094	7.808	50.246	9.190	3015	2.380
2.135	7.803	51.246	9.190	3075	2.378
2.177	7.798	52.246	9.190	3135	2.377
2.219	7.794	53.246	9.190	3195	2.376
2.260	7.789	54.246	9.190	3255	2.374
2.302	7.785	55.246	9.190	3315	2.373
2.344	7.781	56.246	9.190	3375	2.372
2.385	7.776	57.246	9.190	3435	2.370
2.427	7.772	58.246	9.190	3495	2.369
2.469	7.769	59.246	9.190	3555	2.368
2.510	7.765	60.246	9.190	3615	2.367
2.552	7.761	61.246	9.190	3675	2.366
2.594	7.758	62.246	9.190	3735	2.365
2.635	7.757	63.246	9.190	3795	2.364
2.677	7.757	64.246	9.190	3855	2.364
2.719	7.757	65.246	9.190	3915	2.364
2.760	7.757	66.246	9.190	3975	2.364
2.802	7.757	67.246	9.190	4035	2.364
2.844	7.757	68.246	9.190	4095	2.364
2.885	7.757	69.246	9.190	4155	2.364
2.927	7.757	70.246	9.190	4215	2.364
2.969	7.757	71.246	9.190	4275	2.364
3.010	7.757	72.246	9.190	4335	2.364

Attachment 3

Waste Management Plan

encycle consulting

waste less, achieve more

EcoGraf Headquarters, East Rockingham

Processing Waste Management Plan

22 June 2022

Rev_0

22 June 2022

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Revision	Drafted	Reviewed	Date issued
Rev_0	G Busby/B Stokes-Hughes	A Bremner/S Chami	22 June 2022

22 June 2022

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Glossary of terms and acronyms

DG	Dangerous Goods
General (solid) waste	Material that is intended for disposal to landfill (or in some States, incineration), normally what remains after the recyclables have been collected separately.
Hazchem overpack drum	Overpack drums or hazmat drums (also known as hazspill drums or hazshield drums) are used to contain and safely transport damaged drums or drums which may be filled with dangerous substances or hazardous waste.
IBC	intermediation bulk containers
MGB	Mobile Garbage Bin – A wheeled bin with a lid often used for kerbside collection of waste or recyclables. (Often called a 'wheelie bin').
MRB	Mobile Recycling Bin – A wheeled bin ("wheelie" bin) with a lid used for collection of recyclables (similar to an MGB). Generally have a different colour body and/or lid to MGBs
Recycling	Where a material or product undergoes a form of processing to produce a feedstock suitable for the manufacture of new products
Reuse	Replacing a 'disposable' or single-use item with one which can be used again (without needing to be processed or dismantled i.e. 'recycled')
Sludge	For the purpose of this Waste Management Plan, this refers to the spadeable waste material that is generated from treating the waste water and reagents added from processing graphite. This spadeable sludge material will be generated at the waste water treatment plant
Spadeable waste	Waste material that is sufficiently solid to be handled by a spade i.e. not a liquid
WWTP	Waste water treatment plant

22 June 2022

1 Processing Waste Management Plan Brief

This Processing Waste Management Plan has been prepared for Hunt Architects, on behalf of their client EcoGraf Limited. EcoGraf propose to construct and operate Australia's first purified spherical graphite processing facility at the EcoGraf™ Processing Facility in the Kwinana-Rockingham Strategic Industrial Area of Western Australia. The Facility is to be developed on Lot 2, Zirconia Drive, East Rockingham and is located in the City of Rockingham local government area.

The City of Rockingham has reviewed a Waste Management Plan (WMP), submitted as part of the Development Approval (DA) application; detailing management of waste and recyclables arising from the development's administrative aspects i.e. from offices, meeting rooms and staff areas.

The WMP for the administrative aspects of the development is current and suitable to the City's requirements, and no modifications have been made. Refer to 'EcoGraf HQ, East Rockingham – Waste Management Plan' (Encycle, January 2022).

The City has raised queries in relation to the management of the processing waste streams. Consequently, there are two WMPs for the development, being:

I. Waste Management Plan covering the administrative aspects i.e. office areas, meeting rooms and admin areas (submitted to and reviewed by the City)
II. Processing Waste Management Plan covering the graphite processing waste and recycling stream (this document).

The brief of the Processing Waste Management Plan:

- Focuses on the delineation and management of the waste streams that will be generated by the graphite processing operations
- Addresses queries raised by the City of Rockingham in their review of the DA application for the Facility.

The processing buildings and operations assessed are identified in Figure 1 and Table 1.

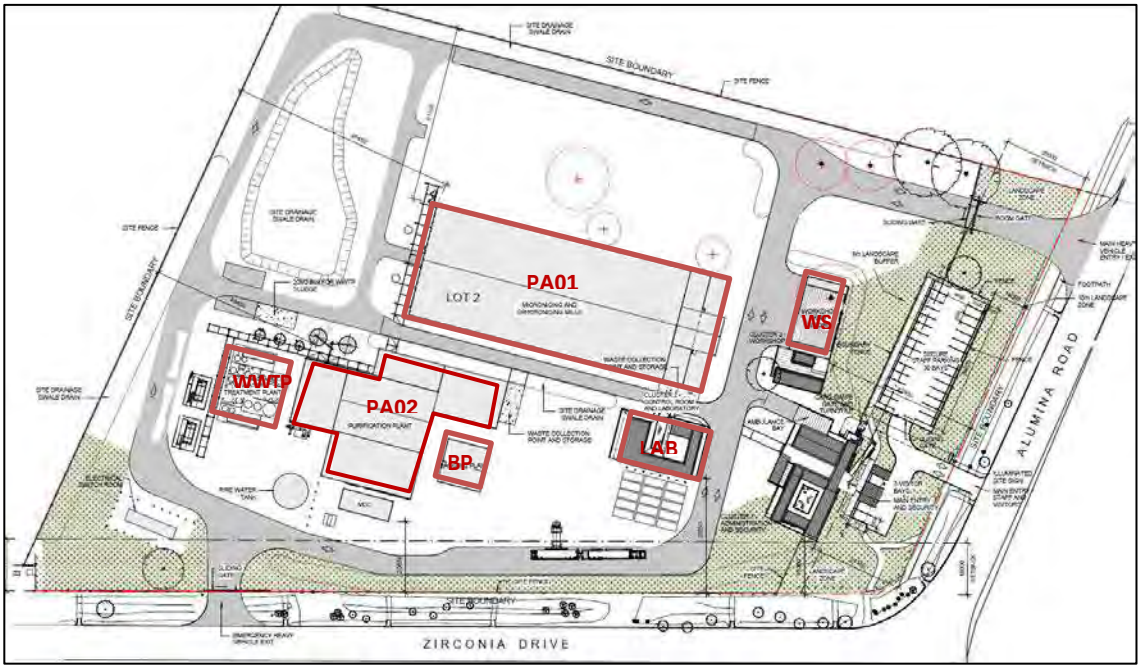

Figure 1: Graphite processing operational buildings (outlined in red) in Processing WMP

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Table 1: Graphite processing buildings identification

Building Id	Building operations	Description
PA01	Micronising & Spheronising mills	Processes graphite feedstocks into different grades of particles
PA02	Purification plant	Purifies graphite, caustic and sulphuric acid reagents used in the purification process
BP	Bagging plant	Bagging of graphite product for distribution to graphite battery markets
WWTP	Waste water treatment plant	Treats waste water comprising reagents added during the purification process
Lab	Laboratory	Product and quality assurance testing
WS	Workshop	Equipment storage and maintenance

1.1 City of Rockingham requirements

The City of Rockingham has requested information on waste management for the processing wastes from the proposed EcoGraf facility following a review of the Development Assessment Panel (DAP) application and DA being sought (reference: D22/52755).

The reviewed and summarised information requested relevant to this Processing WMP are:

1. Confirmation and detailing of the processing general solid waste produced from the development
2. Confirmation from Water Corporation that all waste water generated (including industrial waste water) from the proposed facility will be able to be discharged to the sewerage system

   Note: this point is being addressed directly by EcoGraf in liaison with the Water Corporation and does not form part of this document.
3. Detailing of laboratory waste i.e. hazardous waste / Dangerous Goods (DGs) and how these will be managed for waste treatment / disposal
4. Details on how any contaminants are treated during the process, and how / where these are managed/disposed i.e. process flow and clarification of treatment of graphite feedstock fines materials and management of waste water treatment sludge
5. The type of waste, quantities expected, the locations for storage and how the storage areas and containers are to be housed and cleaned. Council requires waste generation sources to be clearly shown and annotated on plans.

2 Context

The Processing WMP has been prepared based on the following information:

- Architectural plans from Hunt Architects received on 20 and 21 June 2022
- 'Lot 2 Zirconia Drive, East Rockingham: Traffic Impact Statement' received from onemilegrid on 21 June 2022
- City of Rockingham – Planning Procedure 1.11, updated 30/09/2021
- 'Completion of EcoGraf™ Processing Facility Development Report', ASX Announcement, 5 November 2020
- Engagement of hazardous waste specialist consultant, Westref Enviro Pty Ltd
- Discussion and correspondence on process flow with EcoGraf Project Engineer and EcoGraf's process systems designer contractor
- Discussion and correspondence on laboratory functions and chemicals to be utilised with EcoGraf's Chemist.

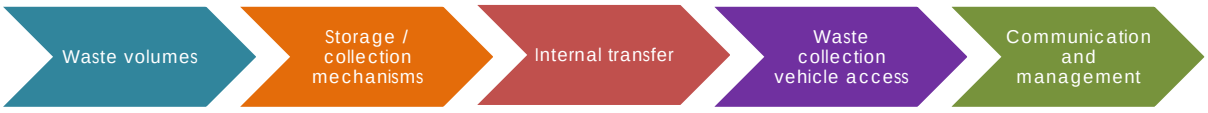
2.1 Considerations for waste systems

For efficient and effective waste management, the collection and centralisation of waste should be carefully considered at the building/s design phase. Key factors considered for the processing buildings in the design of waste systems were:

- Process flow and waste, recycling, hazardous waste and / or dangerous goods generated at each step (refer Figure 2)
- The volumes of waste, recycling, hazardous waste and / or dangerous goods likely to be generated during processing operations
- Types and sizes of bins and where to locate for ease of access for EcoGraf personnel / waste collection contractors
- Safety for all operatives involved in waste management
- Access to bins and storage areas from within the building
- Access for different types of waste collection vehicles
- Amenity (odours and noise)
- The ongoing management of waste and recycling services
- City of Rockingham DA queries.

2.2 Key components of the Processing WMP

This WMP consists of five core components. The following report will present detailed information on each of the following components.



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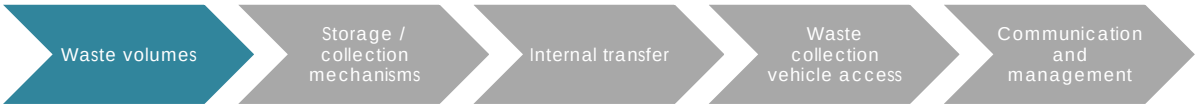
3 Waste streams and estimated volumes

- Addresses City of Rockingham DA queries 1, 3 and 4 (refer section 1.1).



The types of waste identified from the graphite processing buildings and operations are shown in Figure 2 and Table 2.

Table 2: Waste streams and types of waste generated from processing operations by building

Building Id	Type of waste	Disposal / recycling / treatment	Waste stream
PA01	Bulka bags – split open when dispensing of graphite feedstock, and wastage from bagging operations	Disposed to landfill as general waste	General waste
	Fines particles / dust from general clean-up / spills	Disposed to landfill as general waste	General waste
	Packing materials i.e. cardboard, shrink wrap plastics	Sent to commercial recycling facilities	Recycling
	Fines stored in silos, to be sold as by-product. Contingency for fines to be disposed to landfill (worst case scenario)	Sold as by-product	General waste disposal contingency
PA02	Reagents received and pumped into fixed isotainers - no waste arising	n/a	n/a
BP	Bulka bags – wastage from bagging operations	Disposed to landfill as general waste	General waste
	General clean-up from bagging operations	Disposed to landfill as general waste	General waste
	Packing materials i.e. cardboard, shrink wrap plastics	Sent to commercial recycling facilities	Recycling
WWTP	Spadeable gypsum sludge containing residual levels of caustic and sulphuric acid	Disposed to landfill, landfill class to be determined	General (solid) waste
Lab	Receptacles containing minor residual amount of caustic and sulphuric acid	Sent to hazardous waste recycling facility for treatment, recycling or disposal	Hazardous waste / Dangerous goods
WS	Equipment storage / maintenance, all vehicles electric – no waste generated	n/a	n/a

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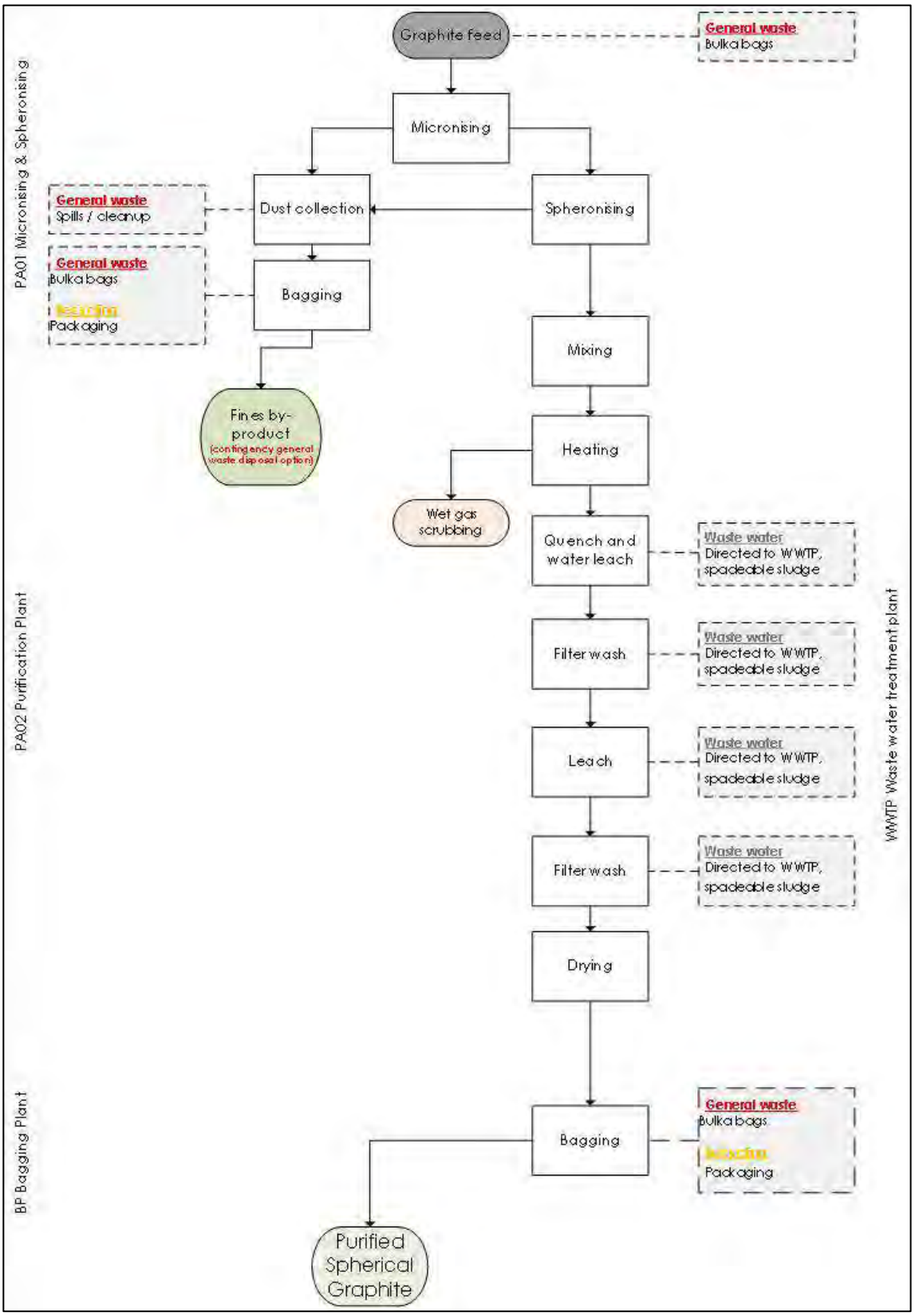

Figure 2: Graphite processing waste streams

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3.1 Estimated volumes

Table 3 details the types of waste, collection receptacles / bins and collection frequencies. Table 4 identifies the waste streams at each step of the process flow.

Table 3: Waste types, receptacles and collection frequency for process waste

Process step	Waste stream and type	Receptacle / bin size	Number	Collection frequency	Colour code
PA01 - Graphite feed	General waste (bulka bags)	1100L bin	1	Weekly	GW
PA01 - Micronising & Spheronising	Fines by-product	Silo	n/a	As needed	Sales
PA01- Dust collection	General waste (fines / clean up)	240L bin	1	As needed	GW
PA01 -Bagging (fines by-product)	Cardboard recycling	660L bin	1	As needed	CB
	Soft plastics (shrink wrap)	660L bin	1	As needed	SP
BP	General waste (bulka bags)	660L bin	1	As needed	GW
	General waste (fines / clean-up)	240L bin	1	As needed	GW
	Cardboard recycling	660L bin	1	As needed	CB
	Soft plastics (shrink wrap)	660L bin	1	As needed	SP
LAB	Spent acid	20L container	1	n/a	HW/DGs
	Spent caustic	20L container	1	n/a	HW/DGs
	Chemical spill kit	240L bin	1	If / as needed	HW/DGs
	Spent acid	60L drum	2	Weekly	HW/DGs
	Spent caustic	60L drum	2	Weekly	HW/DGs
	Spent acid / caustic	70L tub	2	As needed	HW/DGs
WWTP	Sludge	20m^3 bin	1	Twice weekly	GW

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Table 4: Graphite processing building and operations waste streams identification

Building Id	Building operations	Waste streams			
		General Waste (GW)	Recycling (SP / CB)	Hazardous waste (HW)	Dangerous Goods (DGs)
PA01	Micronising & Spheronising mills	✓	✓	—	—
PA02	Purification plant	—	—	—	—
BP	Bagging plant	✓	✓	—	—
WWTP	Waste water treatment plant	—	—	✓	—
Lab	Laboratory	—	—	✓	✓
WS	Workshop	—	—	—	—

Legend:

GW – general waste

SP – soft plastics recycling

CB – cardboard recycling

HW – hazardous waste

DGs – dangerous goods

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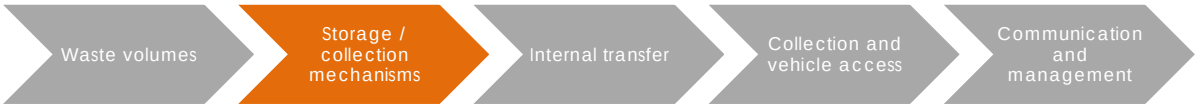
4 Storage / collection mechanisms

- Addresses City of Rockingham DA query 3, 4 and 5 (refer section 1.1).



4.1 PA01, BP, WWTP Waste design aspects

The following aspects have been designed in for the waste management storage and collection mechanisms from the processing, bagging plant and waste water treatment plant:

- Lidded 660L or 1100L general waste and / or recycling bins are located external to PA01 and BP (as there are steps up to these buildings)
- Bins located external to building PA01 and BP are in close proximity, for ease of disposal of waste streams and convenience for collection by the waste collection contractor
- Externally located bins will not contain food waste as waste is disposed from the processing operations and operators lunch / staff areas are separate to the processing buildings. Notwithstanding, externally located bins will be lidded bins to mitigate any potential for vermin, blown litter or dust generation
- Bins will be washed down at the bin storage / collection location, with a hose cock installed to enable bins to be washed out and waste water to be directed to trade waste
- After a review of various options by Encycle, Westref Enviro and EcoGraf, the most efficient and practical collection method for sludge has been implemented. Crates will be located under the point source of generation of the gypsum sludge. These crates will be transferred by forklift and emptied into a 20m^3 bin located external to the WWTP. This bin will have a rolled tarp or similar cover mechanism to prevent infiltration of rainwater (refer photos 1 and 2 below for collection mechanisms).

Photo 1: Yellow crates capture sludge

Photo 2: Sludge transferred to 20m^3

22 June 2022

The storage and collection mechanisms i.e. bin types, receptacles and collection points are shown in Figure 3.

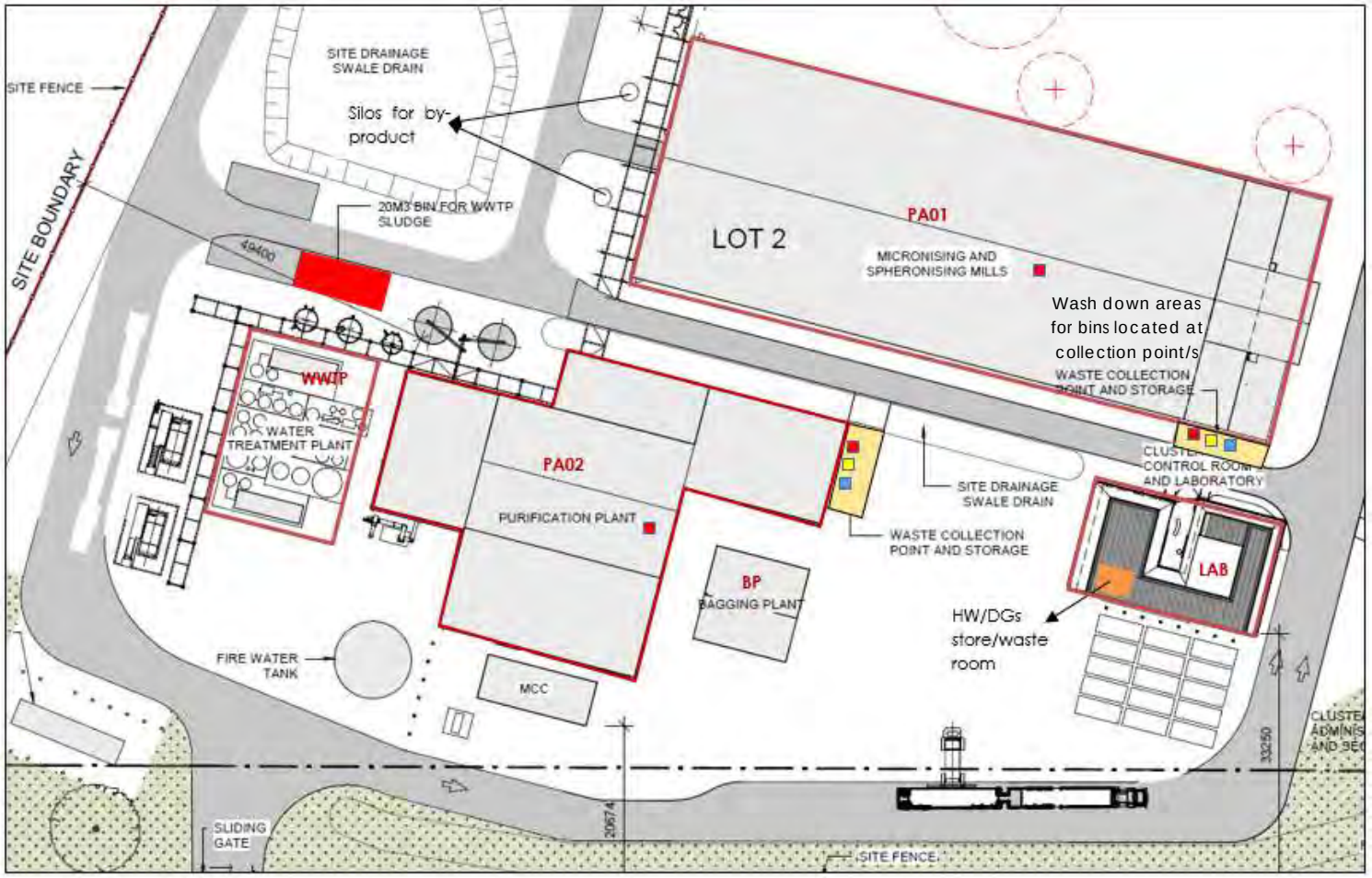


Figure 3: Processing waste streams storage mechanisms and collection points

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4.2 Laboratory hazardous waste / dangerous goods store area

Storage of empty receptacles and receptacles containing caustic / sulphuric acid will follow the same requirements and procedures for storage and handling as documented in the EcoGraf Dangerous Goods Management Plan.

For waste management the DGs Management Plan should include:

- Separate area of the DGs store will contain separate hazardous waste cabinets to store sulphuric acid / caustic receptacles (i.e. separate acid / alkaline areas and cabinets)
- Visual aids and signage to be provided to ensure that the area works as intended from a DGs / hazardous waste storage requirement
- DGs (hazardous waste) store / cabinet to be lockable
- Artificial lighting, sensor or switch controlled both internal and external to be provided
- Supply of water with trade waste water outlet
- Decontamination showers to be installed adjacent to the lab hazardous waste / DGs store in the event of any spillages incident and to safeguard personnel health and safety
- Chemical spill it and associated equipment to be housed in laboratory DGs store area (refer photos 3 and 4).

The location for laboratory hazardous waste / DGs store area and decontamination showers is shown on Figure 4.

Photo 3: Chemical spill kit

Photo 4: Spill smart vacuum

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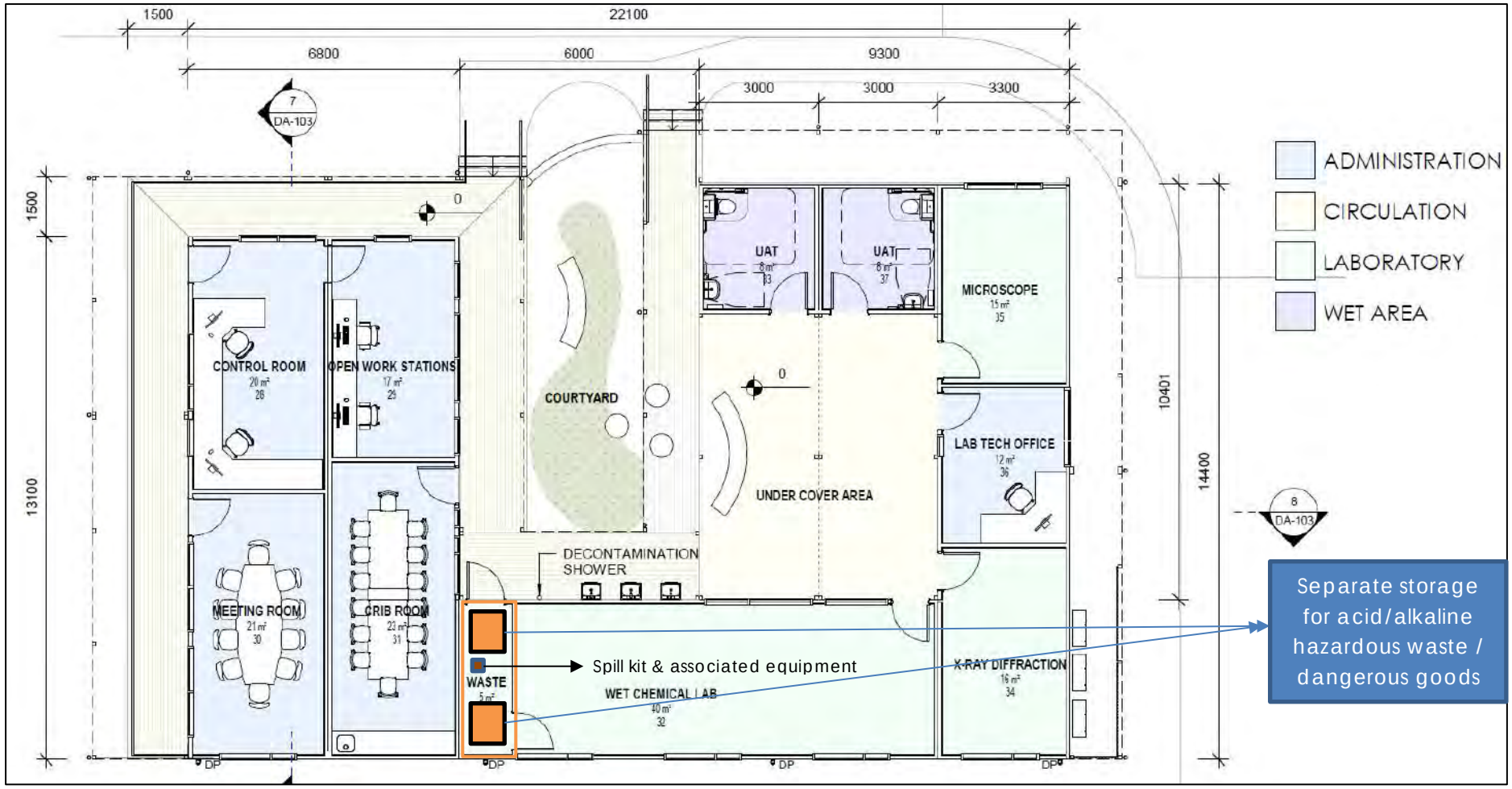

Figure 4: Laboratory hazardous waste / DGs store area

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5 Internal transfer

- Addresses City of Rockingham DA query 5 (refer section 1.1).

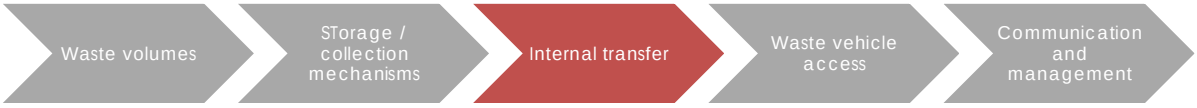

Table 5 outlines the internal transfer of waste from generation point to collection bin / receptacle.

Table 5: Internal transfer of waste from processing buildings and operations

Process step	Waste stream and type	Receptacle / bin size	Internal transfer
PA01			
Graphite feed	General waste (bulka bags)	1100L bin	- EcoGraf personnel dispose waste bulka bags into a waste bulka bag (bags on split at one end) - When full, bulka bag disposed to 1100L general waste bin located external to PA01 - Bulka bag containing waste bulka bags may be put on a trolley to the door - Weight of waste bulka bags to be limited to c.30 kg for handling and disposal
Micronising & Spheronising	Fines by-product	Silo	- Fines transferred from dust collection / extraction and stored in silos, and dispensed to 1m³ bulka bags on sale as by-product - Contingency (worst case scenario) designed into waste management plan for disposal to landfill
Dust collection	General waste (fines / clean up)	240L bin	- 240 L bin to be lined with plastic bag, located inside PA01 - When full, bag to be transferred by EcoGraf personnel to 660 L general waste bin located external to PA01
Bagging (fines by-product)	Cardboard recycling	660L bin	- Cardboard boxes to be flat packed - Boxes and cardboard rolls (from shrink wrap) to be disposed to 660 L recycling bin by EcoGraf personnel, located external to PA01. Trolley may be used to transfer cardboard to the door
	Soft plastics (shrink wrap)	660L bin	- Bag and frame to be used to dispose of any waste shrink wrap - When full, bag to be disposed to 660L plastics recycling bin located external to PA01 by EcoGraf personnel
BP	General waste (bulka bags)	660L bin	- 240L bin to be lined with plastic bag, located inside BP - When full, plastic bag to be transferred by EcoGraf personnel to 660L general waste bin located external to BP

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Process step	Waste stream and type	Receptacle / bin size	Internal transfer
	General waste (fines / cleanup)	240L bin	- Cardboard boxes to be flat packed - Boxes and cardboard rolls (from shrink wrap) to be disposed to 660L recycling bin by EcoGraf personnel, located external to BP - Trolley may be used to transfer cardboard to the door
	Cardboard recycling	660L bin	- Bag and frame to be used to dispose of any waste shrink wrap - When full, plastic bag to be disposed to 660 L plastics recycling bin located external to BP by EcoGraf personnel
	Soft plastics (shrink wrap)	660L bin	- 240 L bin to be lined with plastic bag - When full, plastic bag to be transferred by EcoGraf personnel to 660 L general waste bin located external to BP
LAB	Spent acid	20L container	- Any residual decanted into 60 L Hazchem overpack drum for storage in the designated dangerous goods area in the lab by EcoGraf laboratory personnel (refer photo 5)
	Spent alkaline	20L container	- Any residual decanted into 60 L Hazchem overpack drum for storage in the designated dangerous goods area in the lab
	Chemical spill kit	240L bin	- Stored in designated dangerous goods area in the lab (refer photos 3 and 4) - If used, material to be collected by licensed controlled (hazardous) waste contractor
	Spent acid	60L drum	- Stored in designated dangerous goods area in the lab - May be stored in hazardous waste cabinet or on spill bund (refer photo 6) - EcoGraf to engage a licenced controlled (hazardous) waste contractor to collect - Weight of drums to be limited to c.30 kg for manual handling and transfer down stairs
	Spent caustic	60L drum	- Stored in designated dangerous goods area in the lab - May be stored in hazardous waste cabinet or on spill bund - EcoGraf to engage a licenced controlled (hazardous) waste contractor to collect - Weight of drums to be limited to c.30 kg for manual handling and transfer down stairs
	Spent acid / caustic	70L tub	- Separate tubs for acid / caustic to be stored in designated dangerous goods area in the lab - May be stored in hazardous waste cabinet or on spill bund (refer photo 7) - EcoGraf to engage a licenced controlled (hazardous) waste contractor to collect - Used to store smaller receptacles for collection by a licenced controlled (hazardous) waste contractor - Weight of tub/s to be limited to c.30 kg for manual handling and transfer down stairs

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Process step	Waste stream and type	Receptacle / bin size	Internal transfer
WWTP	Sludge	20m^3 bin	- Sludge collected in crates at point of generation, emptied into 20 m^3 bin by forklift, located in close proximity (refer photos 1 and 2) - Waste collection contractor will collect for disposal to appropriately licensed landfill.

Photo 5: 20L carboy

Photo 6: 60L hazchem overdrum

Photo 7: Spill bund

Photo 8: 70L tub

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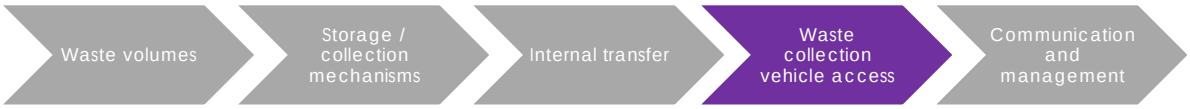
6 Waste collection vehicle access



Several waste collection vehicles will be required to access the site and collect the waste streams from designated collection points. The collection points are marked on Figure 3.

Swept path analysis has been undertaken on the different types of waste vehicles that will be required to access the site and are shown in Figure 5. For more detail on waste collection and swept path analysis, refer to 'Lot 2 Zirconia Drive, East Rockingham: Traffic Impact Statement' developed by onemileroad (June, 2022).

EcoGraf will engage a licenced controlled (hazardous) waste collection provider to collect the waste receptacles from the laboratory. The internal transfer of the receptacles is outlined in Table 4. Note that the collection vehicle used for collection of the lab waste streams will be a smaller vehicle than the rear-lift or hook-lift waste collection vehicle and hence has provision to access the site.

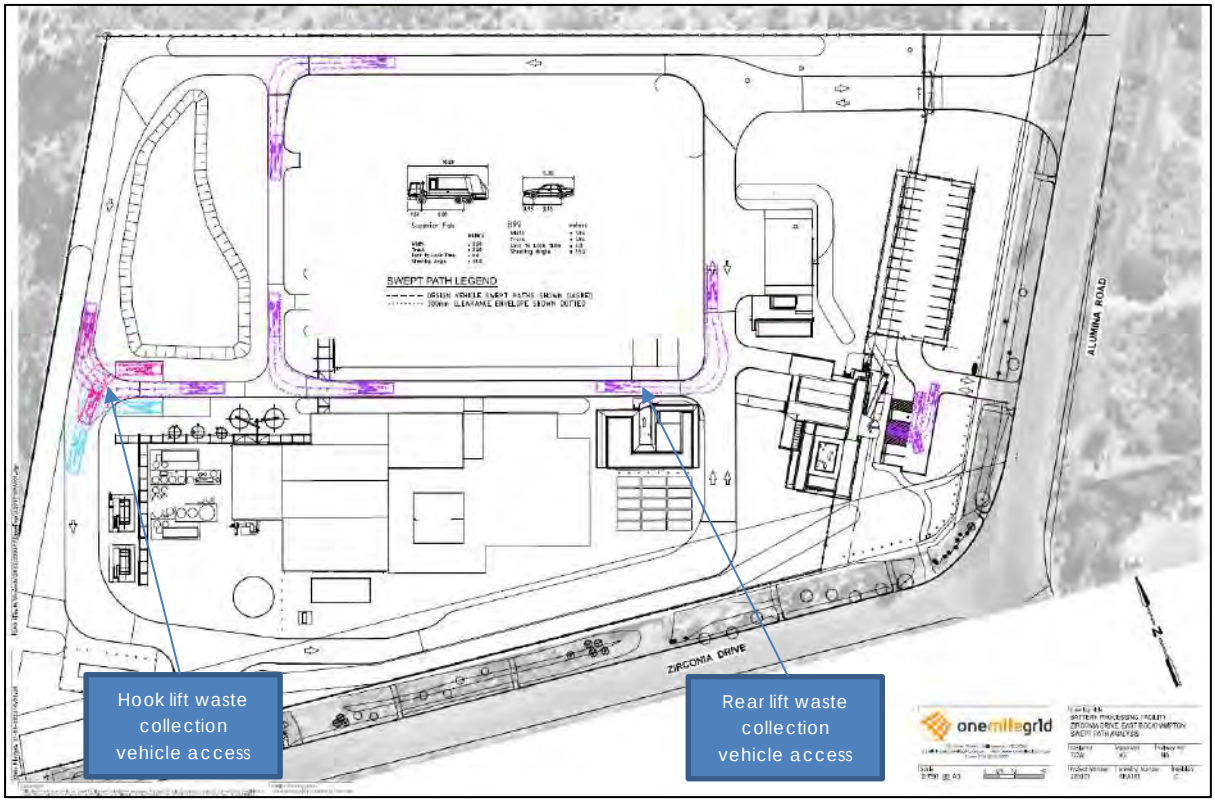


Figure 5: Swept path analysis for waste collection vehicle (general waste / recycling, sludge)

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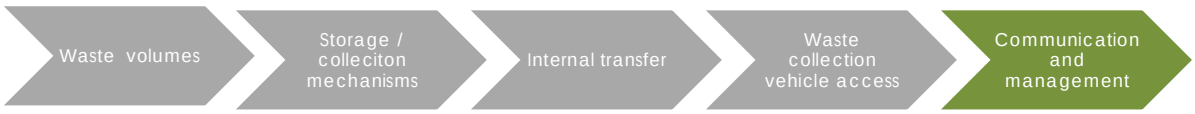
7 Ongoing communication and management



7.1 Management

A designated EcoGraf Processing Facility staff member i.e. site manager / supervisor will be responsible for overseeing the waste management systems. This staff member will be trained and informed about their responsibility to implement the waste management systems and in particular to follow procedures for the storage and handling of hazardous / dangerous goods wastes. The management of hazardous / DGs is documented in the EcoGraf Dangerous Goods Management Plan.

EcoGraf Management are to ensure that laboratory staff are adequately trained in the decanting of residual liquids to Hazchem overdrum, from smaller receptacles, and the safe operation of these drums i.e. securing lids etc. The EcoGraf Dangerous Goods Management Plan is to be followed in the handling and storage of hazardous / dangerous goods including waste receptacles.

EcoGraf will engage a hazardous waste / Dangerous Goods specialist to train staff on how to appropriately handle and store wastes including management of spills.

7.2 Communication

EcoGraf staff members will be made aware, through a corporate document (or equivalent), of the waste and recycling systems and how they should be used, and the Dangerous Goods Management Plan.

An operational Waste Management Plan suitable for presenting to process building users, including how the plan should be communicated will be developed and implemented during both the initial occupation and ongoing use of the process buildings.

A designated EcoGraf staff member will be responsible for the continuing education of staff on correct segregation of waste and recyclables to ensure successful performance of the waste and recycling systems.

Attachment 4

Transport Impact Statement addendum

ABN: 79 168 115 679
56 Down Street
COLLINGWOOD, VIC 3066
www.onemilegrid.com.au

21 June 2022

EcoGraf

Via email: cspence@ecograf.com.au

Attention: Cameron Spence

Lot 2 Zirconia Drive, East Rockingham

Transport Impact Statement

Introduction

A Transport Impact Statement (TIS) was previously prepared by i3 Consultants for the proposed development at Lot 2 Zirconia Drive, East Rockingham, dated May 2020. A planning application (Application Number D22/52755) was submitted to Council, and a Request for Further Information (dated 8 April 2022) was subsequently received. Council provided the following comments regarding traffic, access, car parking and manoeuvrability:

1. *The provided Traffic Impact Statement (TIS) is considered outdated. A revised TIS is required based on the current proposal.*
2. *The concept plan presented in the TIS is significantly different to that presented in the proposal plans.*
3. *Swept path analysis must be provided demonstrating that design vehicles entering and exiting the site from the proposed crossovers via Alumina Road and Zirconia Drive can be accommodated without conflict.*
4. *Plans must demonstrate compliance with AS2890, noting the following:*
   - *Areas used for vehicle turning movements have a minimum circulating roadway width of 5.5m between kerbs for two-way roadways;*
   - *Car parking bay dimensions should be shown; and*
   - *Provision for cars to turn around at the end of the visitor parking area such that they are able to drive out in forward gear.*
5. *The car parking calculation requires further clarity. There appears to be a discrepancy between the staff numbers shown in Table 1; Page 3 of the GHD report, and those used for the calculation in Table 4; page 7 of the GHD report.*

   Please clarify the total staff numbers on site at any one time and the rostering used to manage car parking during shifts and for shift change over. The minimum number of car parking bays provided on site should accommodate for the total number of staff on site at any one time, including peak periods for shift change over.
6. *The location of the boom gate and security gate on the Alumina Road entry/exit shall be revised so that a truck with multiple trailers can fit wholly within the site whilst waiting for the gate to open. Please also clarify the requirement for and operation of the boom gate and sliding gate.*
7. *Please confirm that Western Power have no objection to the access and fencing alignment proposed within the vicinity of the 'Switch Room' as shown on the plans.*

onemile**grid** has been requested by EcoGraf to prepare an addendum to the Transport Impact Statement prepared by i3 Consultants for the proposed development at Lot 2 Zirconia Drive, East Rockingham.

Existing Conditions

The subject site is labelled as Lot 2 Zirconia Drive, East Rockingham, and is located on the northwest corner of the Zirconia Drive / Alumina Road intersection as shown in Figure 1.

Figure 1 Site Location

Copyright OpenStreetMap

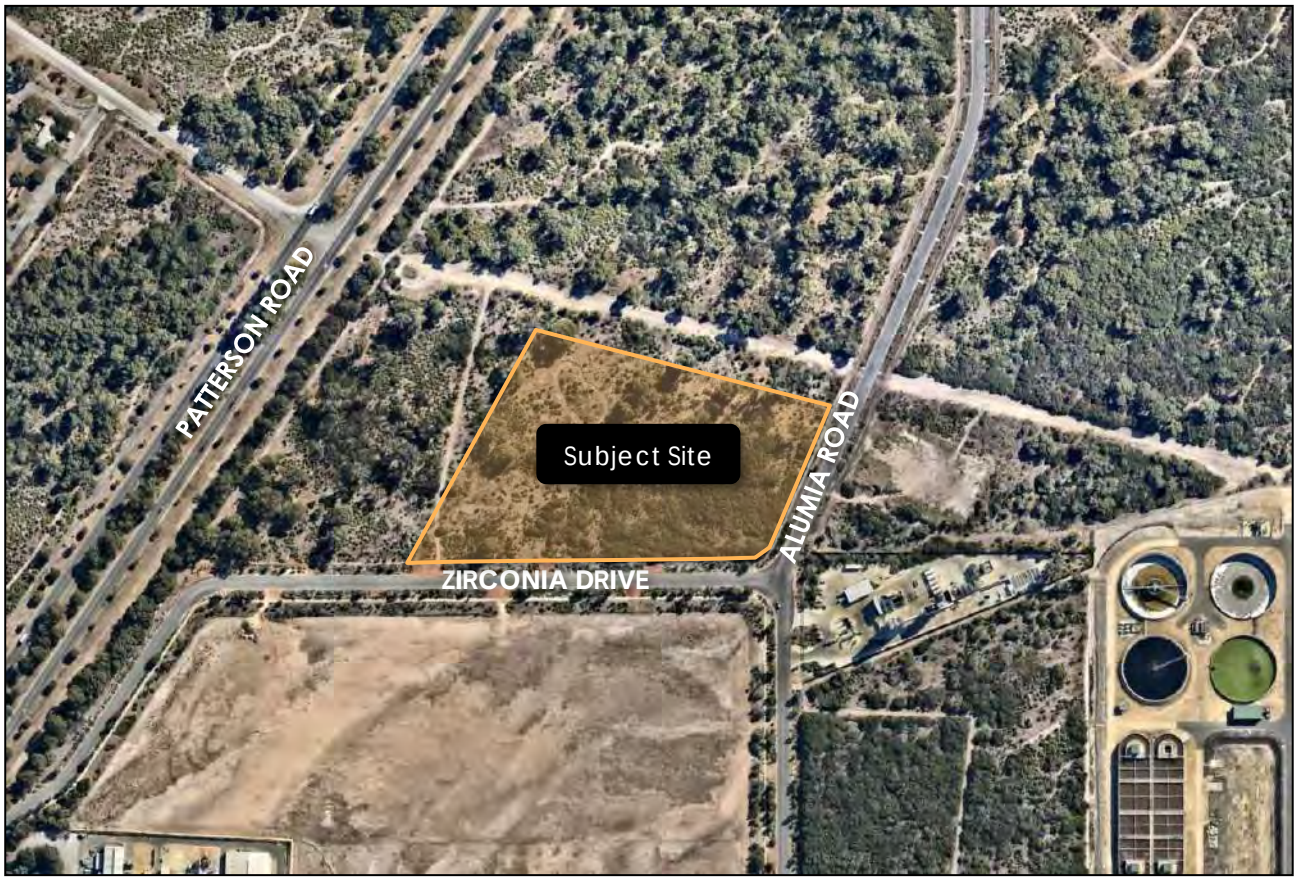
The site is irregular in shape with frontages to Zirconia Drive and Alumina Road along its southern and eastern boundaries respectively.

The site is currently largely vacant with a Western Power switch room located in the southwest corner of the site.

The site is located within the Rockingham Industry Zone and is situated within a Special Industry zone of the Rockingham Industry Design Framework.

An aerial view of the subject site is provided in Figure 2.

Figure 2 Site Context (5 April 2022)



Copyright Nearmap

Road Network

Zirconia Drive

Zirconia Drive is a local road, running from Alumina Road in the east and reconnecting to Alumina Road in the west. Zirconia Drive provides a two-way 10 metre wide carriageway adjacent to the site.

Alumina Road / Alloy Avenue

Alumina Road / Alloy Avenue is a local road, running from Patterson Road in the north and reconnecting to Patterson Road in the south. Alumina Road / Alloy Avenue provides a two-way 10 metre wide carriageway adjacent to the site.

The southern connection to Patterson Road is provided as a T-intersection with a staged median crossing (seagull intersection), while the northern connection has now been upgraded to a signalised cross-intersection.

Development Proposal

General

The proposed plans for the EcoGraf battery anode material facility have been updated, with the proposed layout shown in Figure 3.

The site will comprise of multiple buildings including the following:

- Site office (main entry)
- Micronising & Spheronising mills
- Purification plant
- Bagging plant
- Wastewater treatment plant
- Laboratory
- Workshop

The site will operate 24 hours a day, 7 days a week.

Based on the workforce numbers that were provided by EcoGraf, it is understood that the site will employ a total of 46 staff. The site will accommodate 16 staff during a standard shift operation (14 day-shift staff plus 2 shift staff contingent) with the number increasing to 30 during the shift change-over of the 14 day-shift staff.

Car Parking and Access

A total of 33 parking spaces are proposed to be provided within the site, including 30 staff spaces and three visitor spaces (including one accessible space). The parking area is accessed via a connection to Alumina Road.

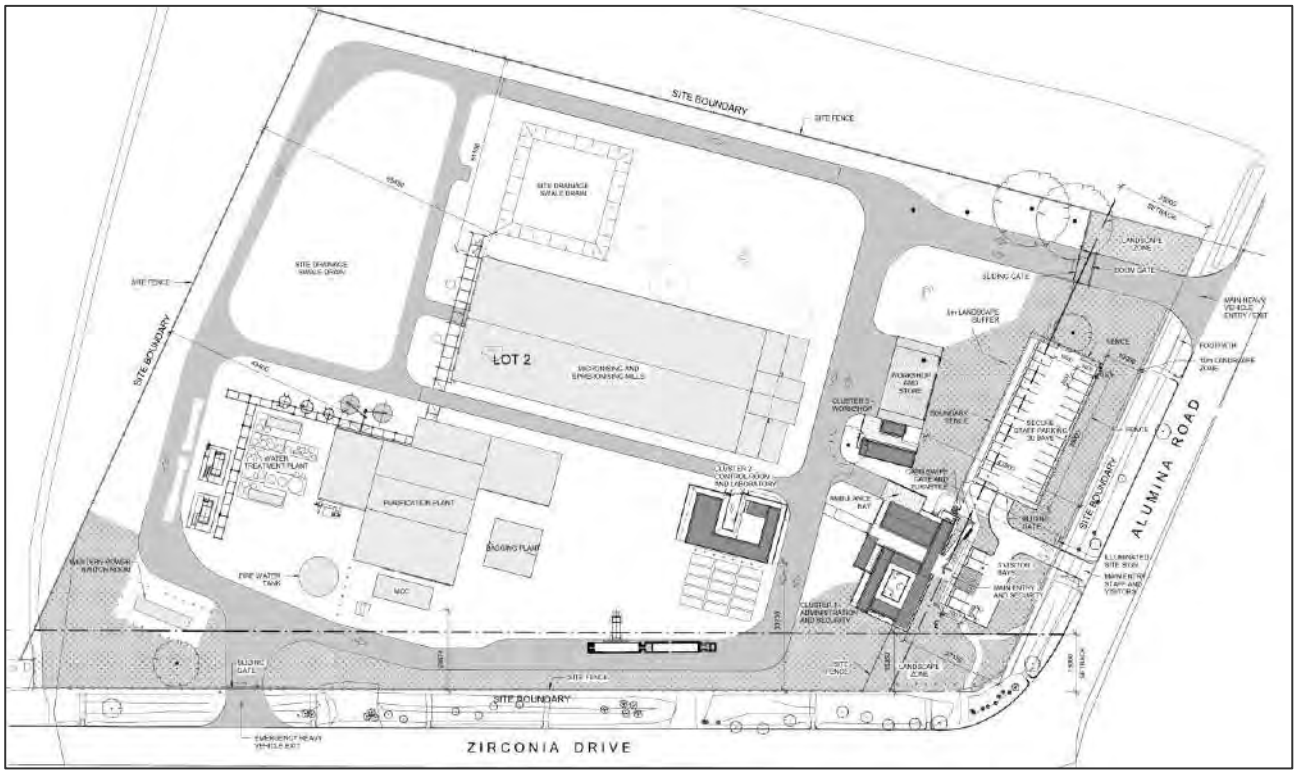
The northern portion of the parking area comprises of the 30 staff parking spaces, secured by a sliding gate. The southern portion of the parking area situated in front of the site office comprises of the three visitor spaces (including one accessible space).

Loading and Waste

The site is provided with an internal accessway network providing access throughout. Main heavy vehicle entry and exit will be provided via Alumina Road in the northeast corner of the site. An emergency heavy vehicle exit connection to Zirconia Drive is provided in the southeast portion of the site. The site is expected to accommodate loading vehicles up to 26m B-Double (BD).

Regarding waste, rear lift waste trucks will collect bins from along the centre road to the south of the micronising and spheronising mills. Additionally, a hooklift truck will collect 20 m³ bins from adjacent the water treatment plant.

Figure 3 Proposed Development Layout



Design Assessment

Accessways

The car parking accessway has been dimensioned with a minimum width of 5.5 metres in accordance with **Council comment 4** and is appropriate for two-way traffic flow. Regarding vehicle turnaround within the visitor parking area, vehicles can utilise the wide chevron marked shared area adjacent to the accessible bay to turnaround and exit in a forward direction in accordance with **Council comment 4**. Swept path diagrams have been prepared by **one**mile**grid** demonstrating access with a 99th percentile vehicle (B99).

The heavy vehicle entry/exit points have been designed to accommodate vehicles up to 26m B-Doubles (BD) in accordance with **Council comment 3**. Additionally, the internal accessway running around the perimeter of the site has been designed to accommodate 26m B-Doubles (BD), while the central portion of the site has been designed to accommodate loading/waste vehicles up to 10.8 metres long. Swept path diagrams have been prepared by **one**mile**grid** demonstrating access throughout the site with a 26m B-Double (BD) and a 10.8 metre loading vehicle.

Furthermore, the access gate has been repositioned so that 26m B-Doubles (BD) can fit wholly within the site whilst waiting for the gate to open in accordance with **Council comment 6**.

Car Parking Dimensions

Standard car spaces have been designed with a length of 5.6 metres a minimum width of 2.6 metres and are accessed from aisles of no less than 6.0 metres in accordance with the Australian Standard for Off-Street Car Parking AS2890.1.

The accessible bay is provided with a length of 5.6 metres and a width of 2.6 metres, and an adjacent shared area of the same length and an oversized width, accessed from aisles of no less than 6.0 metres in accordance with the Australian Standard for Off-Street Parking for People with Disabilities AS2890.6.

Car Parking Provision

Council comment 5 states the following regarding car parking provision:

> *The minimum number of car parking bays provided on site should accommodate for the total number of staff on site at any one time, including peak periods for shift change over.*

As noted in the Development Proposal section, based on total staff across each shift and accounting for shift turnovers, it is anticipated that the site will accommodate a maximum of 30 staff on site at one time. It is noted that this only occurs during the shift changeover period and at all other times, there will be no more than 16 staff on-site.

Assuming that each staff member drives themselves to the site, a car parking demand for 30 car spaces during the shift changeover period will result. It is noted that this is conservative as some staff may car pool, be dropped off etc.

It is proposed to provide 30 staff spaces on-site which will meet the projected maximum demand of 30 spaces. Additionally, three visitor spaces (including one accessible space) is proposed to be provided and is considered appropriate.

Traffic

Traffic Generation

Based on the previous TIS prepared by i3 Consultants (Section 6.1.4), the site was expected to accommodate approximately 12 trucks per day, equating to approximately 24 truck movements per day once fully constructed. The same heavy vehicle traffic generation rates have been adopted for the purposes of this assessment.

Regarding peak hour movements, it is estimated that 50% of the 33 car parking spaces will 'turnover' in the peak hours, while it is estimated that 10% of daily heavy vehicle movements will occur in the peak hours.

It is expected that waste will be collected outside of peak hour times.

Table 1 summarises the expected traffic generation in the peak hours based on empirical calculations.

Table 1 Empirical Traffic Volumes

Component	*Vehicle Type*	*Peak Hour Movements (AM and PM Peaks)*
Staff/Visitors	Cars	17
Trucks	Up to 26m B-Double (BD)	2
Total		**19**

Reviewing the volumes above, it is noted that a maximum of 19 vehicle movements per hour are expected across the peak hours, equivalent to less than one movement every three minutes. The traffic volumes generated by the proposed development are very low and are expected to be easily absorbed into the surrounding road network.

Patterson Road

As indicated in Section 8 of the TIS previously prepared by i3 Consultants, the functional one-way mid-block capacity of Patterson Road based on two lanes in each direction with a dual carriageway is 1,900 vehicles per hour.

Based on the latest data obtained from Mainroads Western Australia (Monday to Friday 2021/22), the one-way traffic volumes on Patterson Rd exceed 1,900 vehicles per hour between 4:00pm and 5:00pm for southbound traffic, as shown in Figure 4. i3 Consultants previously recommended that

the shift hours for the site are set to avoid generating traffic between the hours where southbound traffic on Patterson Road exceeds 1,900 vehicles per hour.

Therefore, **one**mile**grid** also reiterates i3 Consultants' recommendation to schedule shift change overs outside the hours of 4:00pm and 5:00pm on weekdays. Noting that a number of shifts are proposed, this is not considered to represent any operational difficulties.

Figure 4 Patterson Road Hourly Volumes south of Charles Street (Monday to Friday 2021/22)

mainroads WESTERN AUSTRALIA

SITE 1858

Hourly Volume

Patterson Rd (H002)

South of Charles St (SLK 24.93)

2021/22

Monday to Friday

	All Vehicles			Heavy Vehicles			
	NB	SB	Both	NB	SB	Both	%
00:00	40	52	92	2	2	4	4.3
01:00	40	35	75	2	2	4	5.3
02:00	41	31	72	2	3	5	6.9
03:00	136	38	174	3	5	8	4.6
04:00	512	108	620	11	12	23	3.7
05:00	1849	436	2285	50	41	91	4.0
06:00	1745	743	2488	74	90	164	6.6
07:00	1486	1194	2680	69	99	168	6.3
08:00	1093	1152	2245	73	119	192	8.6
09:00	856	839	1695	75	115	190	11.2
10:00	796	810	1606	77	115	192	12.0
11:00	841	866	1707	77	122	199	11.7
12:00	856	937	1793	79	116	195	10.9
13:00	854	974	1828	62	114	176	9.6
14:00	963	1468	2431	70	133	203	8.4
15:00	1175	1818	2993	61	151	212	7.1
16:00	1163	2196	3359	34	139	173	5.2
17:00	977	1672	2649	20	96	116	4.4
18:00	489	779	1268	9	39	48	3.8
19:00	314	386	700	7	20	27	3.9
20:00	235	271	506	3	12	15	3.0
21:00	183	230	413	5	9	14	3.4
22:00	104	171	275	1	4	5	1.8
23:00	57	91	148	2	4	6	4.1
TOTAL	16805	17297	34102	868	1562	2430	7.1

Peak Statistics

AM	TIME	05:15	07:30	07:00	11:30	10:45	10:45
	VOL	1952	1311	2680	81	126	203
PM	TIME	15:30	16:00	16:00	12:00	15:00	15:00
	VOL	1197	2196	3359	79	151	212

Truck Access Routes

i3 Consultants previously raised an issue in Section 13 of the report regarding the inability for heavy vehicles greater that 18.5 metres to wait in the median island (seagull intersection) when turning right out of Alumina Road without impeding other turning movements on Patterson Road. i3 Consultants recommended that vehicles exceeding 18 metres in length should be discouraged to turn right onto Patterson Road until such time as the new signalised Patterson Road / Charles Street intersection has been constructed to the north of the site.

Patterson Road / Charles Street intersection is now fully constructed, therefore, any heavy vehicles exceeding 18 metres in length will be advised to travel via this intersection.

There are subsequently no accessibility issues to and from the site for trucks.

Conclusions

It is proposed to develop the subject site for an EcoGraf battery anode material facility.

Considering the analysis presented above, it is concluded that:

- The proposed car parking and access design is considered appropriate;
- The proposed supply of car parking is appropriate for the proposed development;
- The anticipated traffic volumes generated by the development is not expected to have a substantial impact on the surrounding road network; and
- Council comments have been satisfied.

Please do not hesitate to contact the undersigned, or Yoshi Campitelli on (03) 9982 9728 or at yoshi.campitelli@onemilegrid.com.au, should you wish to discuss the above.

Yours sincerely

Valentine Gnanakone

Director

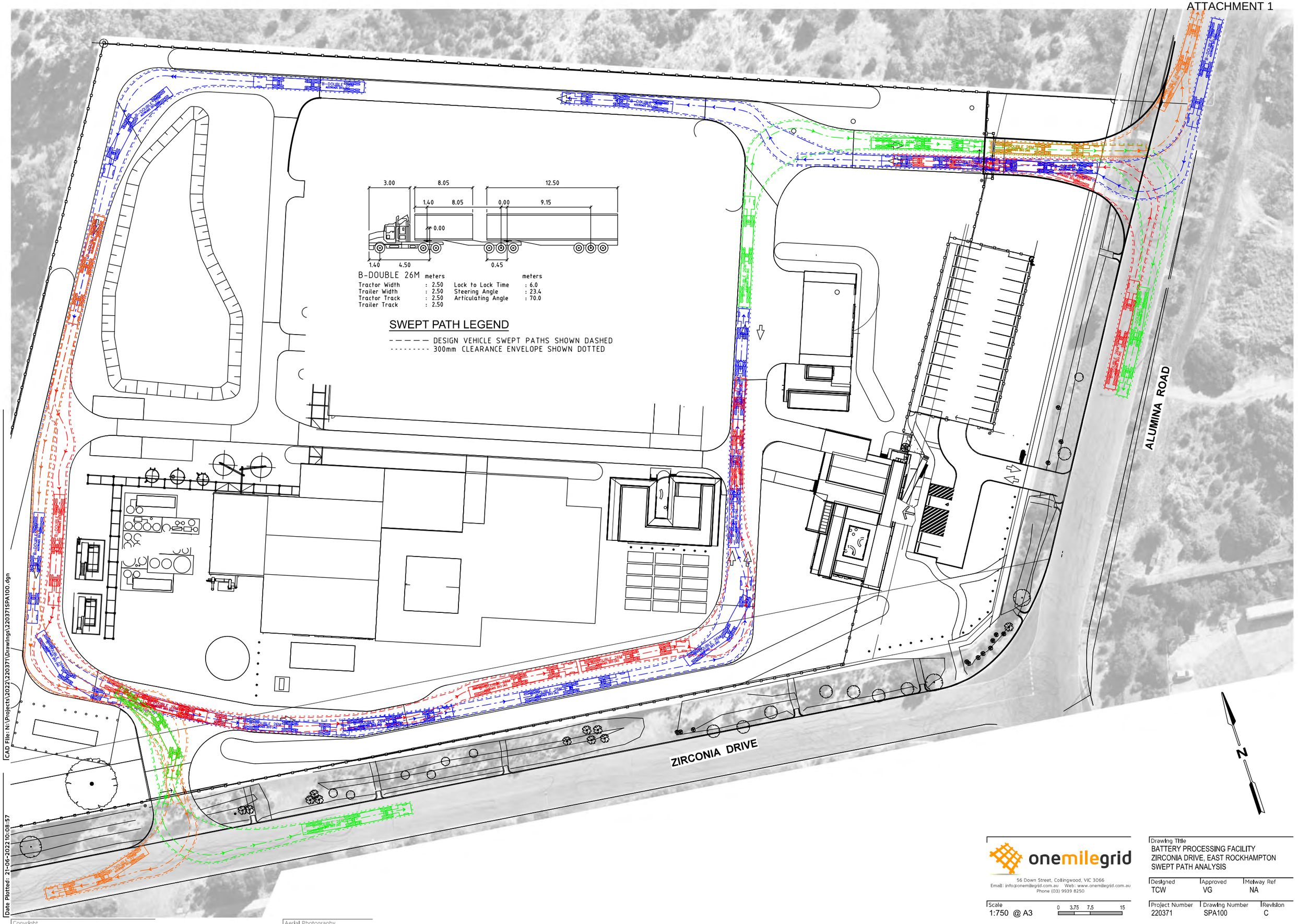
onemile**grid**

m: 0418 592 383
d: (03) 9982 9721
e: val.gnanakone@onemilegrid.com.au

P/R: Yoshi Campitelli/Valentine Gnanakone

att: Swept path diagrams

ATTACHMENT 1



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Date Plotted: 21-06-2022 10:08:57

Aerial Photography
Aerial photography provided by Nearmap

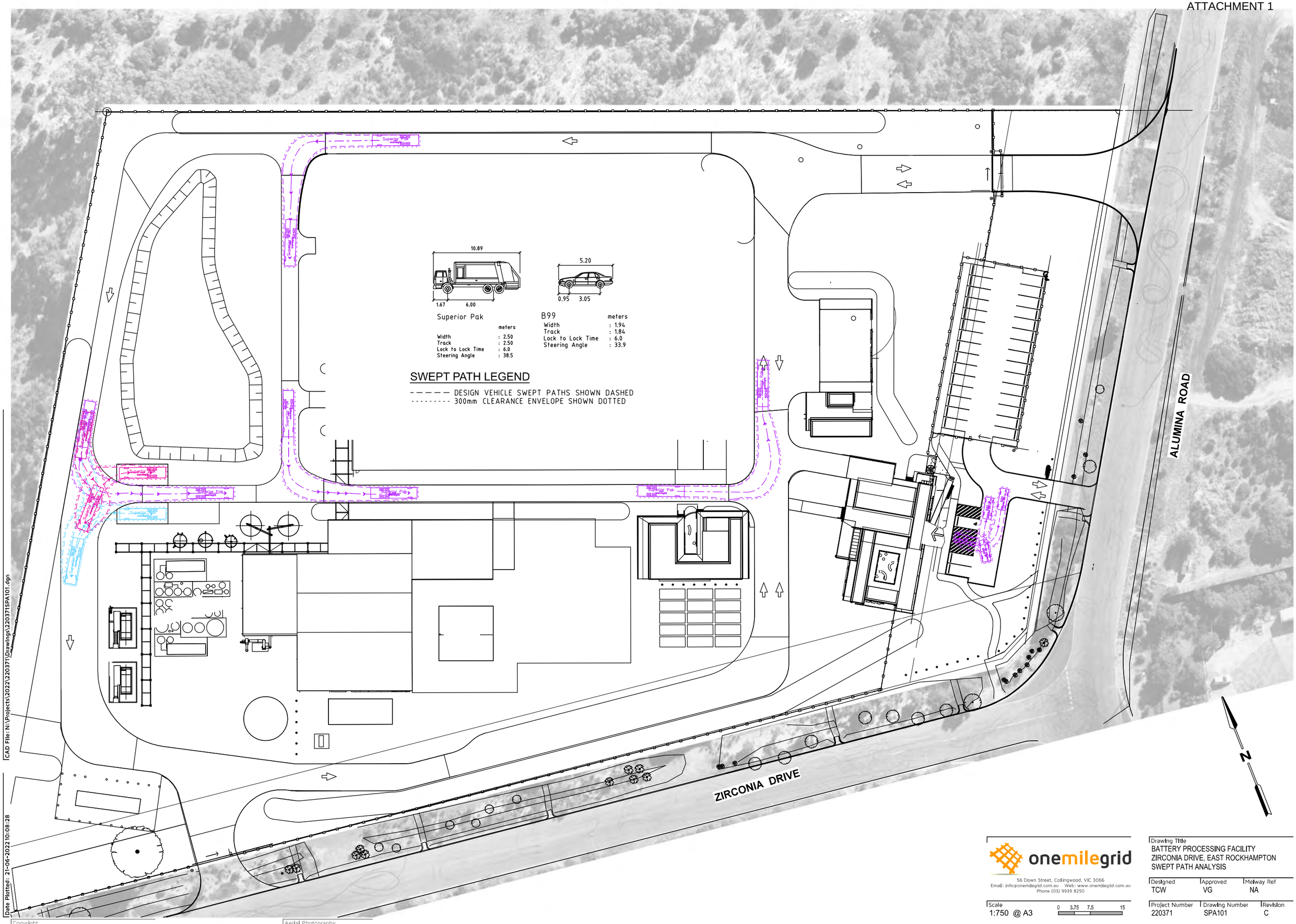
onemilegrid
56 Down Street, Collingwood, VIC 3066
Email: info@onemilegrid.com.au Web: www.onemilegrid.com.au
Phone (03) 9939 8250

Scale
1:750 @ A3
0 3.75 7.5 15

Drawing Title
BATTERY PROCESSING FACILITY
ZIRCONIA DRIVE, EAST ROCKHAMPTON
SWEPT PATH ANALYSIS

Designed	Approved	Melway Ref
TCW	VG	NA

Project Number	Drawing Number	Revision
220371	SPA100	C



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Aerial Photography
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Scale
1:750 @ A3
0 3.75 7.5 15

Drawing Title
BATTERY PROCESSING FACILITY
ZIRCONIA DRIVE, EAST ROCKHAMPTON
SWEPT PATH ANALYSIS

Designed	Approved	Melway Ref
TCW	VG	NA

Project Number	Drawing Number	Revision
220371	SPA101	C

Attachment 5

Bushfire Management Plan

Bushfire management plan/Statement addressing the Bushfire Protection Criteria coversheet

Site address: Lot 2 Zirconia Drive, East Rockingham

Site visit: Yes ☑ No ☐

Date of site visit (if applicable): Day 18th Month August Year 2021

Report author or reviewer: Ian Macleod

WA BPAD accreditation level (please circle):

Not accredited ☐ Level 1 BAL assessor ☐ Level 2 practitioner ☑ Level 3 practitioner ☐

If accredited please provide the following.

BPAD accreditation number: 39131 Accreditation expiry: Month November Year 2022

Bushfire management plan version number: 1.1

Bushfire management plan date: Day 25th Month January Year 2022

Client/business name: Ecograf

	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 bushfire protection criteria elements)?		✔

Is the proposal any of the following (see SPP 3.7 for definitions)?	Yes	No
Unavoidable development (in BAL-40 or BAL-FZ)		✔
Strategic planning proposal (including rezoning applications)		✔
High risk land-use		✔
Vulnerable land-use		✔

None of the above ☑

Note: Only if one (or more) of the above answers in the tables is yes should the decision maker (e.g. local government or the WAPC) refer the proposal to DFES for comment.

Why has it been given one of the above listed classifications (E.g. Considered vulnerable land-use as the development is for accommodation of the elderly, etc.)?

The information provided within this bushfire management plan to the best of my knowledge is true and correct:

Signature of report author or reviewer 

Date 25th January 2022

Bushfire Management Plan

Lot 2 Zirconia Drive, East Rockingham

City of Rockingham

Planning Stage:	Development Application
Planning Development Type:	Construction of Class 4 - 9 Buildings
Bushfire Policy – Specific Development or Use Type:	N/A

Job Number:	190466
Assessment Date:	18 August 2021
Report Date:	19 January 2022

BPP Group Pty Ltd t/a Bushfire Prone Planning
ACN: 39 166 551 784 | ABN: 39 166 551 784

Level 1, 159-161 James Street
Guildford WA 6055

PO Box 388
Guildford WA 6935

08 6477 1144 | admin@bushfireprone.com.au

DOCUMENT CONTROL

PREPARATION		
Author:	Ian Macleod (BPAD Level 2 - No. 39131)	Ian Macleod
Co-Author:	Select.	
Review/Authorise:	Kathy Nastov (BPAD Level 3 - No. 27794)	K. Nastov

VERSION HISTORY		
Version	**Version Details**	**Date**
1.0	Original Document Issue	19 January 2022
1.1	Revised site plan, mapping amended.	25 January 2022
1.2	Revised site plan, amend BMP to suit.	22 June 2022
BMP (Standard DA-Non-Tourism) Template v8.5		

DISTRIBUTION				
Destination	**Version**	**No. Copies**	**Hard Copy**	**Electronic Copy**
Person/Business: Shaun O'Neill/Ecograf **Email: soneill@ecograf.com.au**	1.2		☐	☒
Person/Business: **Email:**			☐	☐

TABLE OF CONTENTS

LIST OF FIGURES

EXECUTIVE SUMMARY

This Bushfire Management Plan is to accompany a Development Application for a Micronising, Spheronising and Purification Plant at Lot 2 Zirconia Drive, East Rockingham in the City of Rockingham. The proposal will be constructed wholly on Lot 2. However, there is scope to expand onto the neighbouring Lot 1 at a later date.

The assessments and bushfire protection measures detailed the BMP, assume that environmental approval will be achieved or clearing permit exemptions will apply. The whole of the subject lot is to be maintained to a low bushfire threat state. Substantial trees will be maintained where possible.

This proposal is compliant with the Acceptable Solutions of the Bushfire Protection Criteria.

The required bushfire protection measures can be achieved within the subject lot boundaries and will not affect the bushfire and environmental management of neighbouring lots.

The proposed development will provide an area of land within the lot that can be considered suitable for development as buildings within this area will be subject to BAL ratings of BAL-29 or lower. This meets the requirements established by Acceptable Solution A1.1 and its associated explanatory note.

Future buildings on the lot of the proposed development can be surrounded by an APZ that will ensure the potential radiant heat impact of a bushfire does not exceed 29 kW/m2 (BAL-29). The required APZ specifications of width, location and management can be achieved within the lot boundaries.

For this proposed development, the whole of the subject lot is to be managed and maintained to a low bushfire threat state in perpetuity.

Two different vehicular access/egress routes to two different destinations are available to the subject site. The routes are constructed public roads which are available to occupants of the site, and the public, at all times and under all weather conditions.

The proposed development has a looped internal driveway system for the main production area, with two different entry/exit locations. Proposed driveway widths range from 4 to 8 metres. A parking area for workers and visitors is separate to the main site access driveways and has an available turnaround area for fire appliances.

The subject lot will comply with the requirements of the local government annual firebreak notice issued under s33 of the Bush Fires Act 1954.

A reticulated water supply is available to the subject site Hydrants are located on Zirconia Drive and Alumina Road The nearest hydrant is located 28 metres from the subject site on the south side of Zirconia Drive.

Buildings of Class 4 to Class 9 are not required by the Building Code of Australia (BCA) to be constructed to comply with bushfire performance requirements. As the future buildings will be located in a bushfire prone area and may be subject to a bushfire attack, Bushfire Prone Planning recommends that some degree of upgrading be considered to improve the protection for occupants and the building's survivability. At a minimum protection from ember attack should be considered (i.e. constructed to the standard required for BAL-12.5).

1 PROPOSAL DETAILS

1.1 Description and Associated Plans and Maps

Proponent:	Ecograf
Bushfire Prone Planning Commissioned to Produce the Bushfire Management Plan (BMP) By:	Ecograf
For Submission To:	City of Rockingham
Purpose of the BMP:	To accompany a planning application
'Development' Site Total Area:	3.7711 hectares
Description of the Proposed Development/Use:	
This Bushfire Management Plan is to accompany a Development Application for a Micronising, Spheronising and Purification Plant at Lot 2 Zirconia Drive, East Rockingham in the City of Rockingham. The proposal will be constructed wholly on Lot 2. However, there is scope to expand onto the neighbouring Lot 1 at a later date.	

ATTACHMENT 1

Figure 1.1

Proposed Development Site Layout Map

Lot 2 on Plan 404186
Zirconia Drive
EAST ROCKINGHAM
CITY OF ROCKINGHAM

Id	Building Description
1	Micronising-Spheronising Plant
2	Purification Plant
3	Bagging Plant
4	Workshop-Store
5	Administration-Security
6	Control Room - Lab
7	MCC
8	Water Treatment

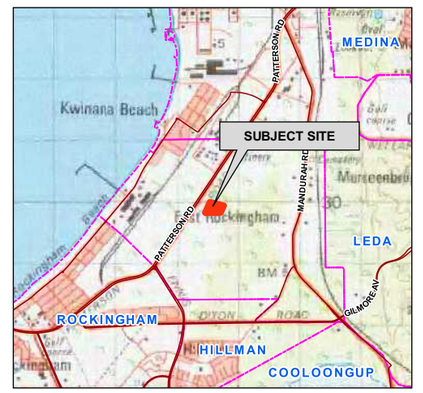
------ **LEGEND** ------

- Hydrant
- Fire Water Tank
- Structures
- Silo
- Container
- Western Power Switch Room
- Drainage Swale
- Managed Areas
- Landscape Areas
- Footpath
- Driveway
- Subject Lot
- Cadastre

0 10 20 30 40 50 60

Metres

------ **LOCALITY** ------



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Coordinate System: GDA 1994 MGA Zone 50
Projection: Universal Transverse Merctaor Units: Metre
Map by: Ian Macleod 22-06-2022
SCALE (A3): 1 : 1000

ATTACHMENT 1

Figure 1.2

Proposed Development Bushfire Prone Areas Map

Lot 2 on Plan 404186
Zirconia Drive
EAST ROCKINGHAM
CITY OF ROCKINGHAM

PORT RD
BEACH ST
PATTERSON RD
BUTCHER ST
MOUNSEY RD
GENTILE RD
KWINANA BEACH RD
CLAYMORE ST
OCEAN ST
WELLARD RD
OFFICE RD
ROCKINGHAM BEACH RD
CHARLES ST
WARD RD
MANDURAH RD
ZIRCONIA DR
ALUMINA RD
KENT ST
LEWINGTON ST
SMYTHE ST
JECKS ST
WANLISS ST
REGAN ST
TESLA RD
ENNIS AV
HURRELL WAY
MORGAN ST
DIXON RD
ROCKINGHAM SES
ROCKINGHAM CFRS/VFRS
CROMPTON RD
DAY RD
GILMORE AV
DOWLING ST
CALUME ST
SIMPSON AV
GODDARD ST
ASHFORD AV
MCNICHOLL ST
LEEUWIN PDE
READ ST
DARILE ST
MILINA ST
MANDURAH RD
Lake Cooloongup - White Lake

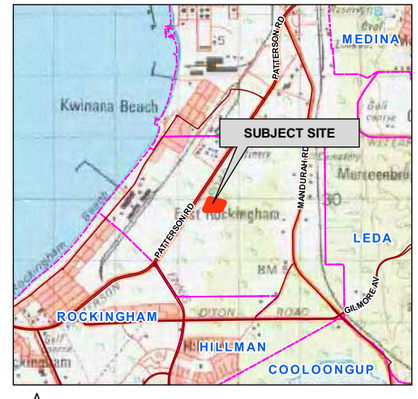
------ LEGEND ------

- DFES Stations
- Bush Fire Prone Areas 2021
- Subject Lot
- Cadastre

0 200 400 600 800 1,000 1,200

Metres

------ LOCALITY ------



AERIAL IMAGERY: Landgate/SLIP

BUSHFIRE PRONE PLANNING

Coordinate System: GDA 1994 MGA Zone 50
Projection: Universal Transverse Merctaor Units: Metre
Map by: Ian Macleod 21-06-2022
SCALE (A3): 1 : 20000

1.2 Existing Documentation Relevant to the Construction of this Plan

This section acknowledges any known reports or plans that have been prepared for previous planning stages, that refer to the subject area and that may or will impact upon the assessment of bushfire risk and/or the implementation of bushfire protection measures and will be referenced in this Bushfire Management Plan.

Table 2.1: Existing relevant documentation.

RELEVANT EXISTING DOCUMENTS		
Existing Document	Copy Provided by Client	Title
Structure Plan	N/A	
Environmental Report	No	
Landscaping (Revegetation) Plan	No	
Bushfire Risk Assessments	No	

2 ENVIRONMENTAL CONSIDERATIONS

2.1 Native Vegetation – Restrictions to Modification and/or Clearing

Many bushfire prone areas also have high biodiversity values. SPP 3.7 policy objective 5.4 recognises the need to consider bushfire risk management measures alongside environmental, biodiversity and conservation values (Guidelines s2.3).

There is a requirement to identify any need for onsite modification and/or clearing of native vegetation and whether this may trigger potential environmental impact/referral requirements under State and Federal environmental legislation. Confirmation that any proposed native vegetation modification and/or clearing is acceptable, should be received from the relevant agencies by the proponent and provided to the bushfire consultant for inclusion in the Bushfire Management Plan if it will influence the required bushfire planning assessments and outcomes. The following table details any potential environmental restrictions of which the author of this report is aware.

Table 2.2: Native vegetation and potential environmental considerations and restrictions.

NATIVE VEGETATION MODIFICATION / CLEARING - POTENTIAL ENVIRONMENTAL RESTRICTIONS IDENTIFIED				
Environmental Considerations / Features	Potential Mapping Data Source (SLIP / Local Planning)	Relevant to Proposed Development	Data Applied	Action Required
Onsite clearing of native vegetation is required.		Yes		
Environmental impact/referral requirements under State and Federal environmental legislation may be triggered.		Possible		
National Park / Nature Reserve	DBCA-011	No- Confirmed by Bushfire Consultant	Relevant Database Reviewed by Bushfire Consultant	None
Conservation Covenant	DPIRD-023	Not Known	Data Not Readily Available to Bushfire Consultant	Proponent to Seek Advice
Bush Forever Site	DPLH-019	No- Confirmed by Bushfire Consultant	Relevant Database Reviewed by Bushfire Consultant	None
RAMSAR Wetland	DBCA-010	Not Known	Data Not Readily Available to Bushfire Consultant	Proponent to Seek Advice
Geomorphic and Other Wetland	DBCA-011-019, 040, 043, 044	Not Known	Data Not Readily Available to Bushfire Consultant	Proponent to Seek Advice
Threatened and Priority Ecological Communities (TECs or PECs)	DBCA-038	Possible	Data Not Readily Available to Bushfire Consultant	Proponent to Seek Advice
Threatened and Priority Flora including Declared Rare Flora (DRFs)	DBCA-036	Possible	Data Not Readily Available to Bushfire Consultant	Proponent to Seek Advice
Land Identified as significant through a Local Biodiversity Strategy	LG - Intramaps	Not Known	Data Not Readily Available to Bushfire Consultant	Proponent to Seek Advice

Statement of how the identified environmental feature(s) is dealt with in this Bushfire Management Plan (and the location of relevant information):

The assessments and bushfire protection measures detailed the BMP, assume that environmental approval will be achieved or clearing permit exemptions will apply.

It is advised that the proponent seek further advice from an Environmental Consultant or the WA Department of Biodiversity Conservation and Attractions for further information on the condition and species contained within the proposed development area and the requirement for referral of the proposal.

Development Design Considerations

Establishing development in bushfire prone areas can adversely affect the retention of native vegetation through clearing associated with the creation of lots and/or asset protection zones. Where loss of vegetation is not acceptable or causes conflict with landscape or environmental objectives, it will be necessary to consider available design options to minimise the removal of native vegetation.

Table 2.3: Development design.

MINIMISE THE REMOVAL OF NATIVE VEGETATION	
Design Option	Assessment / Action
Reduction of lot yield	N/A
Cluster development	N/A
Construct building to a standard corresponding to a higher BAL as per BCA (AS 3959:2018 and/or NASH Standard)	N/A
Modify the development location	N/A
The whole of the subject lot is to be maintained to a low bushfire threat state. Substantial trees will be maintained where possible.	
IMPACT ON ADJOINING LAND	
Is this planning proposal able to implement the required bushfire protection measures within the boundaries of the land being developed so as not to impact on the bushfire and environmental management of neighbouring reserves, properties or conservation covenants?	Yes
The required bushfire protection measures can be achieved within the subject lot boundaries and will not affect the bushfire and environmental management of neighbouring lots.	

2.2 Retained Vegetation / Re-vegetation / Landscape Plans (including POS)

Riparian zones, wetland/foreshore buffers, road verges and public open space may have plans to re-vegetate or retain vegetation as part of the proposed development. Vegetation corridors may be created between offsite and onsite vegetation and provide a route for fire to enter a development area.

All retained/planned vegetation and its management will be considered in the development of this Bushfire Management Plan.

Is re-vegetation of riparian zones and/or wetland or foreshore buffers and/or public open space a part of this Proposal?	No
N/A	
Is the requirement for ongoing maintenance of existing vegetation in riparian zones and/or wetland or foreshore buffers and/or public open space a part of this Proposal?	No
N/A	
Has a landscape plan been developed for the proposed development?	No
N/A	

3 POTENTIAL BUSHFIRE IMPACT ASSESSMENT

3.1 Assessment Input

3.1.1 Fire Danger Index (FDI) Applied

AS 3959:2018 Table 2.1 specifies the fire danger index values to apply for different regions. The values used in the model calculations are for the Forest Fire Danger Index (FFDI) and for which equivalent representative values of the Grassland Fire Danger Index (GFDI) are applied as per Appendix B. The values can be modified if appropriately justified.

Table 3.1: Applied FDI Value

FDI VALUE			
Vegetation Areas	As per AS 3959:2018 Table 2.1	As per DFES for the Location	Value Applied
All Vegetation Areas	80	N/A	80

3.1.2 Vegetation Classification and Effective Slope

Classification: Bushfire prone vegetation identification and classification has been conducted in accordance with AS 3959:2018 s2.2.3 and the Visual Guide for Bushfire Risk Assessment in WA (DoP February 2016).

When more than one vegetation type is present, each type is identified separately, and the applied classification considers the potential bushfire intensity and behaviour from the vegetation types present and ensures the worst case scenario is accounted for – this may not be from the predominant vegetation type.

The vegetation structure has been assessed as it will be in its mature state (rather than what might be observed on the day). Areas of modified vegetation are assessed as they will be in their natural unmodified state (unless maintained in a permanently low threat, minimal fuel condition, satisfying AS 3959:2018 s2.2.3.2(f) and asset protection zone standards). Vegetation destroyed or damaged by a bushfire or other natural disaster has been assessed on its revegetated mature state.

Effective Slope: Refers to the ground slope under each area of classified vegetation and is described in the direction relative to the view from the building or proposed development site. Effective slope is not the same as 'average slope', rather it is the slope which most significantly influences fire behaviour. This slope has a direct and significant influence on a bushfire's rate of spread and intensity.

Where there is a significant change in effective slope under an area of classified vegetation, that will cause a change in fire behaviour, separate vegetation areas will be identified to enable the correct assessment.

When the effective slope, under a given area of bushfire prone vegetation, will be different relative to multiple proposed development sites, then the effective slopes corresponding to the different locations, are separately identified.

Table 3.2: Vegetation classification and effective slope.

ALL VEGETATION WITHIN 150 METRES OF THE PROPOSED DEVELOPMENT				
Vegetation Area	Identified Vegetation Types [1] or Description if 'Excluded'	Applied Vegetation Classification [1]	Effective Slope (degrees)[2] (AS 3959:2018 Method 1)	
			Assessed	Applied Range
1	Closed scrub D-13 Open scrub D-14	Class D Scrub	0	upslope or flat
2	Closed scrub D-13 Open scrub D-14	Class D Scrub	0	upslope or flat
3	Open forest A-03	Class A Forest	0	upslope or flat
4	Open scrub D-14	Class D Scrub	0	upslope or flat
5	Tussock grassland G-22	Class G Grassland	0	upslope or flat
6	Open scrub D-14	Class D Scrub	0	upslope or flat
7	Open heath C-11	Class C Shrubland	0	upslope or flat
8	Non-vegetated areas	Excluded as per Section 2.2.3.2 (e) Non Vegetated Areas	N/A	N/A
Representative photos of each vegetation area, descriptions and classification justification, are presented on the following pages. The areas of classified vegetation are defined, and the photo locations identified on Figure 3.1, the vegetation and topography map.				
Note[1]: Described and classified as per AS 3959:2018 Table 2.3 and Figures 2.3 and 2.4 (A)-(H) Note[2]: Effective slope measured as per AS 3959:2018 Section 2.2.5 and Appendix B Part B4				

VEGETATION AREA 1		
AS 3959:2018 Vegetation Classification Applied:	Class D Scrub	
Vegetation Types Present:	Closed scrub D-13	Open scrub D-14
Description/Justification:	Photos 1a and 1b: Coastal scrub to 3 metres tall, grass trees, grass understorey. Photo 1c: In background, thick scrub to 4 metres tall.	

Photo ID: 1a

Photo ID: 1b

Photo ID: 1c

VEGETATION AREA 2		
AS 3959:2018 Vegetation Classification Applied:	Class D Scrub	
Vegetation Types Present:	Closed scrub D-13	Open scrub D-14
Description/Justification:	Photos 2a and 2b: In background, closed scrub 4 to 6 metres tall, grass understorey. Photos 2c to 2f: Open scrub and grass trees to 3 metres tall, grass understorey.	

Photo ID: 2a

Photo ID: 2b

Photo ID: 2c

Photo ID: 2d

Photo ID: 2e

Photo ID: 2f

VEGETATION AREA 2	
AS 3959:2018 Vegetation Classification Applied:	Class D Scrub
Vegetation Types Present:	Open scrub D-14
Description/Justification:	Open scrub to 4 metres tall, grass trees, grass understorey.

Photo ID: 2g

VEGETATION AREA 3	
AS 3959:2018 Vegetation Classification Applied:	Class A Forest
Vegetation Types Present:	Open forest A-03
Description/Justification:	Photo 3a: Tuarts, open scrub, grass trees, grass understorey. Photo 3b: Along road reserve. Eucalypts to 12 metres, scrub and shrubs, grass understorey.

Photo ID: 3a	Photo ID: 3b

VEGETATION AREA 3	
AS 3959:2018 Vegetation Classification Applied:	Class A Forest
Vegetation Types Present:	Closed scrub D-13
Description/Justification:	Photos 3c to 3g: Tuarts, open scrub, grass trees, grass understorey.

Photo ID: 3c

Photo ID: 3d

Photo ID: 3e

Photo ID: 3f

Photo ID: 3g

VEGETATION AREA 4	
AS 3959:2018 Vegetation Classification Applied:	Class D Scrub
Vegetation Types Present:	Open scrub D-14
Description/Justification:	Open scrub to 3 metres tall, grass trees, grass understorey.

Photo ID: 4a

Photo ID: 4b

VEGETATION AREA 5	
AS 3959:2018 Vegetation Classification Applied:	Class G Grassland
Vegetation Types Present:	Tussock grassland G-22
Description/Justification:	Recently cleared area, grass regrowth, assessed in mature state as grassland.

Photo ID: 5a

Photo ID: 5b

VEGETATION AREA 5	
AS 3959:2018 Vegetation Classification Applied:	Class G Grassland
Vegetation Types Present:	Tussock grassland G-22
Description/Justification:	Vacant lot, grass regrowth. Assessed in mature state as grassland.

Photo ID: 5c

VEGETATION AREA 6	
AS 3959:2018 Vegetation Classification Applied:	Class D Scrub
Vegetation Types Present:	Open scrub D-14
Description/Justification:	Along road verges. Revegetated with shrubs and scrub. Occasional well spaced tree.

Photo ID: 6a

Photo ID: 6b

VEGETATION AREA 6	
AS 3959:2018 Vegetation Classification Applied:	Class D Scrub
Vegetation Types Present:	Open scrub D-14
Description/Justification:	Along road verges. Revegetated with shrubs and scrub. Occasional well spaced tree.

Photo ID: 6c

VEGETATION AREA 7	
AS 3959:2018 Vegetation Classification Applied:	Class C Shrubland
Vegetation Types Present:	Open heath C-11
Description/Justification:	Along road verges. Grass trees, sedges and low shrubs.

Photo ID: 7a

Photo ID: 7b

VEGETATION AREA 8	
AS 3959:2018 Vegetation Classification Applied:	Excluded as per Section 2.2.3.2 (e) Non Vegetated Areas
Vegetation Types Present:	No vegetation present
Description/Justification:	Limestone tracks and bitumen roads.

Photo ID: 8a

Photo ID: 8b

Photo ID: 8c

ATTACHMENT 1

Figure 3.1

Existing Topography & Classified Vegetation Map

Lot 2 on Plan 404186
Zirconia Drive
EAST ROCKINGHAM
CITY OF ROCKINGHAM

Vegetation Area	Vegetation Class	Vegetation Type	Effective Slope
1	D	Scrub	0
2	D	Scrub	0
3	A	Forest	0
4	D	Scrub	0
5	G	Grassland	0
6	D	Scrub	0
7	C	Shrubland	0
8	Ex	Exempt	

------ LEGEND ------

- Photos
- Elevation (m)
- Subject Lot
- 150 Assessment Area
- Cadastre

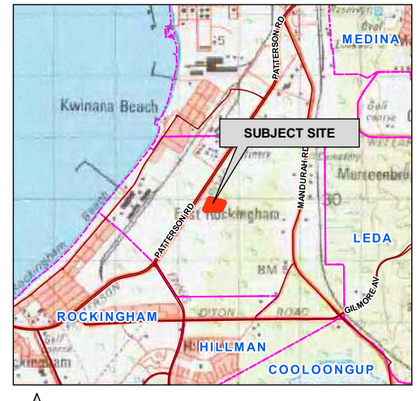
Classified Vegetation

- Class A - Forest
- Class C - Shrubland
- Class D - Scrub
- Class G - Grassland
- Exclusion 2.2.3.2

0 20 40 60 80 100 120

Metres

------ LOCALITY ------



AERIAL IMAGERY: Landgate/SLIP

BUSHFIRE PRONE PLANNING

Coordinate System: GDA 1994 MGA Zone 50
Projection: Universal Transverse Merctaor Units: Metre
Map by: Ian Macleod 20-12-2021
SCALE (A3): 1 : 2000

3.1.3 Vegetation Separation Distance

The vegetation separation distance is the horizontal distance measured from the relevant parts of an existing building or a future building's planned location (within a lot), to the determined edge of an area of classified vegetation.

This separation distance applied to determining a Bushfire Attack Level (BAL) can be either:

- The *measured distance* – for which the location of the building relative to the edge of classified vegetation must be known. This will result in single determined BAL that will apply to a building. (The measured distance is a required calculation input); or
- A *calculated minimum and maximum distance (range)* that will correspond to each individual BAL. The calculated distances provide an indicative (or achievable) BAL for which the determined BAL will be dependent on the known location of the building relative to the edge of classified vegetation.

  The calculated range of distances corresponding to each BAL can be presented in different formats (tables or a BAL contour map), dependent on the form of information that is most appropriate for the proposed development/use. These distance ranges corresponding to BAL(s) will be presented in Section 3.2: 'Assessment Output".

For the proposed development/use, the applicable vegetation separation distances will be presented within the Bushfire Management Plan in this location:	In Section 3.2 'Assessment Output' as a table containing the calculated ranges of distance corresponding to each BAL and illustrated as a BAL Contour Map.

3.2 Assessment Output

UNDERSTANDING THE RESULTS OF THE BUSHFIRE IMPACT ASSESSMENT

Bushfire Attack Levels (BALs) – Their Application in the Building Environment is Different to the Planning Environment

In the building environment, a ***determined BAL*** is required for the proposed construction at the building application stage. This is to inform approval considerations and establish the bushfire construction standards that are to apply. An indicative BAL is not acceptable for a building application.

In the planning environment, through the application of SPP 3.7 and associated Guidelines, the deemed to satisfy requirement for a proposed 'development site' or sites (defined by the LPS Amendment Regulations 2015 as "that part of a lot on which a building that is the subject of development stands or is to be constructed"), is that a BAL-29 or lower rating can be achieved once all works associated with the proposal are completed. For planning approval purposes, an ***indicative BAL*** can provide the required information.

Determined Bushfire Attack Level

A determined BAL is to apply to an existing building or the 'development site' on which the building is to be constructed and not to a lot or building envelope. Its purpose is to state the potential radiant heat flux to which the building will be exposed, thereby determining the construction standard to be applied.

A determined BAL cannot be given for a future building whose design and position on the lot are unknown or the vegetation separation distance has not been established. It is not until these variables have been fixed that a determined BAL can be stated, and a BAL Certificate can be issued.

The one exception is when a building ***of any dimension*** can be ***positioned anywhere*** on a proposed lot (within R-Code building setbacks) or within a defined building envelope, and always remain subject to the same BAL, regardless of the retention of any existing classified vegetation either onsite or offsite.

Indicative Bushfire Attack Level

If a BAL is not able to achieve 'determined' status it will be an indicative BAL. It indicates the BAL that can be achieved by the proposed development/use. However, it is conditional upon an assessment variable(s) being confirmed at a later stage (e.g. the building location is established/changed, or vegetation is modified/removed to establish the vegetation separation distance).

A BAL certificate cannot be issued for an indicative BAL – unless that BAL cannot vary (refer to 'Determined BAL' above).

In table form, a single or a range of indicative BAL(s) may be presented. If a single indicative BAL is stated for a defined area (i.e. the lot or building envelope), this will be the highest indicative BAL impacting the defined area.

In BAL contour map form (refer to Section 3.2.1), the illustrated BAL contours visually identify areas of land for which if any part of an existing or proposed building is located on that land and within the BAL contours, then the highest BAL affecting that building (or part of the land on which the building will be constructed), will be the indicative BAL that is to apply.

The BAL can only become a determined BAL once the actual location of that building on the land is known and/or the required minimum vegetation separation distance corresponding to the relevant BAL contour is established (refer to Table 3.3).

3.2.1 Bushfire Attack Level Results - BAL Contour Map Format

INTERPRETATION OF THE BUSHFIRE ATTACK LEVEL (BAL) CONTOUR MAP

The contour map will present different coloured contour intervals extending from the areas of classified bushfire prone vegetation. These represent the different bushfire attack levels that will exist at varying distances away from the classified vegetation in the event of a bushfire in that vegetation.

The areas of classified vegetation to be considered in developing the BAL contours, are those that will remain as the intended end state of the subject development once earthworks, clearing and/or landscaping and re-vegetation have been completed (or each stage completed).

Each bushfire attack level corresponds to a set range of radiant heat flux that is generated by a bushfire. That range is defined by the AS 3959:2018 BAL determination methodology.

The width of each shaded BAL contour is a diagrammatic representation of the separation distances from the classified vegetation that correspond to each BAL for each separately identified area of classified vegetation. They have been calculated by the application of the unique site variables including vegetation types and structure, ground slope and applied fire weather.

(Refer to Section 3.2 'Understanding the Results of the Bushfire Impact Assessment' for the explanation of how BAL(s) for buildings will be assessed from the BAL Contour Map).

Construction of the BAL Contours

VEGETATION AREAS APPLIED TO THE DEVELOPMENT OF THE BAL CONTOUR MAP

All identified areas of classified vegetation have been applied with the following exceptions:

1. For Figure 3.2, all classified vegetation within the existing lot 2 is excluded and the BAL contours are constructed into the lot from any classified vegetation outside the boundaries of Lot 2.

This approach is applied to indicate the achievable bushfire attack levels within the specified lot and the resultant area of developable land (i.e. subject to BAL-29 or less). It is based on the following assumptions:

1. Any classified vegetation within the subject lot will be managed by the landowner to meet asset protection zone standards.

VEGETATION SEPARATION DISTANCES APPLIED

The distances that have been applied to illustrating the width of each BAL contour shown in Figure 3.2 are stated in Table 3.3. These correspond to each Bushfire Attack Level and are specific to the proposed development site.

Table 3.3: Vegetation separation distances applied to construct the BAL contours.

BAL CONTOUR MAP – APPLIED VEGETATION SEPARATION DISTANCES								
Derived from the Application of Method 1 BAL Determination Methodology (AS 3959:2018 Section 2, Table 2.5)[1]								
Vegetation Area	Vegetation Classification	Effective Slope (degree range)	BAL and Corresponding Separation Distance (m)					
			BAL-FZ	BAL-40	BAL-29	BAL-19	BAL12.5	BAL-LOW
1	Class D Scrub	upslope or flat	<10	10-<13	13-<19	19-<27	27-<100	>100
2	Class D Scrub	upslope or flat	<10	10-<13	13-<19	19-<27	27-<100	>100
3	Class A Forest	upslope or flat	<16	16-<21	21-<31	31-<42	42-<100	>100
4	Class D Scrub	upslope or flat	<10	10-<13	13-<19	19-<27	27-<100	>100
5	Class G Grassland	upslope or flat	<6	6-<8	8-<12	12-<17	17-<50	>50
6	Class D Scrub	upslope or flat	<10	10-<13	13-<19	19-<27	27-<100	>100
7	Class C Shrubland	upslope or flat	<7	7-<9	9-<13	13-<19	19-<100	>100
Note[1] All the assessment inputs applied are presented in Section 3.1.								

Id	Name
1	Micronising-Spheronising Plant
2	Purification Plant
3	Bagging Plant
4	Workshop-Store
5	Administration-Security
6	Control Room - Lab
7	MCC
8	Water Treatment

Vegetation Area	Vegetation Class	Vegetation Type	Effective Slope
1	D	Scrub	0
2	D	Scrub	0
3	A	Forest	0
4	D	Scrub	0
5	G	Grassland	0
6	D	Scrub	0
7	C	Shrubland	0

Figure 3.2

Proposed Development BAL Contour Map

Lot 2 on Plan 404186
Zirconia Drive
EAST ROCKINGHAM
CITY OF ROCKINGHAM

ZIRCONIA DR
ALUMINA RD
PATTERSON RD

AREA 1
AREA 2
AREA 3
AREA 4
AREA 5
AREA 6
AREA 7

1 2 3 4 5 6 7 8

H

------ LEGEND ------

- Hydrant
- Fire Water Tank
- Structures
- Silo Legend
- Container
- Western Power Switch Room
- Driveway
- Asset Protection Zone
- Subject Lot
- 100m BAL Buffer
- Cadastre

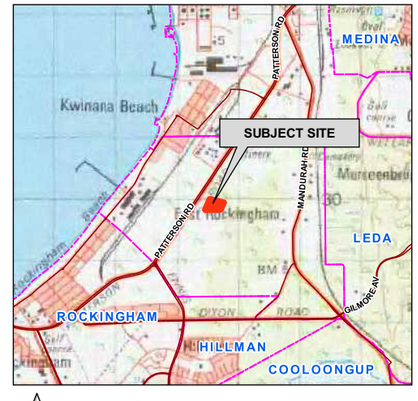
Bushfire Attack Levels

- BAL-FZ
- BAL-40
- BAL-29
- BAL-19
- BAL-12.5

0 20 40 60 80 100 120

Metres

------ LOCALITY ------



AERIAL IMAGERY: Landgate/SLIP

Coordinate System: GDA 1994 MGA Zone 50
Projection: Universal Transverse Merctaor Units: Metre
Map by: Ian Macleod 22-06-2022
SCALE (A3): 1 : 1800

BUSHFIRE PRONE PLANNING

3.2.2 Bushfire Attack Level Results - Derived from The BAL Contour Map

Table 3.4: Indicative BAL(s) for proposed building works.

BUSHFIRE ATTACK LEVEL FOR PLANNED BUILDINGS/STRUCTURES	
BAL Determination Methodology Applied[1]	Method 1 as per AS 3959:2018 s2.2.6 and Table 2.5.
Building/Structure Description (planned)	Indicative BAL (refer to start of s3.2)
1. Micronising - Spheronising Plant	**BAL-12.5**
2. Purification Plant	**BAL-12.5**
3. Bagging Plant	**BAL-12.5**
4. Workshop - Store	**BAL-12.5**
5. Administration - Security	**BAL-29**
6. Control Room - Laboratory	**BAL-12.5**
7. MCC	**BAL-19**
8. Water Treatment	**BAL-12.5**
Silos	**BAL-12.5**
Containers	**BAL-19**
Western Power Switch Room	**BAL-29**
Fire Water Tank	**BAL-19**
Note[1] Assessment inputs applied are presented in Section 3.1.	

4 IDENTIFICATION OF BUSHFIRE HAZARD ISSUES

In response to the Bushfire Management Plan requirements established by Appendix 5 of the Guidelines for Planning in Bushfire Prone Areas (WAPC 2017 v1.3), the following statements are made to assist in the understanding of whether the proposal is likely to be able to comply with the bushfire protection criteria now or in subsequent planning stages.

Spatial Context - Broader Landscape Considerations	
Wider road network and access constraints	Arterial roads are located nearby to the proposed development site providing access and egress in multiple directions. At a more local level Zirconia Drive and Alumina Road provide access and egress in two different directions from the subject lot. There is no access constraint for the subject site with regards to what is considered acceptable from a planning perspective.
Proximity of settlements and emergency services	The subject site is part of a large area of industrial allotments. The Rockingham townsite is approximately 2km from the subject site. Emergency services are located in Rockingham (3km by road) and in Kwinana (10km by road).
Bushfire prone vegetation types and extent (including conserved vegetation)	Large areas of bushfire prone vegetation exist across the broader landscape as retained native vegetation but interspersed with cleared and/or developed industrial lots. Vegetation types range from forest to scrub, shrub and grassland. The site would not be subject to large fire runs or landscape type bushfires due to developed industrial and residential lots creating a fragmented distribution of vegetation.
Topography and fire behaviour interactions.	The topography on and surrounding the subject lot is flat and will not increase bushfire rates of spread and intensity.
Potential for extreme fire behaviour and pyro convective events.	Unlikely due to fragmented vegetation and flat topography surrounding the site.
Environmental Considerations	
Constraints to implementing required and/or additional bushfire protection measures	The environment considerations as stated in Section 2 of this BMP are unlikely to affect the implementation of the required bushfire protection measures.
Provision of Access Within the Subject Site	
Potential constraints	No constraints to establishing the required access within the subject site will exist.
Potential Bushfire Impacts	
Flame and radiant heat and ability to establish an APZ	The proposed lot sizes will allow a suitable APZ to be established within the lot. This will prevent flame contact to the proposed buildings from the classified vegetation. Application of bushfire construction standards will mitigate the risks from radiant heat impact to what is considered an acceptable level.
Embers/firebrands, smoke and fire-driven wind	These will be the major impacts to the subject site. The appropriate protection measures of building construction and strict management of the APZ will mitigate the risk to what is considered an acceptable level.

5 ASSESSMENT AGAINST THE BUSHFIRE PROTECTION CRITERIA ESTABLISHED BY THE GUIDELINES

For a development application that is not a 'Tourism Land Use' to be considered compliant with SPP 3.7, it must satisfy (achieve) the intent of each of the four elements of the bushfire protection criteria. These criteria are established by the *Guidelines for Planning in Bushfire Prone Areas WAPC 2017 v1.3*). Compliance can be achieved by either:

- Meeting all applicable acceptable solutions corresponding to each element (i.e. the minimum bushfire protection measures that are deemed to satisfy planning requirements); or
- Where an acceptable solution cannot be met, by developing a performance solution that satisfies the established requirements.

5.1 Local Government Variations to Apply

Local governments may add to or modify the acceptable solutions of the Bushfire Protection Criteria (BPC) and/or apply technical requirements that vary from those specified in the Guidelines for Planning in Bushfire Prone Areas (WAPC). In such instances, this Proposal will be assessed against these variations and/or any specific local government technical requirements for emergency access and water. Refer to Appendices 2 and 3 for relevant technical requirements.

Will local or regional variations (endorsed by WAPC / DFES) to the applicable acceptable solutions established by the *Guidelines* or the *Position Statement: Tourism land uses in bushfire prone areas WAPC October 2019,* apply to this Proposal?	N/A

5.2 Summary of Assessment Against the Bushfire Protection Criteria

SUMMARISED OUTCOME OF THE ASSESSMENT AGAINST THE BUSHFIRE PROTECTION CRITERIA					
Element of the Bushfire Protection Criteria	Basis for the Proposal Achieving Full Compliance with SPP 3.7			The Proposal Cannot Achieve Full Compliance with SPP 3.7	
	Acceptable Solutions Met		Achieves the Intent of the Element		
	All applicable solutions are fully met	All applicable solutions are not fully met. A merit based assessment and/or a bushfire performance comparison of the proposals residual risk with that of the residual risk of the acceptable solution is conducted (refer Note 4)	A performance principle-based solution is applied	Bushfire planning development type that may not require full compliance is applied	An improvement in bushfire performance compared to the existing development is detailed (refer Note 4)
1. Location	✓			N/A	
2. Siting and Design of Development	✓				
3. Vehicular Access	✓				
4. Water	✓				

Note: The development proposal has been assessed:

1. Against the requirements established in Appendix 4 of the *Guidelines for Planning in Bushfire Prone Areas, WAPC 2017 v1.3 (Guidelines)*. The Guidelines are found at https://www.planning.wa.gov.au/8194.aspx; and
2. Applying the interpretation guidance provided in *Position Statement: Planning in bushfire prone areas – Demonstrating Element 1: Location and Element 2: Siting and design (WAPC Nov 2019)*.
3. Applying any endorsed variations to the Guideline's acceptable solutions and associated technical requirements that have been established by the local government. If known and applicable these have been stated in Section 5.1 with the detail included as an appendix if required by the local government.
4. When non-compliant with SPP 3.7 and when appropriate, by utilising additional compliance pathways that include the application of merit based assessment and comparative bushfire performance. The validity of this approach is derived from relevant decisions made by the responsible authorities (refer Appendix 2).

5.3 Assessment Detail

Element 1: Location	
Intent: To ensure that strategic planning proposals, subdivision and development applications are located in areas with the least possible risk of bushfire to facilitate the protection of people, property and infrastructure.	
Compliance: How the proposed development achieves the intent of Element 1:	By fully meeting all applicable acceptable solutions established by the bushfire protection criteria (Guidelines v1.3 WAPC 2017)

ASSESSMENT (COMPLIANCE) STATEMENTS

For each applicable acceptable solution, the following statements present the results of the assessment of the proposed development/use against the requirements established by the *Guidelines (WAPC 2017 v1.3)* and apply the interpretation guidance established by the *Position Statement: Planning in bushfire prone areas – Demonstrating Element 1: Location and Element 2: Siting and design (WAPC Nov 2019)*.

Acceptable Solution: A1.1: Development Location

ASSESSMENT AGAINST THE REQUIREMENTS ESTABLISHED BY THE GUIDELINES

The proposed development will provide an area of land within the lot that can be considered suitable for development as buildings within this area will be subject to BAL ratings of BAL-29 or lower. This meets the requirements established by Acceptable Solution A1.1 and its associated explanatory note.

ASSESSMENT AGAINST THE REQUIREMENTS ESTABLISHED BY THE POSITION STATEMENT

The position statement establishes that:

- The source of risk (the hazard) to be considered in Element 1 is the "level of bushfire exposure" from the type and extent of bushfire prone vegetation and the topography of the land on which it exists; and
- "Consideration should be given to the site context" which includes the land both "within and adjoining the subject site". The "hazards remaining within the site should not be considered in isolation of the hazards adjoining the site, as the potential impact of a bushfire will be dependent on the wider risk context."

The position statement also recognises:

- That the proposed development site and its surrounding land may be part of an area "identified for development or intensification of land use prior to the release of SPP 3.7"; consequently
- Consideration by decision-makers "should also be given to improving bushfire management of the site and surrounding area, thereby reducing the vulnerability of people property and infrastructure to bushfire"; and
- The application of mitigation measures to lessen the risk to the broader area would include improvements to the local road network (including emergency access ways), improvements/additions to firefighting water supply and increasing separation distance from the hazard.

The Hazard Within the Subject Site

The whole of the subject lot is to be managed and maintained to a low bushfire threat state (Asset Protection Zone standards). The proposed buildings will be subject to BAL ratings of BAL-29 or lower.

Application of appropriate building design, bushfire construction standards and the ongoing maintenance of the APZ will ensure the buildings will not be impacted by consequential fire within combustible materials used, stored or accumulated within the APZ.

Element 1: Location

The Hazard Adjoining the Subject Site

To the west, north and east of the subject site are areas of scrub, forest and grassland type vegetation. The vegetation is fragmented by developed industrial lots and constructed roadways.

To the south of the subject lot are narrow strips of scrub vegetation along the Zirconia Drive road verges. Further south are recently cleared and levelled lots that appear prepared for construction. However, this area is assessed as grassland. Further south are fragmented areas of forest, scrub and grassland.

The potential exists for intense bushfire behaviour to occur within these areas of bushfire prone vegetation. The potential bushfire impact on persons and property within the proposed development will be to increase the level of ember attack in the event of a bushfire.

This ember threat will be mitigated by the application of appropriate building design, bushfire construction standards and the ongoing maintenance of the required APZ, to ensure the buildings will not be impacted by consequential fire within combustible materials used, stored or accumulated within the APZ.

Element 2: Siting and Design of Development

Intent: To ensure that the siting and design of development (note: not building/construction design) minimises the level of bushfire impact.

Compliance: How the proposed development achieves the intent of Element 2:	By fully meeting all applicable acceptable solutions established by the bushfire protection criteria (Guidelines v1.3 WAPC 2017)

ASSESSMENT (COMPLIANCE) STATEMENTS

For each applicable acceptable solution, the following statements present the results of the assessment of the proposed development/use against the requirements established by the *Guidelines (WAPC 2017 v1.3)* and apply the interpretation guidance established by the *Position Statement: Planning in bushfire prone areas – Demonstrating Element 1: Location and Element 2: Siting and design (WAPC Nov 2019).*

Acceptable Solution: A2.1: Asset Protection Zone

THE APZ - DEVELOPMENT SITING AND DESIGN PLANNING REQUIREMENTS

The necessary outcome of bushfire planning for development siting and design, is to ensure that a building can be located within the developable portion of any lot (i.e. outside those parts of the lot that form the required R-Code building setbacks, or any other excluded area), and be subject to potential radiant heat from a bushfire not exceeding 29 kW/m^2 (i.e. a maximum BAL of BAL-29).

This will be achieved when the size of the "low fuel area immediately surrounding a building", the asset protection zone (APZ), is large enough. This requires a certain separation distance to exist between the building and areas of classified vegetation. These are the BAL-29 APZ dimensions and they will vary dependent on site specific parameters.

The APZ should be contained solely within the boundaries of each lot, except in instances where the neighbouring lot(s) or adjacent public land will be managed in a low-fuel state on an ongoing basis, in perpetuity.

Where possible, planning for siting and design should incorporate elements that include non-vegetated areas (e.g. roads/parking/drainage) and/or formally managed areas of vegetation (public open space/recreation areas/ services installed in a common section of land), as either part of the required APZ dimensions or to additionally increase separation distances to provide greater protection. These elements create robust and easier managed asset protection zones.

THE ASSESSMENT

Future buildings on the lot of the proposed development can be surrounded by an APZ that will ensure the potential radiant heat impact of a bushfire does not exceed 29 kW/m^2 (BAL-29). The required APZ specifications of width, location and management can be achieved.

APZ Width: The required APZ dimensions to ensure buildings are subject to a maximum BAL of BAL-29 (measured from any external wall or supporting post or column to the edge of the classified vegetation), has been determined in Section 3.2 of this BMP and are:

BAL-29 APZ Dimensions		
Applicable to the proposed buildings:	Building to Vegetation Area 1	Minimum 13 metres
	Building to Vegetation Area 2	Minimum13 metres
	Building to Vegetation Area 3	Minimum 21 metres
	Building to Vegetation Area 4	Minimum 13 metres
	Building to Vegetation Area 5	Minimum 8 metres
	Building to Vegetation Area 6	Minimum 13 metres
	Building to Vegetation Area 7	Minimum 9 metres

Element 2: Siting and Design of Development

THE APZ – REQUIRED DIMENSIONS TO SATISFY FUTURE BUILDING (AND ONGOING MANAGEMENT)

It is important for the landowner to be aware that the APZ dimensions that will be required to be physically established and maintained on the lot surrounding relevant future buildings, may be different to those stated above for the BAL-29 APZ - which is the minimum dimension a planning proposal needs to show can be established to comply with SPP 3.7.

The actual APZ dimensions to be physically established and maintained, may be based on which of the following establishes the larger APZ dimension:

- The dimensions corresponding to the determined BAL of a building (refer to Section 3.2 for explanation of the 'planning' versus 'building' requirements and 'indicative' versus 'determined' BAL); or
- The APZ dimensions established by the local government's Firebreak Notice.

If the dimensions of the APZ that are to be established are known at this time, they will be stated below.

For this proposed development, the whole of the subject lot is to be managed and maintained to a low bushfire threat state in perpetuity.

As a reference for proposed and future building locations, the minimum required vegetation separation distances to achieve BAL ratings lower than BAL-29 are stated in the Tables below.

The Vegetation Separation Distances to be Established and Maintained to Achieve a BAL Rating of BAL-19		
Applicable to Proposed and Future Buildings.	Building to Vegetation Area 1	Minimum 19 metres
	Building to Vegetation Area 2	Minimum 19 metres
	Building to Vegetation Area 3	Minimum 31 metres
	Building to Vegetation Area 4	Minimum 19 metres
	Building to Vegetation Area 5	Minimum 12 metres
	Building to Vegetation Area 6	Minimum 19 metres
	Building to Vegetation Area 7	Minimum 13 metres

The Vegetation Separation Distances to be Established and Maintained to Achieve a BAL Rating of BAL-12.5		
Applicable to Proposed and Future Buildings.	Building to Vegetation Area 1	Minimum 27 metres
	Building to Vegetation Area 2	Minimum 27 metres
	Building to Vegetation Area 3	Minimum 42 metres
	Building to Vegetation Area 4	Minimum 27 metres
	Building to Vegetation Area 5	Minimum 17 metres
	Building to Vegetation Area 6	Minimum 27 metres
	Building to Vegetation Area 7	Minimum 19 metres

APZ Location: Asset protection zones of the widths required to achieve a BAL-29 rating for the proposed development can be contained solely within the boundaries of the subject lot. Onsite vegetation will be required to be modified/removed, the authority for which will need to be received from the local government.

For this proposed development, the whole of the subject lot is to be managed and maintained to a low bushfire threat state in perpetuity.

Element 2: Siting and Design of Development

APZ Management: All vegetation that will require modification/removal and future management is onsite and therefore under the control of the landowner.

Retained vegetation will be managed in accordance with the technical requirements established by the Schedule 1: 'Standards for Asset Protection Zones (Guidelines). The APZ specifications are also detailed in Appendix 1 and the City of Rockingham may have additional requirements established by their Fire Control Notice.

Element 3: Vehicular Access	
Intent: To ensure that the vehicular access serving a subdivision/development is available and safe during a bushfire event.	
Compliance: How the proposed development achieves the intent of Element 3:	By fully meeting all applicable acceptable solutions established by the bushfire protection criteria (Guidelines v1.3 WAPC 2017)
ASSESSMENT (COMPLIANCE) STATEMENTS For each applicable acceptable solution, the following statements present the results of the assessment of the proposed development/use against the requirements established by the *Guidelines (WAPC 2017 v1.3).*	
Acceptable Solution: A3.1: Two Access Routes	
Two different access/egress routes to two different destinations are available to the subject site. The routes are constructed public roads which are available to occupants of the site, and the public, at all times and under all weather conditions.	
Acceptable Solution: A3.2: Public Road	
N/A No new roads are planned for this development.	
Acceptable Solution: A3.3: Cul-de-sacs (including a dead-end road)	
N/A	
Acceptable Solution: A3.4: Battle-axe	
N/A	
Acceptable Solution: A3.5: Private Driveways	
The proposed development has a looped internal driveway system for the main production area, with two different entry/exit locations. Proposed driveway widths range from 4 to 8 metres. A parking area for workers and visitors is separate to the main site access driveways and has an available turnaround area for fire appliances. The construction technical requirements established by the Guidelines will be complied with. These requirements are set out in Appendix 2.	
Acceptable Solution: A3.6: Emergency Access Way	
N/A	
Acceptable Solution: A3.7: Fire Service Access Routes	
N/A	
Acceptable Solution: A3.8: Firebreak Width	
The subject lot will comply with the requirements of the local government annual firebreak notice issued under s33 of the Bush Fires Act 1954.	

Element 4: Water	
Intent: To ensure water is available to the subdivision, development or land use to enable people, property and infrastructure to be defended from bushfire.	
Compliance: How the proposed development achieves the intent of Element 4:	By fully meeting all applicable acceptable solutions established by the bushfire protection criteria (Guidelines v1.3 WAPC 2017)
ASSESSMENT (COMPLIANCE) STATEMENTS For each applicable acceptable solution, the following statements present the results of the assessment of the proposed development/use against the requirements established by the *Guidelines (WAPC 2017 v1.3).*	
Acceptable Solution: A4.1: Reticulated Areas	
A reticulated water supply is available to the subject site Hydrants are located on Zirconia Drive and Alumina Road The nearest hydrant is located 28 metres from the subject site on the south side of Zirconia Drive.	
Acceptable Solution: A4.2: Non-Reticulated Areas	
N/A	
Acceptable Solution: A4.3: Non-Reticulated Areas – Individual Lots	
N/A	

5.4 Recommended Additional Bushfire Protection Measures

The following bushfire protection measures are recommended to be implemented and maintained. They are additional to those established by the relevant acceptable solutions applied to the proposed subdivision, development or use.

The relevant acceptable solutions are those against which this planning proposal has been assessed in Section 5.3 of this Bushfire Management Plan.

5.4.1 Recommended Additional Measures to Improve Bushfire Performance

Buildings of Class 4 to Class 9 are not required by the Building Code of Australia (BCA) to be constructed to comply with bushfire performance requirements. As the future buildings will be located in a bushfire prone area and may be subject to a bushfire attack, Bushfire Prone Planning recommends that some degree of upgrading be considered to improve the protection for occupants and the building's survivability. At a minimum protection from ember attack should be considered (i.e. constructed to the standard required for BAL-12.5).

SUMMARY OF RECOMMENDED ADDITIONAL BUSHFIRE PROTECTION MEASURES TO BE APPLIED		
Treatment Category	Brief Description	The Relevant Element and its Intent the Treatment Has Been Developed to Help Achieve
Siting and Design	Recommended minimum bushfire construction standard for buildings within the proposed subdivision to be BAL-12.5.	Element 2

ATTACHMENT 1

Id	Building Description
1	Micronising-Spheronising Plant
2	Purification Plant
3	Bagging Plant
4	Workshop-Store
5	Administration-Security
6	Control Room - Lab
7	MCC
8	Water Treatment

PATTERSON RD

PATTERSON RD

ZIRCONIA DR

ALUMINA RD

Figure 3.2

Proposed Development BAL Contour Map

Lot 2 on Plan 404186
Zirconia Drive
EAST ROCKINGHAM
CITY OF ROCKINGHAM

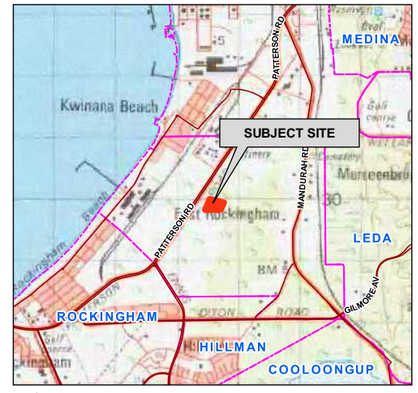
------ LEGEND ------

- Hydrant
- Fire Water Tank
- Access-Egress
- Structures
- Silo
- Container
- Drainage Swale
- Footpath
- Driveway
- Landscape Areas
- Managed Areas
- Asset Protection Zone
- Subject Lot
- Cadastre

0 20 40 60 80 100 120

Metres

------ LOCALITY ------



AERIAL IMAGERY: Landgate/SLIP

Coordinate System: GDA 1994 MGA Zone 50
Projection: Universal Transverse Merctaor Units: Metre
Map by: Ian Macleod 22-06-2022
SCALE (A3): 1 : 2000

BUSHFIRE PRONE PLANNING

6 RESPONSIBILITIES FOR IMPLEMENTATION AND MANAGEMENT OF THE BUSHFIRE PROTECTION MEASURES

Table 6.1: BMP Implementation responsibilities prior to occupancy or building.

Landowner (Developer) - Prior to Occupancy or Building	
No.	Implementation Actions
1	The local government may condition a development application approval with a requirement for the landowner/proponent to register a notification onto the certificate of title and deposited plan. This will be done pursuant to Section 70A *Transfer of Land Act 1893* as amended ('Factors affecting use and enjoyment of land, notification on title'). This is to give notice of the bushfire hazard and any restrictions and/or protective measures required to be maintained at the owner's cost. This condition ensures that: 1. Landowners/proponents are aware their lot is in a designated bushfire prone area and of their obligations to apply the stated bushfire risk management measures; and 2. Potential purchasers are alerted to the Bushfire Management Plan so that future landowners/proponents can continue to apply the bushfire risk management measures that have been established in the Plan.
2	Prior to construction and post planning approval, the entity responsible for having the BMP prepared should ensure that anyone listed as having responsibility under the Plan has endorsed it and is provided with a copy for their information and informed that it contains their responsibilities. This includes the landowners/proponents (including future landowners where the Plan was prepared as part of a subdivision approval), local government and any other authorities or referral agencies ('Guidelines' s4.6.3).
3	Prior to construction, establish the Asset Protection Zone (APZ) to the dimensions described in this Bushfire Management Plan. For this proposal, the whole of the subject lot is to be managed to APZ standards. Establish the APZ to the above dimensions and to the standards established by the Guidelines (refer to Appendix 1) or as varied by the local government through their Firebreak Notice. This is the responsibility of the landowner.
4	The subject lot is to be compliant with the City of Rockingham Fire Control Notice issued under s33 of the Bushfires Act 1954. This may include specifications for asset protection zones that differ from the Guideline's APZ Standards, with the intent to better satisfy local conditions. When these are more stringent than those created by the Guidelines, or less stringent and endorsed by the WAPC and DFES, they must be complied with. Refer to Appendix 1.
5	Prior to occupancy, install the private driveways to the standards stated in the BMP.
6	Prior to any building work, inform the builder of the existence of this Bushfire Management Plan and the responsibilities it contains, regarding the required construction standards. This may be: • The standard corresponding to the determined BAL, as per the bushfire provisions of the Building Code of Australia (BCA); and/or • A higher standard because the BMP establishes that the construction standard is to correspond to a higher BAL as an additional bushfire protection measure.

Table 6.2: Ongoing management responsibilities for the Landowner/Occupier.

Landowner/Occupier - Ongoing	
No.	Ongoing Management Actions
1	Maintain the Asset Protection Zone (APZ) to the dimensions described in this Bushfire Management Plan. For this proposal, the whole of the subject lot is to be managed to APZ standards. Maintain the APZ to the above dimensions and to the standards established by the Guidelines (refer to Appendix 1) or as varied by the local government through their Firebreak Notice. This is the responsibility of the landowner.
2	Comply with the City of Rockingham Fire Control Notice issued under s33 of the Bush Fires Act 1954. This may include specifications for asset protection zones that differ from the Guideline's APZ Standards, with the intent to better satisfy local conditions. When these are more stringent than those created by the Guidelines, or less stringent and endorsed by the WAPC and DFES, they must be complied with. Refer to Appendix 1.
3	Maintain vehicular access routes within the lot to the required surface condition and clearances as stated in the BMP.
4	Maintain the emergency water supply tank and its associated fittings and vehicular access in good working condition.
5	Ensure that any builders (of future structures on the lot) are aware of the existence of this Bushfire Management Plan and the responsibilities it contains regarding the application of construction standards corresponding to a determined BAL.
6	Ensure all future buildings the landowner has responsibility for, are designed and constructed in full compliance with: 1. the requirements of the WA Building Act 2011 and the bushfire provisions of the Building Code of Australia (BCA); and 2. with any identified additional requirements established by this BMP or the local government.
7	To implement and maintain, the recommended additional bushfire protection measures contained in Section 5.4 of this Bushfire Management Plan, if appropriate, in addition to the measures that are established by the acceptable solutions.

Table 6.3: Ongoing management responsibilities for the Local Government.

Local Government - Ongoing	
No.	Ongoing Management Actions
1	Monitor landowner compliance with this Bushfire Management Plan and the annual Fire Control Notice.

APPENDIX 1: TECHNICAL REQUIREMENTS FOR ONSITE VEGETATION MANAGEMENT

A1.1 Requirements Established by the Guidelines – Standards for Asset Protection Zones

(Source: Guidelines for Planning in Bushfire Prone Areas - WAPC 2017 v1.3 Appendix 4, Element 2, Schedule 1 and Explanatory Note E2.1)

DEFINING THE ASSET PROTECTION ZONE (APZ)

Description: An APZ is an area surrounding a building that is managed to reduce the bushfire hazard to an acceptable level (by reducing fuel loads). The width of the required APZ varies with slope and vegetation and varies corresponding to the BAL rating determined for a building (lower BAL = greater dimensioned APZ).

For planning applications, the minimum sized acceptable APZ is that which is of sufficient size to ensure the potential radiant heat impact of a fire does not exceed 29kW/m² (BAL-29). It will be site specific.

For subdivision planning, design elements and excluded/low threat vegetation adjacent to the lot(s) can be utilised to achieve the required vegetation separation distances and therefore reduce the required dimensions of the APZ within the lot(s).

Defendable Space: The APZ includes a defendable space which is an area adjoining the asset within which firefighting operations can be undertaken to defend the structure. Vegetation within the defendable space should be kept at an absolute minimum and the area should be free from combustible items and obstructions. The width of the defendable space is dependent on the space, which is available on the property, but as a minimum should be 3 metres.

Establishment: The APZ should be contained solely within the boundaries of the lot on which the building is situated, except in instances where the neighbouring lot or lots will be managed in a low-fuel state on an ongoing basis, in perpetuity.

The APZ may include public roads, waterways, footpaths, buildings, rocky outcrops, golf courses, maintained parkland as well as cultivated gardens in an urban context, but does not include grassland or vegetation on a neighbouring rural lot, farmland, wetland reserves and unmanaged public reserves.

[Note: Regardless of whether an Asset Protection Zone exists in accordance with the acceptable solutions and is appropriately maintained, fire fighters are not obliged to protect an asset if they think the separation distance between the dwelling and vegetation that can be involved in a bushfire, is unsafe.]

Schedule 1: Standards for APZ

Fences: within the APZ are constructed from non-combustible materials (e.g. iron, brick, limestone, metal post and wire). It is recommended that solid or slatted non-combustible perimeter fences are used.

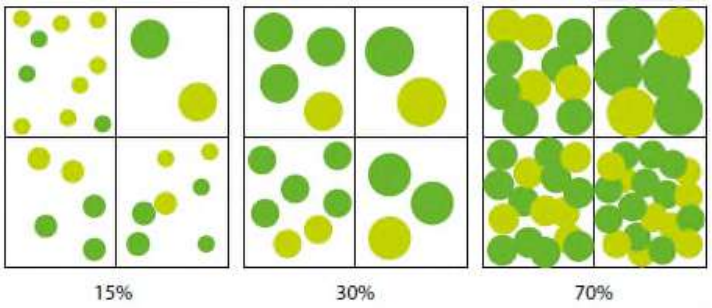
Objects: within 10 metres of a building, combustible objects must not be located close to the vulnerable parts of the building i.e. windows and doors.

Fine Fuel Load: combustible dead vegetation matter less than 6 mm in thickness reduced to and maintained at an average of two tonnes per hectare (example below).

Example: Fine fuel load of 2 t/ha
(Image source: Shire of Augusta Margaret River's Firebreak and Fuel Reduction Hazard Notice)

Trees (> 5 metres in height): trunks at maturity should be a minimum distance of 6 metres from all elevations of the building, branches at maturity should not touch or overhang the building, lower branches should be removed to a height of 2 metres above the ground and or surface vegetation, canopy cover should be less than 15% with tree canopies at maturity well spread to at least 5 metres apart as to not form a continuous canopy. Diagram below represents tree canopy cover at maturity.

Tree canopy cover – ranging from 15 to 70 per cent at maturity



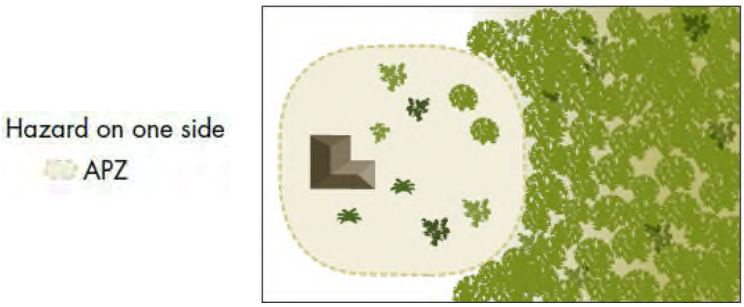
(Source: Guidelines for Planning in Bushfire Prone Areas 2017, Appendix 4)

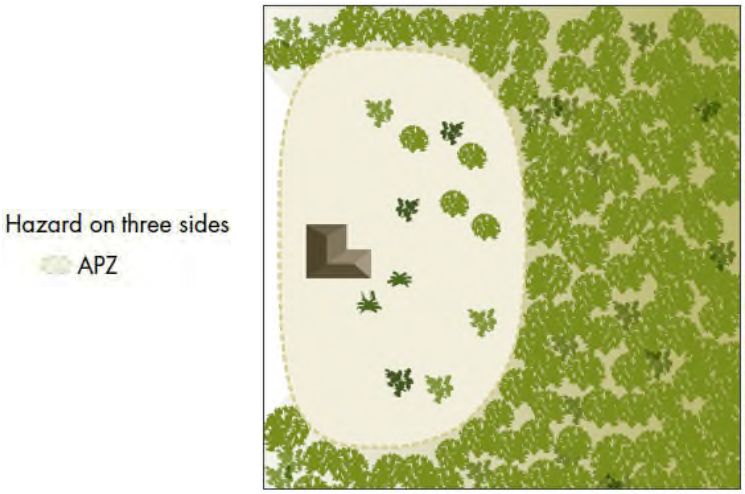
Shrubs (0.5 metres to 5 metres in height): should not be located under trees or within 3 metres of buildings, should not be planted in clumps greater than 5m2 in area, clumps of shrubs should be separated from each other and any exposed window or door by at least 10 metres. Shrubs greater than 5 metres in height are to be treated as trees.

Ground covers (<0.5 metres in height): can be planted under trees but must be properly maintained to remove dead plant material and any parts within 2 metres of a structure, but 3 metres from windows or doors if greater than 100 mm in height. Ground covers greater than 0.5 metres in height are to be treated as shrubs.

Grass: should be managed to maintain a height of 100 mm or less.

The following example diagrams illustrate how the required dimensions of the APZ will be determined by the type and location of the vegetation.





A1.2 Requirements Established by the Local Government – the Firebreak Notice

The local government's current Firebreak Notice is available on their website, at their offices and is distributed as ratepayer's information. It must be complied with.

These requirements are established by the local government's Firebreak Notice created under s33 of the Bushfires Act 1954 and issued annually (potentially with revisions). The Firebreak Notice may include additional components directed at managing fuel loads, accessibility and general property management with respect to limiting potential bushfire impact.

If Asset Protection Zone (APZ) specifications are defined in the Firebreak Notice, these may differ from the Standards established by the Guideline's, with the intent to better satisfy local conditions. When these are more stringent than those created by the Guidelines, or less stringent and endorsed by the WAPC and DFES, they must be complied with.

The APZ dimensions to be physically established and maintained, will be based on which of the following establishes the larger APZ dimension:

- The dimensions corresponding to the determined BAL of a building (refer to Section 3.2 explanation of the 'planning' versus 'building' requirements and 'indicative' versus 'determined' BAL(s)); or
- The APZ dimensions established by the local government's Firebreak Notice.

A1.3 Requirements Recommended by DFES – Property Protection Checklists

Further guidance regarding ongoing/lasting property protection (from potential bushfire impact) is presented in the publication 'DFES – Fire Chat – Your Bushfire Protection Toolkit'. It is available from the Department of Fire and Emergency Services (DFES) website.

A1.4 Requirements Established by AS 3959:2018 – 'Minimal Fuel Condition'

This information is provided for reference purposes. This knowledge will assist the landowner to comply with Management Requirement No. 3 set out in the Guidance Panel at the start of this Appendix. It identifies what is required for an area of land to be excluded from classification as a potential bushfire threat.

"Australian Standard - AS 3959:2018 Section 2.2.3.2: Exclusions - Low threat vegetation and non-vegetated areas:

The Bushfire Attack Level shall be classified BAL-LOW where the vegetation is one or a combination of the following:

a) Vegetation of any type that is more than 100m from the site.

b) Single areas of vegetation less than 1ha in area and not within 100m of other areas of vegetation being classified vegetation.

c) Multiple area of vegetation less than 0.25ha in area and not within 20m of the site or each other or other areas of vegetation being classified vegetation.

d) Strips of vegetation less than 20m in width (measured perpendicular to the elevation exposed to the strip of vegetation) regardless of length and not within 20m of the site or each other, or other areas of vegetation being classified vegetation.

e) Non-vegetated areas, that is, areas permanently cleared of vegetation, including waterways, exposed beaches, roads, footpaths, buildings and rocky outcrops.

f) *Vegetation regarded as low threat due to factors such as flammability, moisture content or fuel load. This includes grassland managed in a* ***minimal fuel condition,*** *(means insufficient fuel available to significantly increase the severity of a bushfire attack – for example, recognisable as short cropped grass to a nominal height of 100mm), mangroves and other saline wetlands, maintained lawns, golf courses (such as playing areas and fairways), maintained public reserves and parklands, sporting fields, vineyards, orchards, banana plantations, market gardens (and other non-curing crops), cultivated gardens, commercial nurseries, nature strips and windbreaks (single row of trees)."*

APPENDIX 2: TECHNICAL REQUIREMENTS FOR VEHICULAR ACCESS

Each local government may have their own standard technical requirements for emergency vehicular access, and they may vary from those stated in the Guidelines.

When required, these are stated in Section 5.1 of this bushfire management plan.

Requirements Established by the Guidelines – The Acceptable Solutions

(Source: Guidelines for Planning in Bushfire Prone Areas WAPC 2017 v1.3, Appendix 4)

VEHICULAR ACCESS TECHNICAL REQUIREMENTS - PART 1

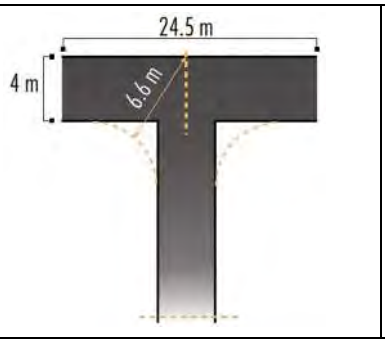
Acceptable Solution 3.5: Private Driveways

The following requirements are to be achieved:

- The design requirements set out in Part 2 of this appendix; and

Where the house site is more than 50 metres from a public road:

- Passing bays every 200 metres with a minimum length of 20 metres and a minimum width of two metres (ie combined width of the passing bay and constructed private driveway to be a minimum six metres);
- Turn-around areas every 500 metres and within 50 metres of a house, designed to accommodate type 3.4 fire appliances to turn around safely (ie kerb to kerb 17.5 metres);
- Any bridges or culverts are able to support a minimum weight capacity of 15 tonnes; and
- All weather surface (i.e. compacted gravel, limestone or sealed).



Acceptable Solution 3.8: Firebreak Width

Lots greater than 0.5 hectares must have an internal perimeter firebreak of a minimum width of three meters or to the level as prescribed in the local firebreak notice issued by the local government.

VEHICULAR ACCESS TECHNICAL REQUIREMENTS - PART 2					
Technical Component	Vehicular Access Types				
	Public Roads	Cul-de-sacs	Private Driveways	Emergency Access Ways	Fire Service Access Routes
Minimum trafficable surface (m)	6*	6	4	6*	6*
Horizontal clearance (m)	6	6	6	6	6
Vertical clearance (m)	4.5	4.5	4.5	4.5	4.5
Maximum grade <50 metres	1 in 10	1 in 10	1 in 10	1 in 10	1 in 10
Minimum weight capacity (t)	15	15	15	15	15
Maximum cross-fall	1 in 33	1 in 33	1 in 33	1 in 33	1 in 33
Curves minimum inner radius (m)	8.5	8.5	8.5	8.5	8.5
* A six metre trafficable surface does not necessarily mean paving width. It could, for example, include four metres of paving and one metre of constructed road shoulders. In special circumstances, where 8 lots or less are being serviced, a public road with a minimum trafficable surface of four metres for a maximum distance of ninety metres may be provided subject to the approval of both the local government and DFES.					

APPENDIX 3: TECHNICAL REQUIREMENTS FOR FIREFIGHTING WATER

Reticulated Areas

[Source: Guidelines for Planning in Bushfire Prone Areas WAPC 2017 v1.3, Appendix 4, Element 4]

The Water Corporation's 'No 63 Water Reticulation Standard' is deemed to be the baseline criteria for developments and should be applied unless local water supply authority's conditions apply.

The requirement is to supply a reticulated water supply and fire hydrants, in accordance with the technical requirements of the relevant water supply authority and DFES.

Key specifications in the most recent version/revision of the design standard include:

- ***Residential Standard*** – hydrants are to be located so that the maximum distance between the hydrants shall be no more than 200 metres.
- ***Commercial Standard*** – hydrants are to be located with a maximum of 100 metre spacing in Industrial and Commercial areas.
- ***Rural Residential Standard*** – where minimum site areas per dwelling is 10,000 m^2 (1ha), hydrants are to be located with a maximum 400m spacing. If the area is further subdivided to land parcels less than 1ha, then the residential standard (200m) is to be applied.

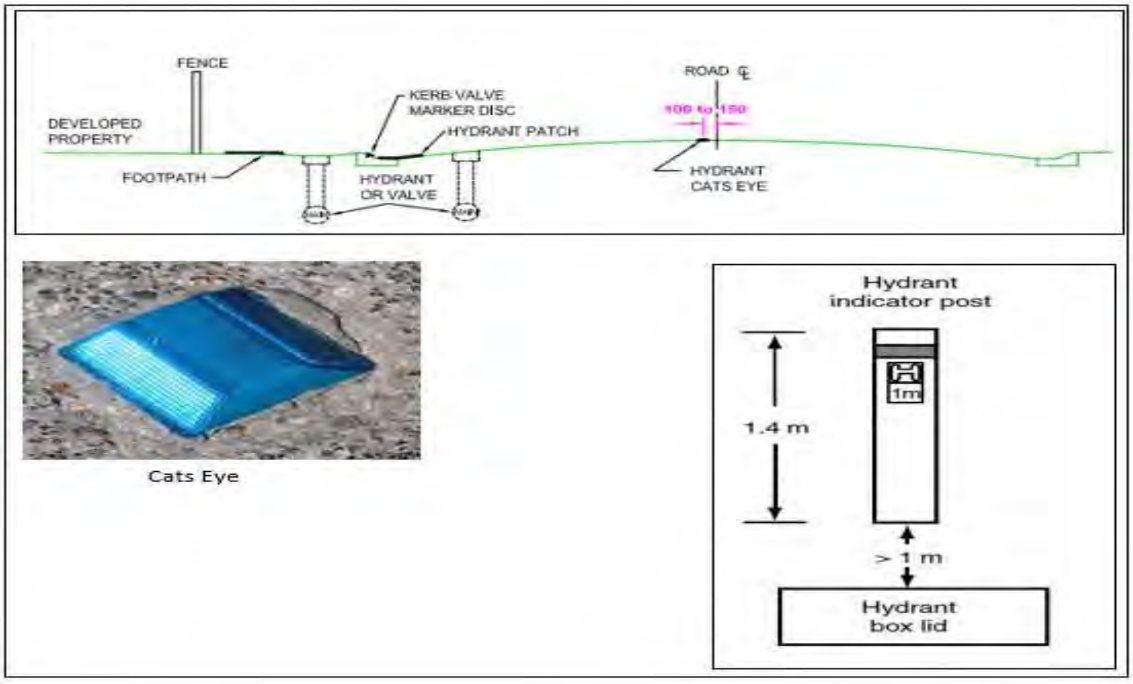


Figure A4.1: Hydrant Location and Identification Specifications

AIR QUALITY IMPACT ASSESSMENT

Graphite Recycling and Manufacturing Facility
Ecograf, East Rockingham

Prepared for:

Ecograf Limited
18 Richardson Street
West Perth WA 6005

SLR Ref: 675.30077-R02
Version No: -v1.0
January 2022

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BASIS OF REPORT

This report has been prepared by SLR Consulting Australia Pty Ltd (SLR) with all reasonable skill, care and diligence, and taking account of the timescale and resources allocated to it by agreement with Ecograf Limited (the Client). Information reported herein is based on the interpretation of data collected, which has been accepted in good faith as being accurate and valid.

This report is for the exclusive use of the Client. No warranties or guarantees are expressed or should be inferred by any third parties. This report may not be relied upon by other parties without written consent from SLR.

SLR disclaims any responsibility to the Client and others in respect of any matters outside the agreed scope of the work.

DOCUMENT CONTROL

Reference	Date	Prepared	Checked	Authorised
675.30077-R02-v1.0	28 January 2022	Jason Shepherd	Judith Cox	Jason Shepherd

EXECUTIVE SUMMARY

SLR Consulting Australia Pty Ltd was commissioned by EcoGraf Limited to undertake an air quality impact assessment for the proposed Graphite Recycling and Manufacturing Facility located at Zirconia Drive, Rockingham, WA.

In support of the development permit application, this report provides an assessment of potential impacts to air quality resulting from emissions from the facility stack emission points in accordance with the WA (Draft) "*Guideline: Air emission*", Department of Water Environmental Regulation, 2019.

With the stack parameters and emissions characteristics for the GRMF emission points provided by GR Engineering and Ecograf, an initial screening assessment identified that emissions of NO_X associated with the kiln required detailed analysis using plume dispersion modelling, the results of which predicted negligible NO_2 impacts at all nearest sensitive and commercial/industrial receptors.

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1 Introduction

SLR Consulting Australia Pty Ltd (SLR) was commissioned by EcoGraf Limited (EcoGraf) to undertake an air quality impact assessment for the proposed Graphite Recycling and Manufacturing Facility (GRMF) located at Zirconia Drive, Rockingham, WA (the Site).

1.1 Purpose and Scope of this Report

In support of the development permit application, this report provides an assessment of potential impacts to air quality resulting from emissions from the GRMF and assessment against relevant regulatory ambient air quality criteria.

1.1.1 Approach to the Air Quality Assessment

The following approach was used for the air quality impact assessment:

- Stack and emission data provided by the client were compiled.
- A screening assessment of identified point source emissions was conducted to 'screen out' insignificant emissions from further analysis.
- A detailed assessment of the remaining identified emissions including:
  - The existing air quality and meteorological environment at the Site was reviewed and a site-representative 1-year meteorological data file suitable for modelling the dispersion of emissions from the power station was compiled using the WRF/CALMET models.
  - The CALPUFF dispersion model was used to predict downwind concentrations of pollutants released to the atmosphere from the GRMF for proposed operations.
  - The potential air quality impacts due to emissions from the GRMF at nearby sensitive receptors were assessed, with reference to relevant legislation, guidelines and standards.

The assessment has been conducted in accordance with, and compared against, appropriate sections of the following guidance documents:

- *National Environment Protection (Ambient Air Quality) Measure*, NEPM, 1998 (Updated 2021)
- *Environmental Protection (Kwinana) (Atmospheric Wastes) Policy* 1999 and *Environmental Protection (Kwinana) (Atmospheric Wastes) Regulations* 1992
- *Environmental Factor Guideline: Air Quality*, WA Environmental Protection Authority, 2016
- *(Draft) Guideline: Air emission*, Department of Water Environmental Regulation, 2019

1.1.2 Report Limitations

The findings of this report are based on the current design of the GRMF and may change as the Project design progresses. Should the final design or conditions vary from the basis of this assessment, the associated impacts may differ from the reported findings.

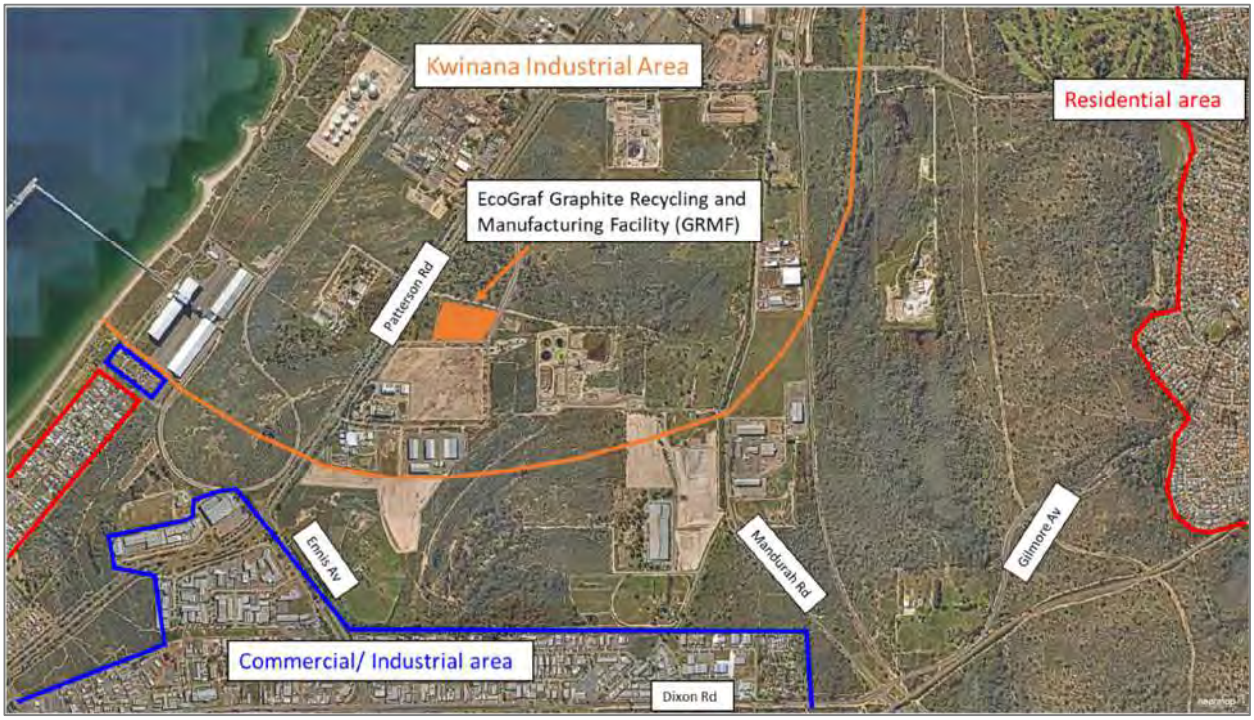
Potential air quality impacts, and any recommended mitigation measures, presented in this assessment are based on the adopted assessment criteria, identified sensitive receivers and the estimated air emissions associated with the proposed operations of the Project.

2 Project Description

The Site is located within Kwinana industrial area. In addition to the nearby industrial area within the same precinct, the surrounding area includes commercial/industrial areas approximately 1.3 km to the south, and two residential areas, one approximately 1.6 km to the west and the other approximately 3.2 km to the east. Figure 1 presents the Site location and surrounding areas.

The GRMF is proposed to operate 24 hours per day.

Figure 1 Site Location



The GRMF is to accept flake graphite of approximately 95% carbon and produce spherical graphite with a purity of greater than 99.96% carbon. The plant is broadly defined as two processing areas, mechanical shaping and purification, with associated services and reagents.

1. Concentrate will be received by GRMF in bulk bags by truck. Bags will be hoisted into the Feed Silo, the bag will be split and the concentrate will be stored in the Feed Silo.
2. Sizing of concentrate will be achieved by milling serviced by a fines baghouse (with fines being diverted to the Fines Bagging Plant).
3. Product will be combined with sodium hydroxide and fed into the Alkaline Bake Kiln. The gas-fired kiln off gases will be scrubbed prior to release to the atmosphere.
4. Quenched material will then be pumped to the Filter 1 Feed tank, and subsequently to the Alkaline Water Leach Product Filter, where it will be filtered and washed.
5. After further wet processing to purify the material, the final product will be fed into a flash dryer with the dried product bagged for distribution. The gas-fired dryer off-gases will be serviced by a dust collector prior to release to the environment.

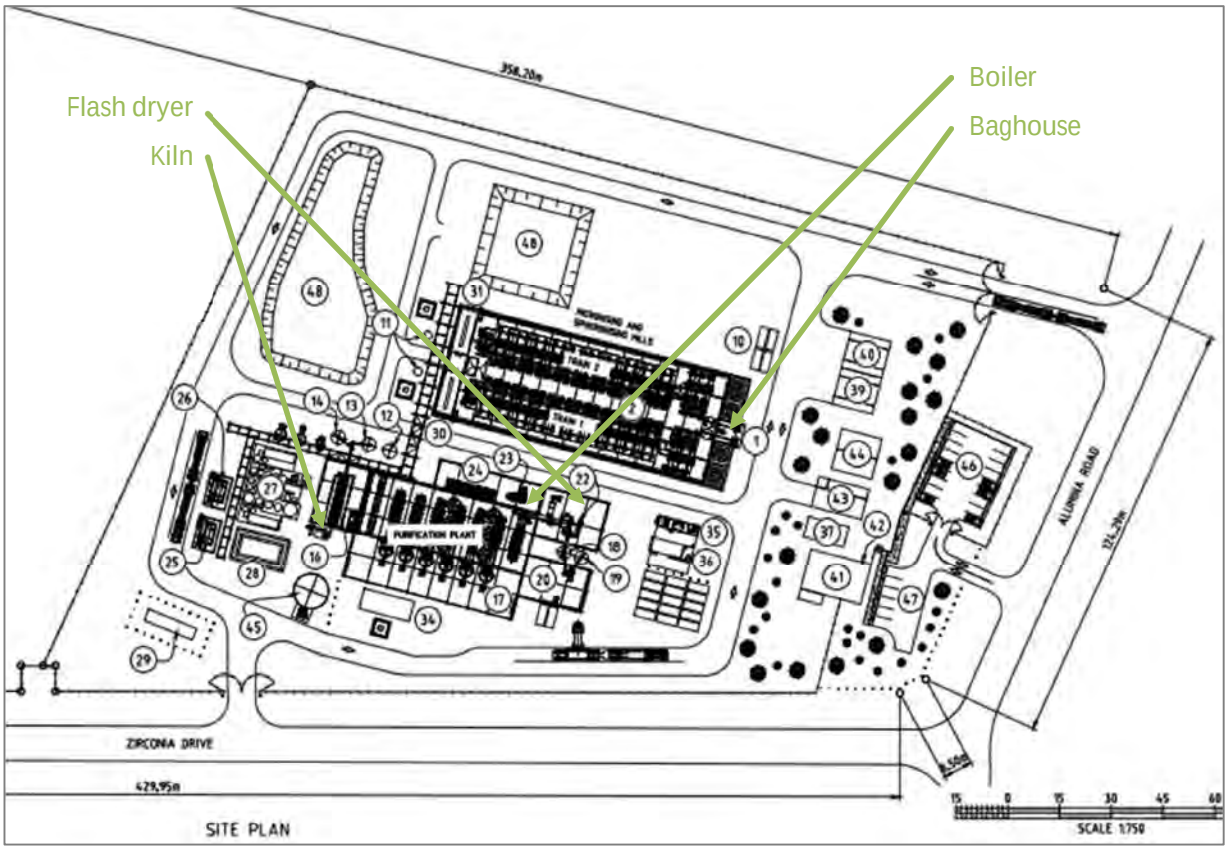
6. A gas-fired steam boiler will produce steam for various heat exchange process required within the process plant. Off gases from the boiler will be vented to atmosphere.

Emissions to air are expected to be limited to those from exhaust stacks (point sources) as follows:

- Caustic bake kiln exhaust: NO_x
- Caustic bake kiln off-gas scrubber stack: CO, CO_2, NO_x, SO_2 and H_2S.
- Alkaline quench tank gas scrubber (combined with kiln scrubber stream): water vapour (H_20), NO_x, H_2S
- Flash dryer exhaust: CO
- Baghouse: PM_{10} and $PM_{2.5}$
- Boiler flue: CO

Figure 2 presents the Site plan and the approximate location of these emission point sources.

Figure 2 Site Plan



2.1 Emission Controls

The GRMF will include emission controls including:

- Off-gas alkaline scrubbers (kiln, quench tank; >99% control of condensable gases)
- Dust collectors (reverse pulsed jet vent filters; reduce dust emissions by >99%)

- Fines baghouse (23 per train, 2 trains; reduce dust emissions by >99%).

2.2 Management and Monitoring

Differential pressure monitoring systems on the baghouses will be used to identify when a bag has failed. Each baghouse stack will be fitted with a monitoring device which will alarm when dust egress is noted.

There will be manual monitoring of dust in the plant areas, particularly within the milling, drying and bagging areas. Stack monitoring to check for escape of condensable gases will be conducted by manual instruments on a regular schedule by plant personnel.

3 Legislative Context and Assessment Criteria

3.1 Commonwealth Legislation

The National Environment Protection Council (NEPC) was established under the National Environment Protection Council Act 1994 with the primary function of:

- developing National Environment Protection Measures (NEPMs)
- assessing and reporting on the implementation and effectiveness of the NEPMs in each State and Territory.

3.1.1 National Environment Protection (Ambient Air Quality) Measure

The National Environment Protection (Ambient Air Quality) Measure (Air NEPM) (NEPC, 2021) contains standards for key pollutants that are required to be achieved nationwide, with due regard to population exposure, that are designed to protect human health and wellbeing. It is the intent of the Air NEPM that the criteria are applicable to the air quality likely to be experienced by the general population as a result of regional anthropogenic activity in urban environments. That is, the criteria are not applicable to locations, that due to their proximity to, are strongly influenced by e.g., road traffic, mining, industry etc, nor to locations strongly influenced by naturally occurring emissions or emission events, e.g., desert dust, bushfires etc.

On 15 April 2021, The National Environmental Protection Council agreed to vary the Air NEPM, and on 18 May 2021 the ambient air standards for NO_2 and SO_2 were amended. These changes to the standards for NO_2 and SO_2 include:

- NO_2:
  - The 1-hour standard for NO_2 in the Air NEPM is retained, however the numerical value of the standard has been reduced to 80 ppb (previously 120 ppb).
  - The annual standard for NO_2 in the Air NEPM is retained, however the numerical value of the standard has been reduced to 15 ppb (previously 30 ppb).
  - The form of both the 1-hour and annual NO_2 standards are as maximum values with no allowable exceedances.
- SO_2:
  - The 1-hour standard for SO_2 in the Air NEPM is retained, however the numerical value of the standard has been reduced to 100 ppb (previously 200 ppb).
  - A future 1-hour SO_2 standard of 75 ppb will be implemented from 2025.
  - The 24-hour standard for SO_2 in the Air NEPM will be retained, however the numerical value of the standard has been reduced to 20 ppb (previously 80 ppb).
  - No future target for 24-hour average SO_2 concentrations is proposed at this stage.
  - The current annual mean standard for SO_2 has been removed from the Air NEPM.
  - The form of both the revised 1-hour and 24-hour SO_2 standards are as maximum values with no allowable exceedances.

The Air NEPM air quality standards are provided in Table 1Error! Reference source not found..

Table 1 Air NEPM Ambient Air Quality Standards

Pollutant	Averaging Period	Maximum Concentration
CO	8 hours	9 ppm
NO_2	1 hour	0.08 ppm
	Annual	0.015 ppm
SO_2	1 hour	0.10 ppm
	24 hours	0.02 ppm
PM_{10}	24 hours	50 µg/m^3
	Annual	25 µg/m^3
$PM_{2.5}$	24 hours	25 (20 in 2025) µg/m^3
	Annual	8 (7 in 2025) µg/m^3

3.2 Western Australian Legislation

The Environmental Protection Authority (EPA) was originally established in 1971. The EPA's operations are governed by the *Environmental Protection (EP) Act 1986* which stipulates that the objective of the EPA is to: *'use its best endeavours – a) to protect the environment; and b) to prevent, control and abate pollution and environmental harm.*' The Act defines the environment as *'living things, their physical, biological and social surroundings, and interactions between all of these*'.

The functions of the EPA include:

- Conducting environmental impact assessments;
- Preparing statutory policies for environmental protection;
- Preparing and publishing guidelines for managing environmental impacts; and
- Providing strategic advice to the Minister for Environment.

The Department of Water and Environmental Regulation (DWER) was established on 1 July 2017 through the amalgamation of the Office of the Environmental Protection Authority with the departments of Water and Environment Regulation. It supports the EPA in conducting environmental impact assessments and developing policies to protect the environment. The DWER also monitors compliance with the conditions of Ministerial Statements.

3.2.1 Environmental Protection Act

The *Environmental Protection (EP) Act (1986)* provides for the prevention, control and abatement of pollution and environmental harm in Western Australia, in accordance with the (section 4A of the EP Act):

- precautionary principle
- polluter pays principle
- principles of intergenerational equity
- conservation of biological diversity and ecological integrity
- waste minimisation principle

3.2.2 Environmental Protection (Kwinana) Atmospheric Wastes) Policy and Regulations, 1992

The Kwinana Power Station is located within in the region covered by the *Environmental Protection (Kwinana) (Atmospheric Wastes) Policy* 1999. The Kwinana EPP defines three types of areas covered by the Policy - Area A (industrial), Area B (buffer) and Area C (residential) and defines Standards and Limits for SO_2 and TSP for these areas. The EPP achieves these ambient Standards and Limits through provision for allocating emission limits on individual industry stack licences issued under the Environmental Protection Act 1986.

As the pollutants assessed in this AQIA are NO_2, CO and VOCs, the requirements of the Kwinana EPP have not been considered further.

3.2.3 Environmental Factor Guideline: Air Quality

The WA EPA's *Environmental Factor Guideline: Air Quality* (WA EPA, 2016) states that the EPA's environmental objective for the factor Air Quality is '*to maintain air quality and minimise emissions so that environmental values are protected*'. A range of development activities are identified that have the potential to impact on air quality, including the burning of fossil fuels for the production of energy.

The guideline states that where air quality has been identified as an environmental factor, the EPA may require the proponent to provide the following information or studies in relation to air emissions that may affect human health or amenity:

- Characterisation of the feedstock and the pollutants and contaminants that are likely to be emitted (Section 2 and Section 4)
- Characterisation of and proximity to sensitive receptors (Section 5.1)
- Background ambient air modelling and the impact of emissions on sensitive receptors, including likely impacts during, worst, best and most likely case scenarios (Section 7)
- Assessment against published standards and criteria (Section 7)
- Identification of emission reduction equipment and proposed technologies and, where relevant, demonstration of the use of proven technologies (Section 2.1)
- Description of proposed management and monitoring arrangements (Section 2.2).

3.2.4 Guideline: Air Emissions (Draft), 2019

A draft of the *Guideline: Air Emissions* (DWER, 2019) (herein the Air Emissions Guideline) was released for public consultation by the DWER in October 2019, with comments closing on 17 January 2020. The objective of the Air Emissions Guideline is to ensure that adequate information is provided to the DWER for assessing applications with identified air emissions. It applies to all applications for a works approval or licence under Part V of the EP Act with an identified air emission component.

Section 9 of the *Air Emissions Guideline* provides a screening analysis method to identify emission sources that do not require detailed analysis. A screening analysis has been completed for all monitored emissions and is presented in Section 6.

Appendix A of the Air Emissions Guideline lists ambient air guideline values (AGVs) to be used in air quality impact assessments. These AGVs are based on the approved health guidelines of the WA Department of Health (DoH) and the New South Wales EPA publication, *Approved methods for the modelling and assessment of air pollutants in New South Wales* (NSW EPA, 2017). Error! Reference source not found.

For a detailed modelling study, the Air Emissions Guideline sets out the following requirements, which have been adopted in this assessment:

- For criteria pollutants, cumulative emissions (pre-proposal and proposed) are to be reported as the maximum concentration.
- For principal toxic and individual toxic substances:
  - Simulations using an averaging time of 1 hour are to be reported as the 99.9th percentile (9th highest value).
  - Simulations using an averaging time longer than 1 hour are to be reported as the 100th percentile (highest value).
  - For worst-case modelling, concentration should be reported as 100th percentile for simulations using an averaging time of 1-hour to ensure a conservative approach.

Table 2 Ambient Air Guideline Values – DWER Guideline: Air Emissions (Draft), 2019

Substance	Averaging Period	Maximum Ambient Concentration		
		ppm	µg/m^3 at 0°C	µg/m^3 at 25°C
CO	1 hour	25	-	30,000
	8 hours	9	-	10,000
NO_2	1 hour	0.12	246	226
	Annual	0.03	62	56
SO_2	1 hour	0.2	570	524
	24 hours	0.08	228	210
	Annual	0.02	60	52
PM_{10}	24 hours	-	50	46
	Annual	-	25	23
$PM_{2.5}$	24 hours	-	25	23
	Annual	-	8	7

3.2.5 Air Quality Modelling Guidance Notes, 2006

The *Air Quality Modelling Guidance Notes* (Department of Environment, 2006) were issued in 2006 by the then Department of Environment to provide clarity on their expectations with respect to air quality modelling and associated meteorological monitoring and/or modelling studies. The Air Emissions Guideline notes that the *Air Quality Modelling Guidance Notes* are expected to be reviewed and updated soon.

4 Pollutants of Interest

GR Engineering, on behalf of Ecograf, provided stack parameters and emissions characteristics for the GRMF emission points. Pollutants to be emitted may include:

- Oxides of nitrogen (NO_X): NO_X is a mixture of gases that are composed of nitrogen and oxygen. The toxicologically significant compound is nitrogen dioxide (NO_2). Other gases belonging to this group are nitric oxide (NO), nitrous oxide (N_2O) and nitrogen pentoxide (N_2O_5). The majority of NO_X (90 to 95%) generated by the combustion of fossil fuels is in the form of NO, with NO_2 contributing the remaining 5 to 10% along with traces of N_2O. NO reacts in the atmosphere to form secondary NO_2 as the plume travels downwind.
- Hydrogen sulphide (H_2S): H_2S is poisonous, corrosive, and flammable. In humans, it will cause headache, conjunctivitis, sleeplessness, pain in the eyes, and similar symptoms at low air concentrations and death at high air concentrations. However, the majority of the complaints arising from hydrogen sulphide air pollution are due to its obnoxious odour in extremely low air concentrations.
- Particulate matter (PM): Small quantities of particulate matter are formed during gas combustion, predominantly in the fine particulate size range, from carry-over of non-combustible trace constituents in the fuel and lubricating oil and as products of incomplete combustion. Drying of granular material may lead to emissions of particulate matter. These emissions will be controlled by passing the dryer exhaust stream through a baghouse which typically removes 95-99% of PM_{10} (all particles with equivalent aerodynamic diameters of less than 10 μm) and $PM_{2.5}$ (a sub-component of PM_{10} with all particles with equivalent aerodynamic diameters of less than 2.5 μm diameter). The size of particles determines their behaviour in the respiratory system, including how far the particles are able to penetrate, where they deposit, and how effective the body's clearance mechanisms are in removing them. Additionally, particle size is an important parameter in determining the residence time and spatial distribution of particles in ambient air, which are key considerations in assessing exposure. $PM_{2.5}$, and in particular the ultrafine sub-micron particles, may penetrate beyond the larynx and into the thoracic respiratory tract and evidence suggests that particles in this size range are more harmful than the coarser component of PM_{10}.

GR Engineering indicate that negligible emissions of the following pollutants may also include:

- Carbon monoxide (CO): CO forms due to incomplete combustion of carbon in fuels (e.g., petrol, wood, coal, natural gas).
- Sulfur dioxide (SO_2): Emissions of SO_2 from fossil fuel combustion are directly proportional to the sulfur content of the fuel. As the sulfur content of natural gas in Australia is very low, emissions of SO_2 from the GRMF are likely to be minor.

5 Receiving Environment

5.1 Sensitive Receptors

Sensitive receptors are located in residential areas approximately 1.6 km west and 3.2 km east of the Site as shown in Figure 3. In the absence of detailed information, there are conservatively assumed to be sensitive receptors located in the commercial/industrial area 1.3 km to the south of the Site. There are nearby (320 m) industrial buildings to the south of the Site with additional buildings further to the west, north and east.

For the purpose of modelling, discrete receptors representing these nearest receptors are included as provided in Table 3 and their location with respect to the GRMF site is presented in Figure 3.

Table 3 Nearby Sensitive Receptors

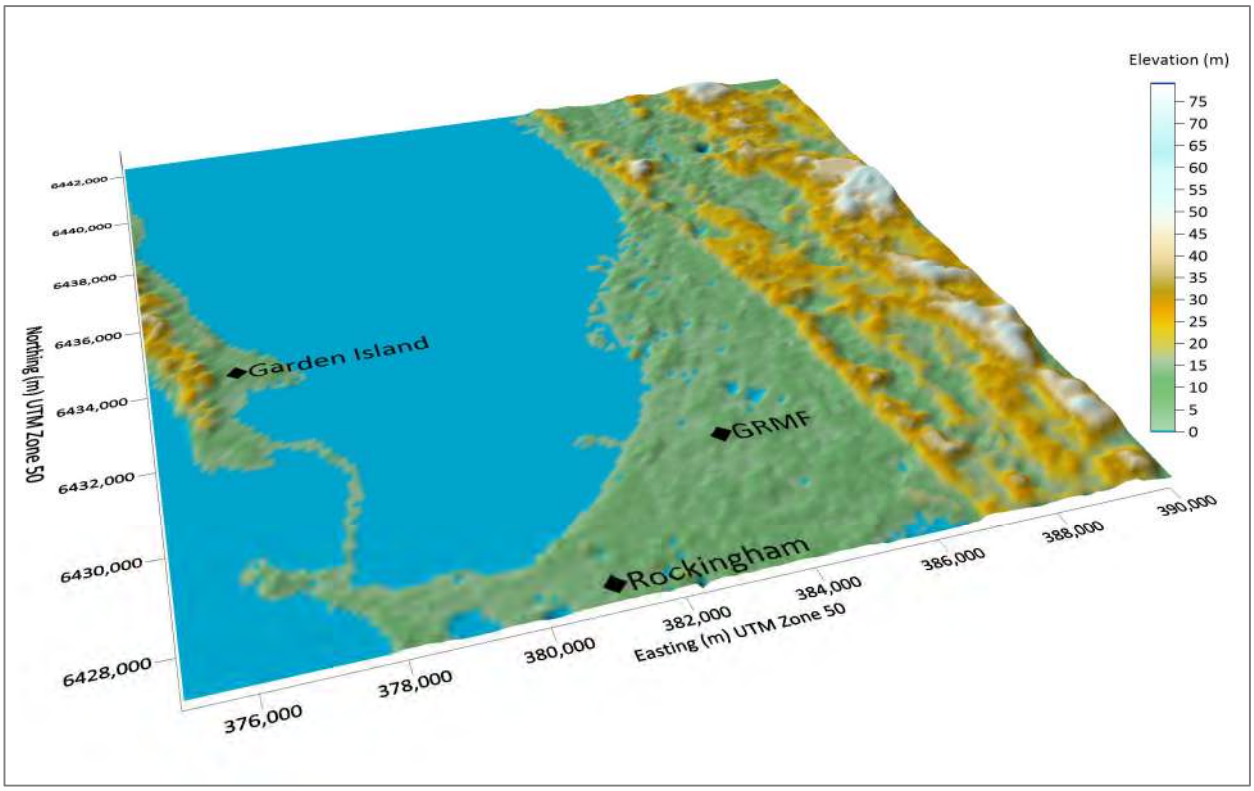
ID	Description	UTM Coordinates	Approximate Distance and Direction from Project
R1	Residence	382,152 m E 6,429,671 m S	1.6 km west
R2	Residence	383,726 m E 6,427,939 m S	2.1 km south
R3	Residence	387,063 m E 6,430,017 m S	3.3 km east
R4	Commercial/industrial	385,505 m E 6,297,767 m S	0.32 km south
R5	Commercial/industrial	383,293 m E 6,430,215 m S	0.45 km west
R6	Commercial/industrial	387,740 m E 6,430,734 m S	0.70 km north
R7	Commercial/industrial	385,217 m E 6,430,168 m S	1.5 km east

Figure 3 Location of Modelled Sensitive Receptors

5.2 Topography

The topography surrounding the GRMF is relatively flat, with no major terrain features nearby other than the coastline, approximately 1.2 km to the east. A three-dimensional representation of the topography in the region surrounding the Project is presented in Figure 4.

Figure 4 Site Topography



5.3 Local Meteorology

The Project site is located within the southwest region of Western Australia, which is characterised by a dry Mediterranean climate, consisting of hot, dry summers and mild, wet winters. The nearest Automatic Weather Stations (AWSs) to the Project site operated by the Bureau of Meteorology (BoM) are the Jandakot Aero AWS, located approximately 20 km to the northeast, and Garden Island Hsf AWS, located approximately 8 km to the west off the coast. The Jandakot Aero AWS (Station 9172) was commissioned in 1972 and has long term (1972-2020) meteorological data for the following parameters:

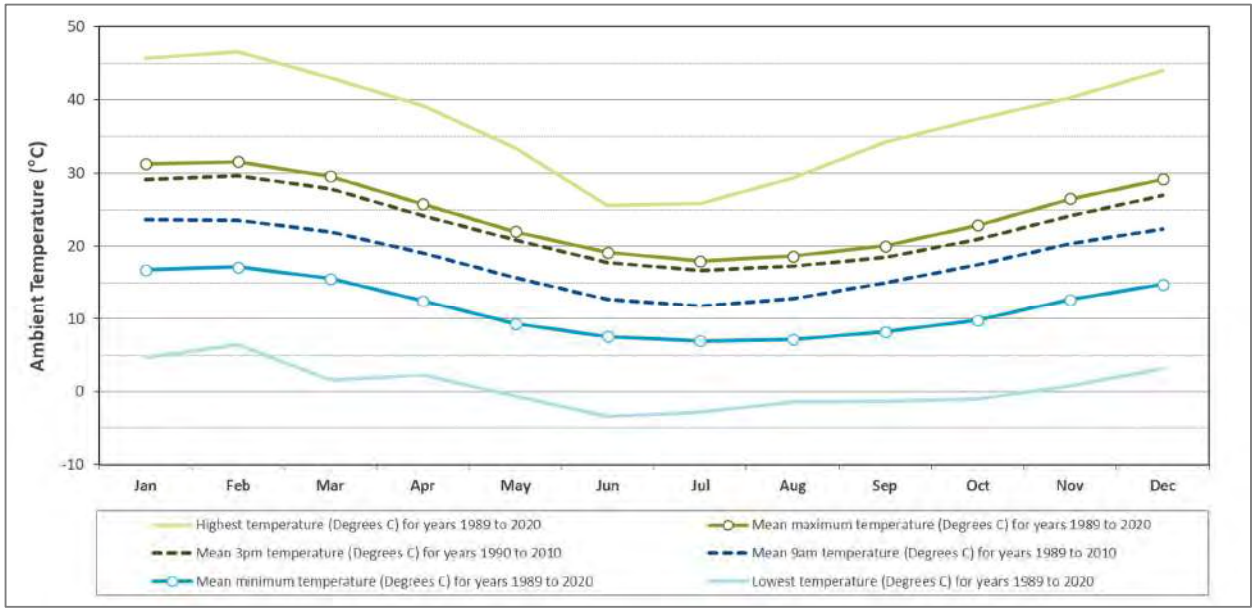
- Temperature (°C)
- Rainfall (mm)
- Relative humidity (%)
- Wind speed (m/s) and wind direction (degrees).

Data from this AWS has been used to characterise the climate of the study area, rather than Garden Island, as it is located on the mainland with no significant topographical features between it and the Site. However, as it is located further inland, some slight differences in meteorological patterns may be expected between it and the Site.

5.3.1 Temperature

Long-term temperature statistics for the Jandakot Aero AWS are summarised in Figure 5. Mean maximum temperatures range from 18°C to 32°C, while mean minimum temperatures range from 7°C to 17°C. Maximum temperatures above 45°C and minimum temperatures less than 0°C have been recorded.

Figure 5 Long Term Temperature Data - Jandakot Aero AWS (1989 – 2020)

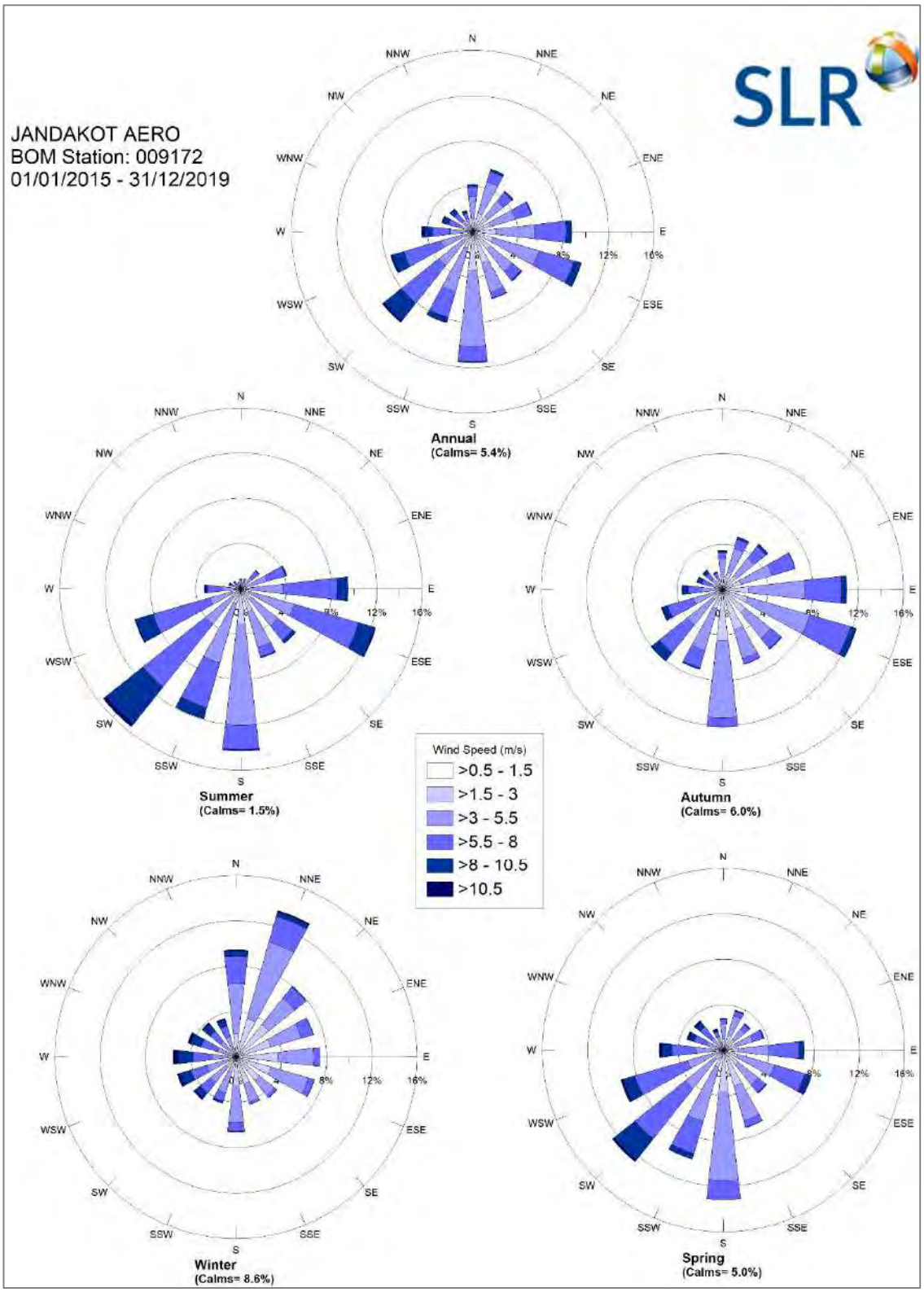


5.3.2 Wind Speed and Direction

Five-year average (2015 – 2019) wind data recorded by the Jandakot Aero AWS are presented as a wind rose in Figure 6. The wind rose shows the frequency of occurrence of winds by direction and strength. The bars correspond to the 16 compass points (degrees from north). The bar at the top of each wind rose diagram represents winds blowing from the north (i.e., northerly winds), and so on. The length of the bar represents the frequency of occurrence of winds from that direction, and the widths of the bar sections correspond to wind speed categories, the narrowest representing the lightest winds. Thus, it is possible to visualise how often winds of a certain direction and strength occur over a long period, either for all hours of the day, or for particular periods during the day.

Figure 6 shows that on an annual basis, winds from the east-southeast to southwest are predominant at the Jandakot Aero AWS, with a lower frequency of winds from other quadrants. Winds from the northwest quadrant are particularly uncommon.

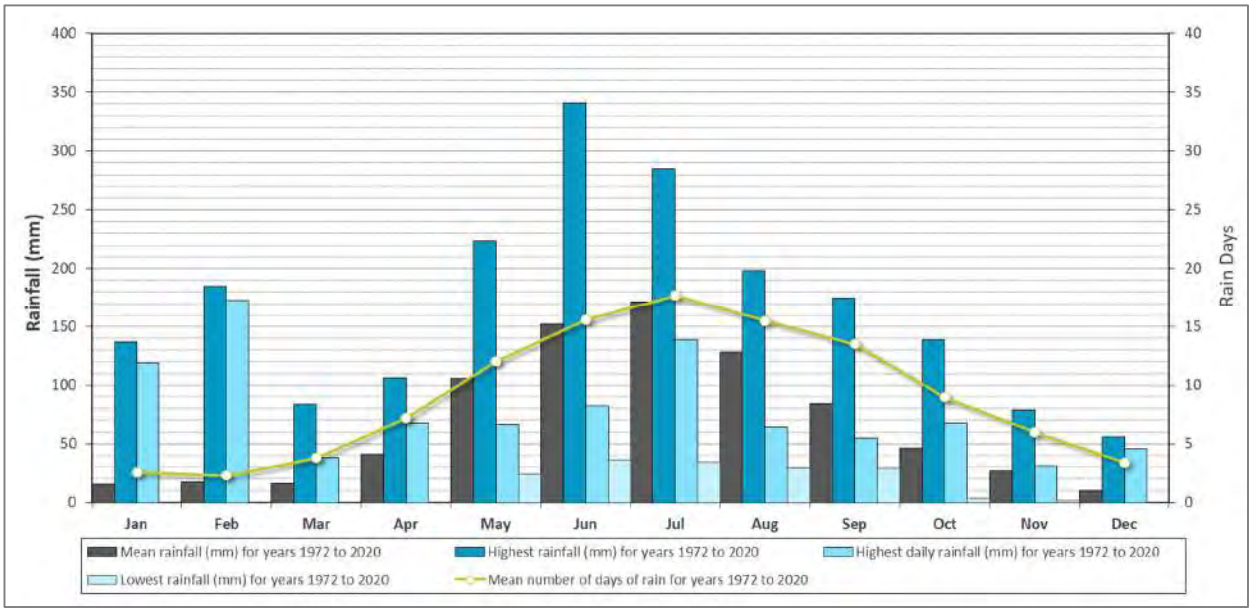
Figure 6 Wind Roses –Jandakot Aero AWS (2015-2019)



5.3.3 Rainfall

Long-term rainfall statistics for the Jandakot Aero AWS are summarised in Figure 7. Rainfall is highest between June to August (Winter) and low during December to February (Summer), with the lowest monthly average of 10.6 mm recorded during December. The highest monthly rainfall recorded over the time period examined was 341 mm recorded in June 1983.

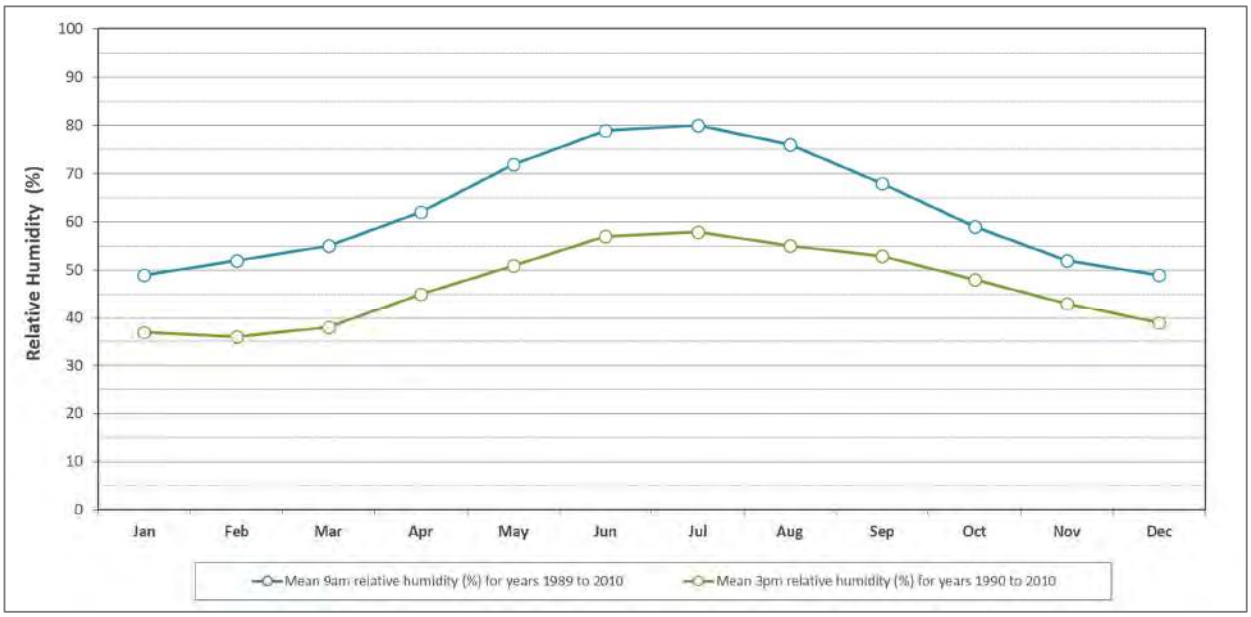
Figure 7 Long Term Rainfall Data - Jandakot Aero AWS



5.3.4 Relative Humidity

Long-term (1990 – 2010) humidity statistics (9 am and 3 pm monthly averages) for the Jandakot Aero AWS are shown in Figure 8. Morning humidity levels range from an average of around 49% in mid-summer to around 80% in mid-winter. Afternoon humidity levels are lower, at around 58% in mid-winter and dropping to a low of 36% in late summer.

Figure 8 Humidity Data –Jandakot Aero AWS



5.4 Existing Air Quality

The air quality in the vicinity of the Site is likely to be influenced by industrial emissions from the nearby Kwinana Industrial Area, approximately 1 km to the north, and to a lesser extent by motor vehicles and other domestic activities in the local area and from the city of Perth. A large proportion of industrial air emissions that occur in the Perth airshed are due to industries that are located in the Kwinana Industrial Area.

In order to assess potential cumulative air quality impacts against the ambient air quality criteria, the background air quality needs to be characterised. DWER operates a number of Ambient Air Quality Monitoring Station (AQMSs) within the Perth metropolitan area and a summary of the data recorded at the closest AQMS (South Lake) for the pollutants of interest for the is provided in Table 4.

The data indicates that the while CO, NO_2 and SO_2 indicators have all been reported below the relevant criteria during recent years, maximum concentrations of PM_{10} and especially $PM_{2.5}$ have exceeded the criteria on occasion. This is not uncommon for urban environments across Australia.

Ozone (O_3) concentrations are provided as these are required for NO_x to NO_2 conversion estimations as detailed in Section 7.4.2.

Table 4 Ambient Criteria Pollutant Concentrations at South Lake AQMS

Year	Concentration							
	Maximum	99th Percentile	98th Percentile	95th Percentile	90th Percentile	75th Percentile	50th Percentile	Annual Average[a]
Daily Peak 8-Hour Average CO Concentration (ppm)								
2018	1.9	1.3	1.3	1.0	0.9	0.4	0.3	-
2019	1.4	1.2	1.2	1.0	0.8	0.5	0.3	-
2020	1.4	1.1	1.0	0.8	0.6	0.4	0.2	-
Criteria	9.0							-
Daily Peak 1-Hour Average NO_2 Concentration (ppm)								
2018	0.047	0.035	0.033	0.029	0.027	0.022	0.015	0.007
2019	0.036	0.031	0.030	0.028	0.026	0.021	0.016	0.007
2020	0.036	0.031	0.028	0.025	0.024	0.019	0.014	0.006
Criteria	0.12							-
Daily Peak 1-Hour Average O_3 Concentration (ppm)								
2018	0.061	0.048	0.044	0.039	0.035	0.032	0.029	-
2019	0.083	0.062	0.057	0.047	0.040	0.033	0.029	-
2020	0.061	0.054	0.048	0.042	0.038	0.032	0.029	-
Criteria	0.1							-
Daily Peak 1-Hour Average SO_2 Concentration (ppm)								
2018	0.022	0.016	0.015	0.012	0.010	0.0006	0.003	-
2019	0.019	0.016	0.014	0.012	0.010	0.006	0.004	-
2020	0.010	0.009	0.0009	0.008	0.006	0.005	0.003	-
Criteria	0.2							-
24-Hour Average SO_2 Concentration (ppm)								
2018	0.005	0.004	0.004	0.004	0.003	0.003	0.002	0.002
2019	0.006	0.005	0.005	0.004	0.004	0.003	0.002	0.002
2020	0.006	0.005	0.005	0.004	0.003	0.003	0.002	0.002
Criteria	0.08							0.02
24-Hour Average PM_{10} Concentration (µg/m³)								
2018	57.1	40.7	34.3	26.7	23.7	20.0	15.4	16.3
2019	98.8	40.4	37.0	30.7	26.7	21.6	16.7	17.7
2020	45.2	32.8	31.8	25.3	21.7	16.8	12.6	13.9
Criteria	50							25
24-Hour Average $PM_{2.5}$ Concentration (µg/m³)								
2018	43.3	27.6	20.2	15.0	12.3	9.4	7.5	8.4
2019	28.9	18.0	16.0	13.5	12.4	9.8	7.8	8.2
2020	34.6	24.7	21.8	14.3	11.3	8.3	6.2	7.2
Criteria	25							8

a If reported

6 Screening Analysis

The Air Emissions Guideline presents a screening analysis to enable insignificant air emissions to be identified and omitted from further detailed analysis.

The screening analysis is a conservative analysis involving simple calculations to predict the screening concentration (SC) assuming worst-case conditions and not considering all factors affecting air dispersion. The SC values are compared with the ambient air quality guideline values (AGV) screening tolerances, which represent likely insignificant impacts.

The screening calculation assumes point source emissions (as from the Project stacks) and excludes plume rise (i.e., as provided by stack exit velocity and temperature), making it conservative (i.e., likely to provide estimates of concentrations higher than would actually occur).

The Air Emissions Guideline indicates that the SC can be assumed to be insignificant if it is:

- < 10% of the 1-hour average AGV
- < 3% of the 24-hour average AGV
- < 1% of the annual average AGV

Note that for this assessment, the 8-hour average SC for CO is conservatively assessed against the 24-hour AGV.

6.1 Screening Concentration Calculation

Step 1: Emission Rate

The emission rate, *E* (g/s), is calculated as follows:

$$E = \frac{C}{1000} Q$$

where *C* is the emission concentration (mg/m^3) expressed on a dry basis at standard conditions and *Q* is the volumetric flow rate of emission in m^3/s.

Step 2: Effective Emission Height

The effective emission height, H_{eff} (m), equals the stack height, unless the stack is near a building that is large enough to affect the plume. In this guideline, the H_{eff} calculation is a conservative approach that estimates the reduction of plume height.

For the Project scenarios where stacks are located near or protruding from buildings with heights (*Hb*) that are greater than 40% of the height of the stack, *Hs*, H_{eff} is calculated as follows:

$$H_{eff} = \frac{Hs}{3}\left(\frac{Hs}{Hb} + 0.5\right)$$

Step 3: Screening Concentration

The SC ($\mu g/m^3$) is calculated from the emission rate and the emission dispersion factor, C_{UE}, which is taken from a lookup table provided in the Air Emissions Guideline (Table 4, page 13).

The SC value is expressed as a percentage of the applicable AGVs at ambient conditions (25˚C, 101.325 kPa) and is assessed against the AGV tolerances (above).

6.2 Results

The results of the screening analysis conducted for all monitored test emissions provided by Ecograf and GR Engineering is provided in Table 5.

Screening analysis is conducted for the following sources and pollutants:

- Kiln flue: NOx (as NO_2)
- Kiln off-gas scrubber stack: H_2S
- Flash dryer flue: NO_x (as NO_2)
- Boiler flue: NO_x (as NO_2)
- Baghouse: PM_{10}, $PM_{2.5}$

Pollutant emissions from the kiln off-gas scrubber, flash dryer, boiler and baghouse are screened out by the process. The screening processes indicates that emissions of NO_x from the kiln exhaust required further detailed assessment.

Table 5 Project Emissions Screening Analysis

Pollutant	AGV		Max. In-Stack Concentration (µg/m³) or Emission Rate (kg/h)	Emission Rate (g/s)	Effective Emission Height (m)			Emission Dispersion Factor (C_{UE})	Screening Concentration		Tolerance (%)	AGV Screening Criterion Met?
	Conc. (µg/m³)	Averaging Period			Hs	Hb	Heff		(µg/m³)	% of AGV		
Kiln Scrubber Stack (100°C)												
H_2S	2800	1 Hour	0.15 kg/h	0.0012	15	10	10	335	0.51	0.02%	10	Yes
	1500	24 Hour						91	0.14	0.09%	3	Yes
	2	Annual						12	0.018	0.91%	1	Yes
Kiln Exhaust (550°C)												
NO (assume all is NO_2)	226	1 Hour	0.001 kg/h	0.041	18	10	13.8	335	38	17%	10	No
	56	Annual						12	1.4	2.4%	1	No
Flash Dryer Exhaust (91°C)												
NO (assume all is NO_2)	226	1 Hour	0.001 kg/h	0.00022	8	10	3.5	2210	0.59	0.26%	10	Yes
	56	Annual						80	0.021	0.038%	1	Yes
Boiler Flue (200°C)												
NO (assume all is NO_2)	226	1 Hour	0.007 kg/h	0.00019	6	10	2.2	2210	6.8	3.0%	10	Yes
	56	Annual						80	0.25	0.44%	1	Yes
Baghouse (90°C; 105,800 Am³/h;)												
PM_{10}	46	24 Hour	25 µg/m³	0.00073	12	10	6.8	376	0.34	0.73%	3	Yes
	23	Annual						48	0.043	0.19%	1	Yes
$PM_{2.5}$	23	24 Hour	8 µg/m³	0.00024	12	10	6.8	376	0.11	0.47%	3	Yes
	7	Annual						48	0.014	0.20%	1	Yes

7 Detailed Assessment Methodology

7.1 Overview

Emissions from the proposed GRMF were modelled using a combination of the WRF, CALMET and CALPUFF models. CALPUFF is a transport and dispersion model that ejects "puffs" of material emitted from modelled sources, simulating dispersion and transformation processes along the way. In doing so, it typically uses the fields generated by a meteorological pre-processor CALMET, discussed further below. Temporal and spatial variations in the meteorological fields selected are explicitly incorporated in the resulting distribution of puffs throughout a simulation period. The primary output files from CALPUFF contain hourly concentration evaluated at selected receptor locations. The CALPOST post-processor is then used to process these files, producing tabulations that summarise results of the simulation for user-selected averaging periods.

7.2 Meteorological Modelling Methodology

Meteorological mechanisms govern the dispersion, transformation, and eventual removal of pollutants from the atmosphere. The extent to which pollution will accumulate or disperse in the atmosphere is dependent on the degree of thermal and mechanical turbulence within the earth's boundary layer. Dispersion comprises vertical and horizontal components of motion. The stability of the atmosphere and the depth of the surface-mixing layer define the vertical component. The horizontal dispersion of pollution in the boundary layer is primarily a function of the wind field. The wind speed determines both the distance of downwind transport and the rate of dilution as a result of plume 'stretching'. The generation of mechanical turbulence is similarly a function of the wind speed, in combination with the surface roughness. The wind direction, and the variability in wind direction, determines the general path pollutants will follow, and the extent of crosswind spreading. Pollution concentration levels therefore fluctuate in response to changes in atmospheric stability, to concurrent variations in the mixing depth, and to shifts in the wind field (Oke, 2002).

For this study, a site-representative three-dimensional meteorological dataset was compiled using a combination of the WRF and CALMET models, details of which are provided in Appendix A.

7.3 Background Concentrations

The predicted Project impacts must be added to the existing background concentrations to give cumulative concentrations with can be assessed against the relevant AGVs. The background concentrations adopted for this study based on the South Lake AQMS monitoring data (Section 5.4) are provided in Table 6.

Table 6 Adopted Background Levels

Pollutant	Averaging Period	Concentration ($\mu g/m^3$)	Comments
NO_2	1-hour	54.8	Maximum of 90th percentile concentrations recorded in 2015-2019 period at South Lake
	Annual	14.2	Maximum of annual average concentrations recorded over the 2015-2019 period at South Lake

7.4 Additional Model Parameters and Options

A summary of additional CALPUFF modelling options and parameters used for the assessment is provided in Table 7.

Table 7 Model Parameters

Parameter	Option
Calculation Type	Concentration
Plume Rise Method	Briggs
Building Downwash	BPIP-PRIME
Gridded Receptors	Cartesian 7 km x 6 km; 100 m spacing; 0 m AGL centred on the GRMF
Discrete Receptors	Refer Table 3

AGL Above ground level

7.4.1 Building Downwash

Building downwash is a phenomenon caused by structures near to pollutant emission sources influencing atmospheric turbulence. Airflow is rapidly mixed to the ground as frictional forces and pressure gradients cause stagnations and eddies to develop in the wake of buildings downwind of elevated sources.

The USEPA has established a Good Engineering Practice (GEP) stack height which is defined as the 'height necessary to ensure that emissions from the stack do not result in excessive concentrations of any air pollutants in the immediate vicinity of the source as a result of atmospheric downwash, eddies or wakes which may be created by the source itself, nearby structures or nearby terrain obstacles' (USEPA, 1985). The definition of GEP stack height is the building height plus 1.5 times the lesser of the building height or projected building width.

A stack is considered to be wake affected when the stack and building are located less than five times the lesser of the building height or project building width apart.

CALPUFF contains the *Prime* algorithm which was used to predict building downwash effects. Influencing building dimensions were calculated using the USEPA's Building Profile Input Program (BPIP).

For modelling purposes, proposed site buildings as well as enclosures for the proposed generators were included in the modelling to account for the potential the building wakes. Details of the included buildings are provided in Table 8.

Table 8 Buildings Included in Model

Building Identification	Height (m)
MS 1+2	6.5
PP17	19
Kiln 16	13
Dryer 22	14
SPG BP 20	8.0
Plant 24+24	7.0

7.4.2 NO_x to NO_2 conversion

NO_x emitted from combustion processes mainly consist of NO with a small portion (approximately 10%) of NO_2. In the atmosphere however, NO emitted from the source oxidises to NO_2 in the presence of ozone (O_3) and sunlight as it travels further from the source. The rate of oxidation depends on a number of parameters including the ambient O_3 concentration. The Approved Methods lists the following methods that can be applied to take account the oxidation of NO to NO_2 in estimating downwind NO_2 concentrations at receptor locations and are used in the absence of more detailed information in the Air Emissions Guideline

Method 1 – 100% Conversion

This method is usually used as a screening level assessment and assumes 100% conversion of NO to NO_2 before the plume arrives at the receptor location. Use of this method can significantly over-predict NO_2 concentrations at nearfield receptors. Given the close proximity of sensitive receptors to the Site the use of Method 1 (100% conversion) is not appropriate.

Method 2 – Ambient Ozone Limiting Method (OLM)

This method assumes that all the available ozone in the atmosphere will react with NO in the plume until either all the O_3 or all the NO is used up. NO_2 concentrations can be estimated by this method using the following equation:

$$[NO_2]_{total} = \{0.1 \times [NO_x]_{pred}\} + MIN\{(0.9) \times [NO_x]_{pred} \text{ or } (46/48) \times [O3]_{bkgd}\} + [NO_2]_{bkgd}$$

Again, given the close proximity of sensitive receptors with short transport and duration periods from the Site, Method 2 could be deemed overly conservative as it assumes that the atmospheric reaction is instantaneous when in reality, the reaction takes place over a number of hours (NSW EPA, 2017).

Method 3 – NO to NO_2 conversion using empirical relationship

An empirical equation for estimating the oxidation rate of NO in power plant plumes dependent on distance downwind from the source and the parameters A and α and has the following form:

$$NO_2 = NO_x \times A(1 - e^{-\alpha x})$$

where *x* is the distance from the source and A and α are classified according to the O_3 concentration, wind speed and season (Janssen, van Wakeren, van Duuran, & Elshout, 1988) as provided in Table 9.

Table 9 Classification of Values for A and α by Season

Season	Ozone (ppb)	Wind Speed (m/s)		
		5	15	>15
Winter	40	A = 0.87 α = 0.07	A = 0.87 α = 0.07	A = 0.87 α = 0.15
	30	A = 0.82 α = 0.07	A = 0.83 α = 0.07	A = 0.83 α = 0.07
	20	A = 0.74 α = 0.07	A = 0.74 α = 0.07	A = 0.74 α = 0.07
	10	A = 0.49 α = 0.05	A = 0.49 α = 0.05	A = 0.49 α = 0.05
Spring/Autumn	60	A = 0.85 α = 0.10	A = 0.85 α = 0.15	A = 0.85 α = 0.30
	40	A = 0.80 α = 0.10	A = 0.80 α = 0.10	A = 0.80 α = 0.25
	30	A = 0.74 α = 0.10	A = 0.74 α = 0.10	A = 0.74 α = 0.15
	20	A = 0.635 α = 0.10	A = 0.635 α = 0.10	A = 0.635 α = 0.10
Summer	200	A = 0.93 α = 0.40	A = 0.93 α = 0.65	A = 0.93 α = 0.80
	120	A = 0.88 α = 0.20	A = 0.88 α = 0.35	A = 0.88 α = 0.45
	60	A = 0.81 α = 0.15	A = 0.81 α = 0.25	A = 0.81 α = 0.35
	40	A = 0.74 α = 0.10	A = 0.74 α = 0.15	A = 0.74 α = 0.25
	30	A = 0.67 α = 0.10	A = 0.67 α = 0.10	A = 0.67 α = 0.10

This assessment employs Method 3, assuming the maximum hourly averaged O_3 concentration for South Lake (61 ppb, refer Table 4) for every hour of the year, to conservatively estimate the maximum incremental and cumulative NO_2 impacts at nearby sensitive receptors as a result of the GRMF emissions. Additional conservatism is realised by using predicted hourly ground-level windspeeds, rather than those predicted at the emission height (15 to 18 m above ground level) where windspeeds would generally be greater.

7.5 Project Inputs

Point sources representing the stack emissions sources are input into the model as provided in Table 10.

Table 10 Modelled Emissions Source

Source	Stack Parameters				Emission Rate (g/s)	
	Release Height (m)	Diameter (m)	Temperature (°C)	Velocity (m/s)	NO_x	H_2S
Kiln combustion	18	0.40	350	12.7	237	0.0
Quench Tank Scrubber	15	0.18	80	8.1	1.6	0.080

7.6 Accuracy of Modelling

All atmospheric dispersion models, including CALPUFF, represent a simplification of the many complex processes involved in the dispersion of pollutants in the atmosphere. To obtain good quality results it is important that the most appropriate model is used and the quality of the input data (meteorological, terrain, source characteristics) is adequate.

The main sources of uncertainty in dispersion models, and their effects, are discussed below:

- Oversimplification of physics: This can lead to both under-prediction and over-prediction of ground level pollutant concentrations. Uncertainties are greater in Gaussian plume models as they do not include the effects of non-steady-state meteorology (i.e., spatially- and temporally varying meteorology).
- Uncertainties in emission rates: Ground level concentrations are proportional to the pollutant emission rate. In addition, most modelling studies assume constant worst-case emission levels, or are based on the results of a small number of stack tests (where relevant), however in reality, operations (and thus emissions) are often quite variable. Accurate measurement of emission rates and source parameters requires continuous monitoring.
- Uncertainties in wind direction and wind speed: Wind direction affects the direction of plume travel, while wind speed affects plume rise and dilution of plume. Uncertainties in these parameters can result in errors in the predicted distance from the source of the plume impact, and magnitude of that impact. In addition, aloft wind directions commonly differ from surface wind directions. The preference to use rugged meteorological instruments to reduce maintenance requirements also means that light winds are often not well characterised.
- Uncertainties in mixing height: If the plume elevation reaches 80% or more of the mixing height, more interaction will occur, and it becomes increasingly important to properly characterise the depth of the mixed layer as well as the strength of the upper air inversion.
- Uncertainties in temperature: Ambient temperature affects plume buoyancy, so inaccuracies in the temperature data can result in potential errors in the predicted distance from the source of the plume impact, and magnitude of that impact.
- Uncertainties in stability estimates: Gaussian plume models use estimates of stability class, and 3D models use explicit vertical profiles of temperature and wind (which are used directly or indirectly to estimate stability class for Gaussian models). In either case, uncertainties in these parameters can cause either under-prediction or over-prediction of ground level concentrations. For example, if an error is made of one stability class, then the computed concentrations can be off by 50% or more.

The USEPA makes the following statement in its Modelling Guideline (US EPA, 2005) on the relative accuracy of models:

"Models are more reliable for estimating longer time-averaged concentrations than for estimating short-term concentrations at specific locations; and the models are reasonably reliable in estimating the magnitude of highest concentrations occurring sometime, somewhere within an area. For example, errors in highest estimated concentrations of ±10 to 40% are found to be typical, i.e., certainly well within the often quoted factor-of-two accuracy that has long been recognised for these models. However, estimates of concentrations that occur at a specific time and site are poorly correlated with actually observed concentrations and are much less reliable."

8 Assessment of Impacts

Table 11 presents the incremental and cumulative maximum 1-hour and annual average NO_2 concentrations predicted at identified sensitive receptor locations. Contour plots of the predicted incremental 1-hour average NO_x concentrations are presented in Figure 9.

The modelling results indicate that the predicted cumulative maximum 1-hour and annual average NO_2 concentrations are below the relevant ambient air quality criteria at sensitive receptor locations.

Table 11 Maximum Predicted NO_2 Concentrations at Sensitive Receptors

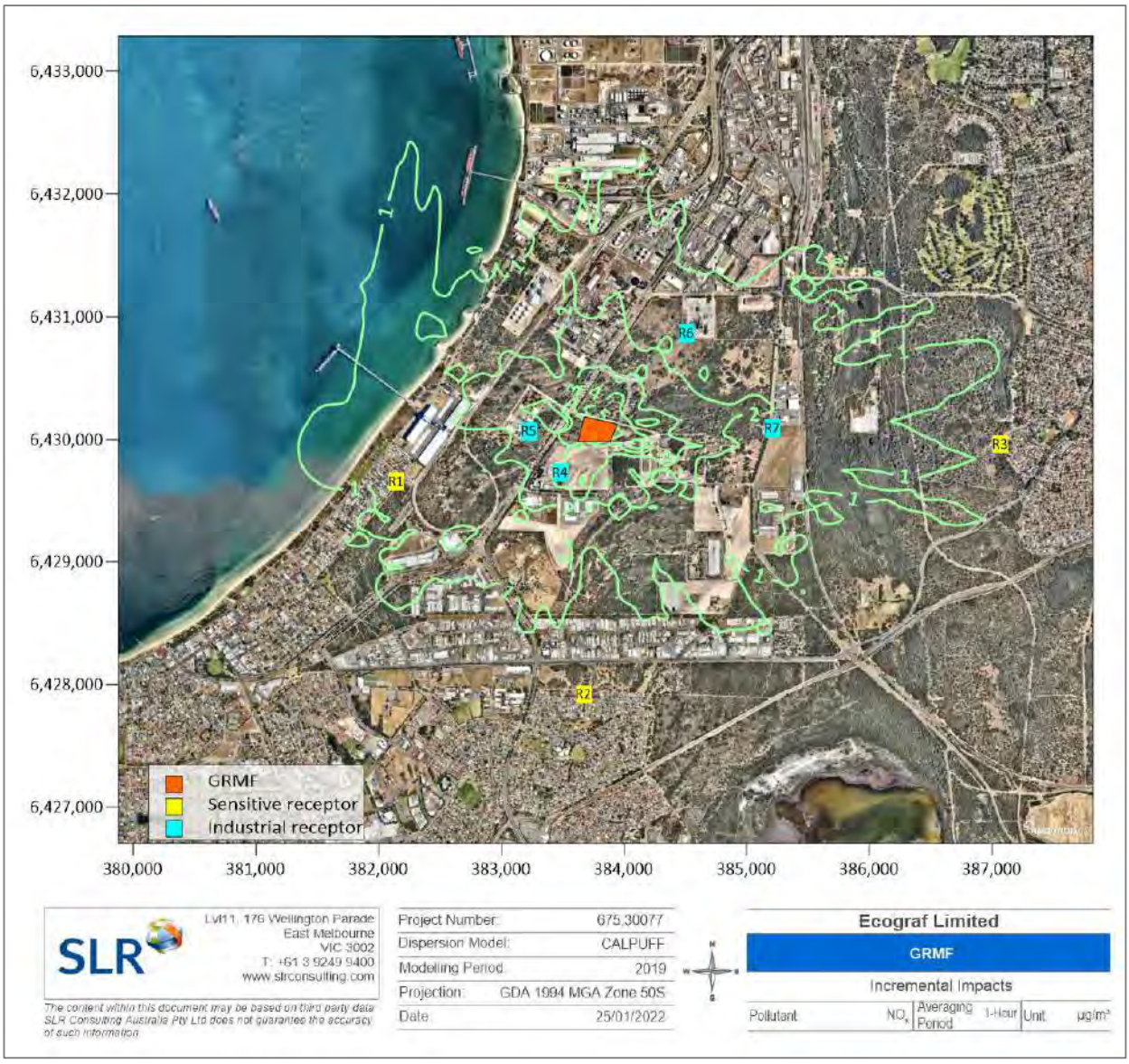
Receptor ID	Incremental (µg/m³)							Cumulative (µg/m³)	
	Maximum 1-Hour	*Corresponding 1-Hour* [a]					Annual	1-Hour	Annual
		NO_x (µg/m³)	*O_3 (ppb)* [b]	*Wind Speed (m/s)*	*Transport Time (s)* [c]	*NO_2 (µg/m³)*			
R1	0.16	0.86	61	5.8	276	55	0.0016	55	14
R2	0.047	0.29	61	2.6	808	55	0.000093	55	14
R3	0.18	0.74	61	3.2	1031	55	0.00057	55	14
R4	0.093	1.5	61	7.0	46	55	0.0015	55	14
R5	0.31	3.6	61	6.1	74	55	0.0029	55	14
R6	0.17	1.3	61	6.1	115	55	0.0033	55	14
R7	0.19	1.6	61	2.9	517	54.8	0.0010	55	14
Criteria									
							Air Guideline	226	56
							Air NEPM	164	31

a Used to calculate 1-hour incremental NO_2 concentration using the Method 3 (Section 7.4.2).

b Conservatively assumed for every hour of the year to give maximum incremental NO_2 concentration (refer Section 7.4.2).

c Approximate plume transport time from source to receptor based on windspeed and separation distance.

Figure 9 Predicted 1-hour Average Incremental NO_X Isopleths – Operations



9 Conclusions

Using emissions characteristics proposed by GR Engineering and Ecograf, emissions from the proposed GRMF have been assessed in accordance with the Air Emissions Guideline with the AGV screening criterion met for kiln the kiln off-gas scrubber, flash dryer and baghouse demonstrating that these emissions can be considered insignificant.

NO_x emissions from the kiln exhaust were subjected to plume dispersion modelling and predicted negligible NO_2 impacts at all nearest sensitive and commercial/industrial receptors.

10 References

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APPENDIX A

Meteorological Modelling

Selection of Representative Year for Modelling

Meteorological data recorded by the meteorological station operated by the BoM at Jandakot Airport over the five-year period 2015-2019 was analysed to select a representative meteorological year. Based primarily on wind data analysis (e.g. number of calms, average wind speed etc.) the 2019 calendar year was identified as a suitably representative year for use in this study.

Weather Research and Forecast Model

The Weather Research and Forecast (WRF) model is a next-generation mesoscale numerical weather prediction system designed for both atmospheric research and operational forecasting needs. The model serves a wide range of meteorological applications across scales from tens of meters to thousands of kilometres.

For this assessment, the WRF modelling system was used to produce the meteorological field required to provide the 'initial guess' field for the CALMET meteorological model. Parameters used in the WRF model for this assessment are presented in Table A1.

Table A1 Meteorological Parameters – WRF

Parameter	Domain 1	Domain 2	Domain 3	Domain 4
Modelling domain	1,890 km × 1,890 km	171 km × 171 km	66 km × 66 km	34 km × 34 km
Grid resolution	27 km	9 km	3 km	1
Number of vertical levels	30	30	30	30
Microphysics	WSM6	WSM6	WSM6	WSM6
Cumulus parametrization	Kain-Fritsch	Kain-Fritsch	Kain-Fritsch	Kain-Fritsch
Shortwave radiation physics	Dudhia	Dudhia	Dudhia	Dudhia
Longwave radiation physics	RRTM	RRTM	RRTM	RRTM
Planetary boundary layer	YSU	YSU	YSU	YSU

CALMET

CALMET is a meteorological model that develops hourly wind and other meteorological fields on a three-dimensional gridded modelling domain that are required as inputs to the CALPUFF dispersion model. Associated two-dimensional fields such as mixing height, surface characteristics and dispersion properties are also included in the file produced by CALMET. The interpolated wind field is then modified within the model to account for the influences of topography, sea breeze (if applicable), as well as differential heating and surface roughness associated with different land uses across the modelling domain. These modifications are applied to the winds at each grid point to develop a final wind field. The final hourly-varying wind field thus reflects the influences of local topography and land uses.

The CALMET model was run for a 30 km by 30 km domain with a 300 m grid resolution. WRF-generated three-dimensional meteorological data were used as the 'initial-guess' wind field, and local topography and land use information and available meteorological data from the BoM stations located at Colpoys Point and Jandakot Airport were used to refine the wind field predetermined by WRF. Wind Data from the South Lake AQMS was not used in the modelling but was instead used to verify the model performance (see below).

Table A2 details the parameters used in the meteorological modelling to drive the CALMET model.

Table A2 Meteorological Modelling Parameters - CALMET

Parameter	Data
Modelling period	1 January 2019 to 31 December 2019
Meteorological grid resolution	100 m
Initial guess field	WRF output
Vertical resolution (cell heights)	10 (0 m, 20 m, 40 m, 80 m, 160 m, 320 m, 640 m, 1200 m, 2000 m, 3000 m, 4000 m)
Data assimilation	Colpoys Point and Jandakot Aero BoM stations

Wind Speed and Wind Direction

A summary of the annual wind behaviour predicted by CALMET for the Project site for the modelled period (2019 calendar year) is presented in Figure A1 and a wind speed frequency chart plot is presented in Figure A2. Figure A1 and Figure A2 show that light to moderate winds from the southwestern quadrant are predominant at the Site. Winds from southern and eastern quadrants are also significant, with very few winds from the northern quadrant.

Figure A1 Wind Roses for the Project Site, as Predicted by CALMET (2019)

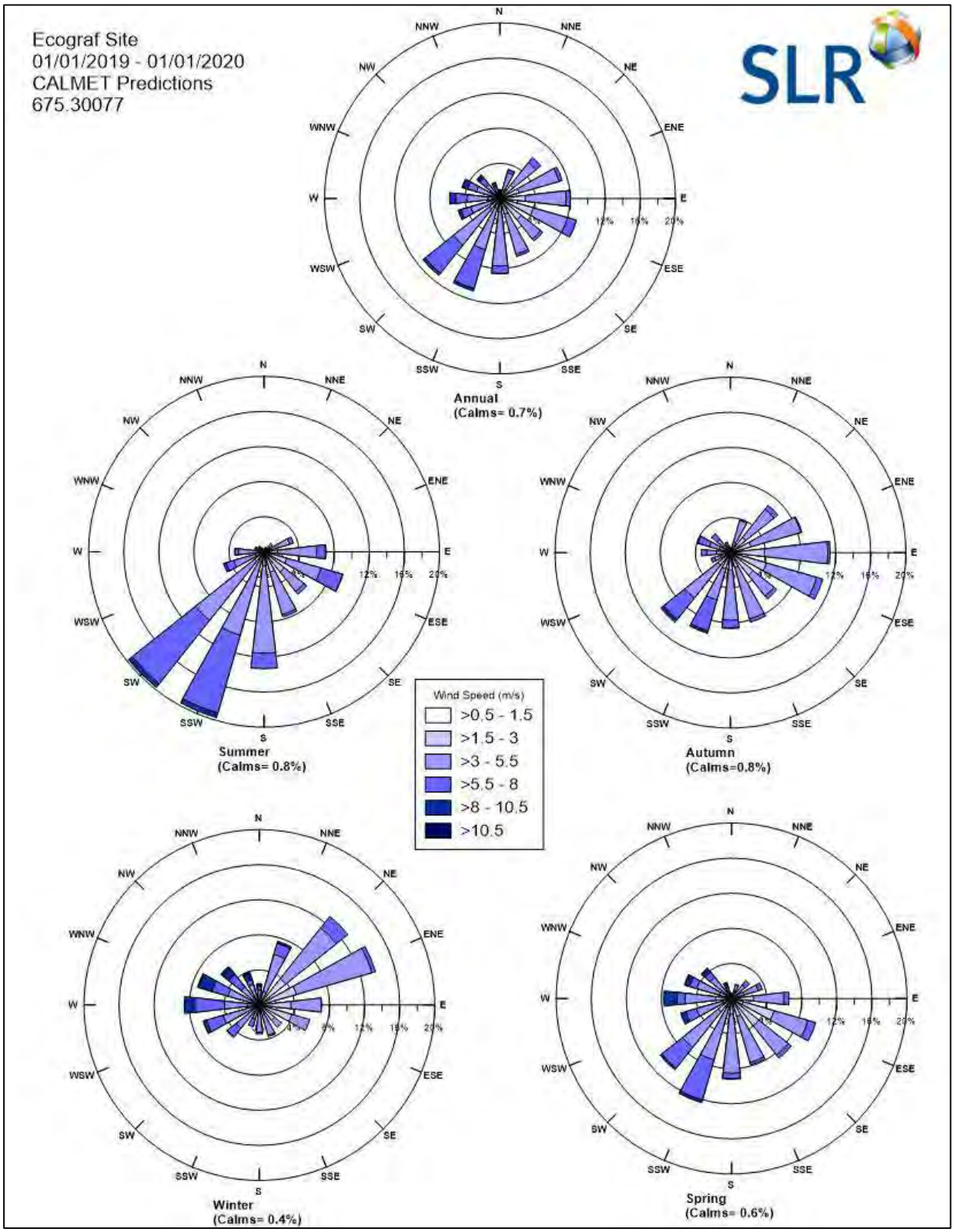
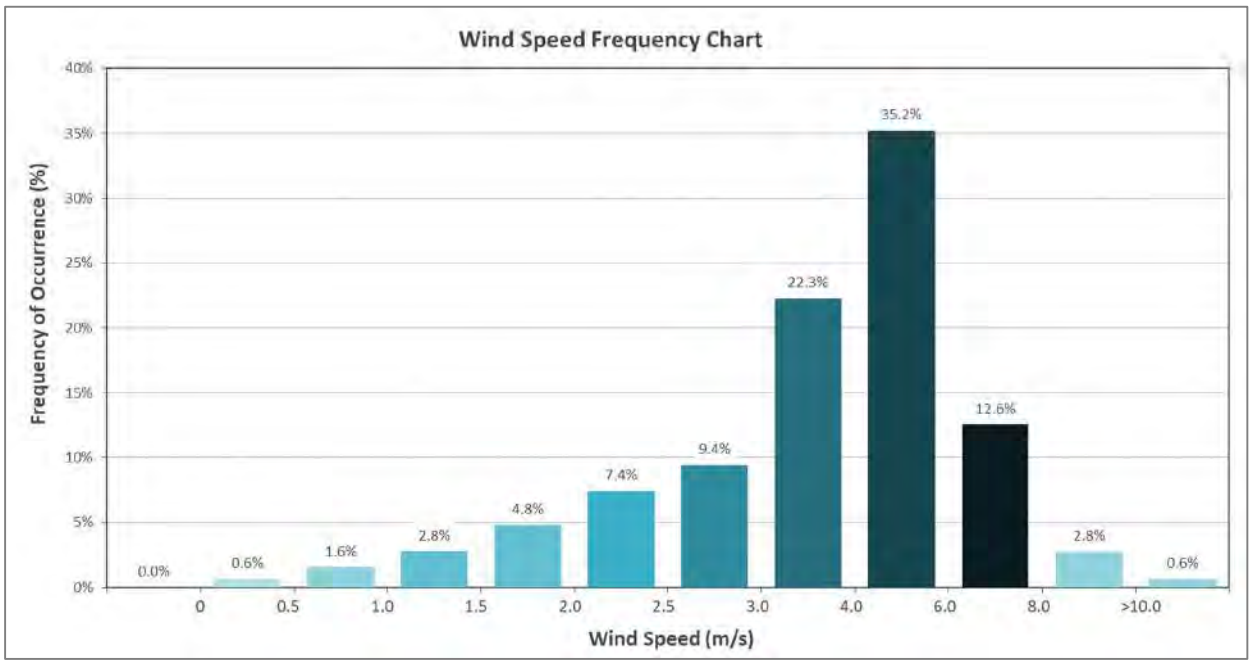


Figure A2 Wind Speed Frequency Plot for the Project Site, as Predicted by CALMET (2019)



Atmospheric Stability

Atmospheric stability refers to the tendency of the atmosphere to resist or enhance vertical motion. The Pasquill-Gifford-Turner (PGT) assignment scheme identifies six Stability Classes, A to F, to categorise the degree of atmospheric stability as follows:

- A = Extremely unstable conditions
- B = Moderately unstable conditions
- C = Slightly unstable conditions
- D = Neutral conditions
- E = Slightly stable conditions
- F = Moderately stable conditions

The meteorological conditions defining each PGT stability class are shown in Table A3.

Figure A3 shows the frequency distribution of the atmospheric stability classes predicted for the Project site. This plot shows that neutral conditions (Stability Class D) are predicted to occur very frequently at the site (approximately 45% of the time). This can be attributed to the relative high frequency of wind speeds greater than 5 m/s at the site (refer to Section 0). As shown in Table A3, night-time stable conditions (Stability Classes E and F) turn into neutral conditions (Stability Class D) when wind speeds are high, resulting in a higher frequency of neutral conditions and lower frequency of stable conditions at night. Similarly, unstable day-time conditions (Stability Classes A - C) also become neutral at higher wind speeds.

Table A3 Meteorological Conditions Defining PGT Stability Classes

Surface wind speed (m/s)	Daytime insolation			Night-time conditions	
	Strong	Moderate	Slight	Thin overcast or > 4/8 low cloud	<= 4/8 cloudiness
< 2	A	A - B	B	E	F
2 - 3	A - B	B	C	E	F
3 - 5	B	B - C	C	D	E
5 - 6	C	C - D	D	D	D
> 6	C	D	D	D	D

Notes:

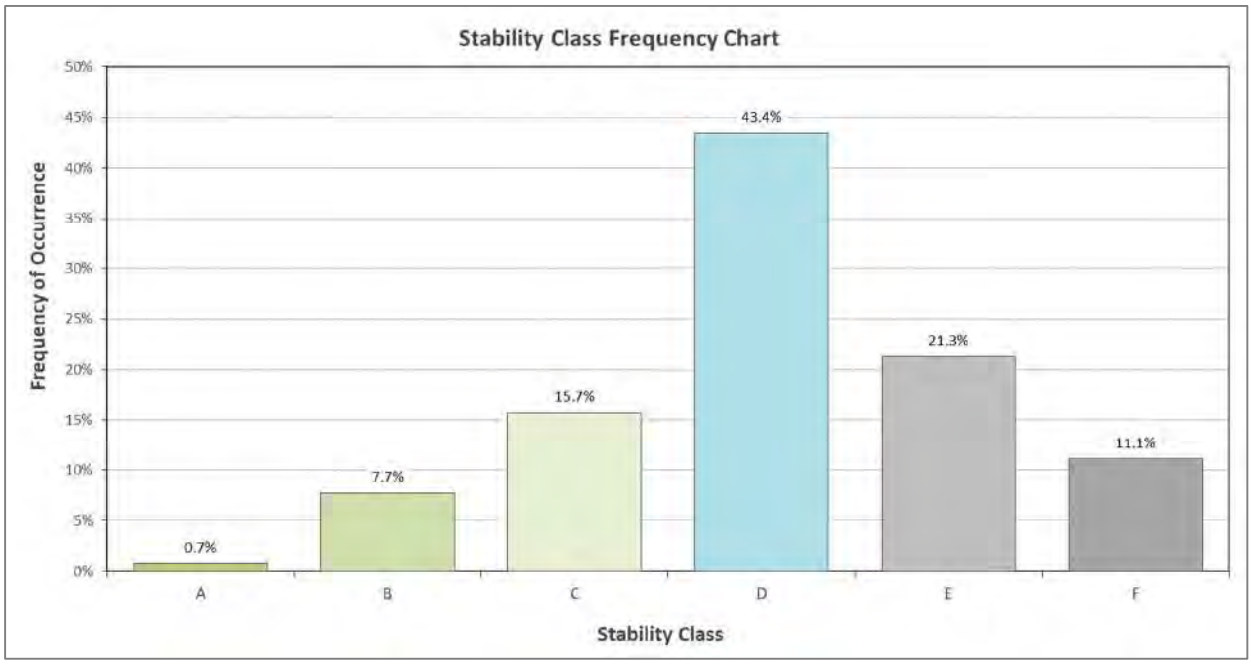
Strong insolation corresponds to sunny midday in midsummer in England; slight insolation to similar conditions in midwinter.

Night refers to the period from 1 hour before sunset to 1 hour after sunrise.

The neutral category D should also be used, regardless of wind speed, for overcast conditions during day or night and for any sky conditions during the hour preceding or following night as defined above.

Source: (NOAA, 2018)

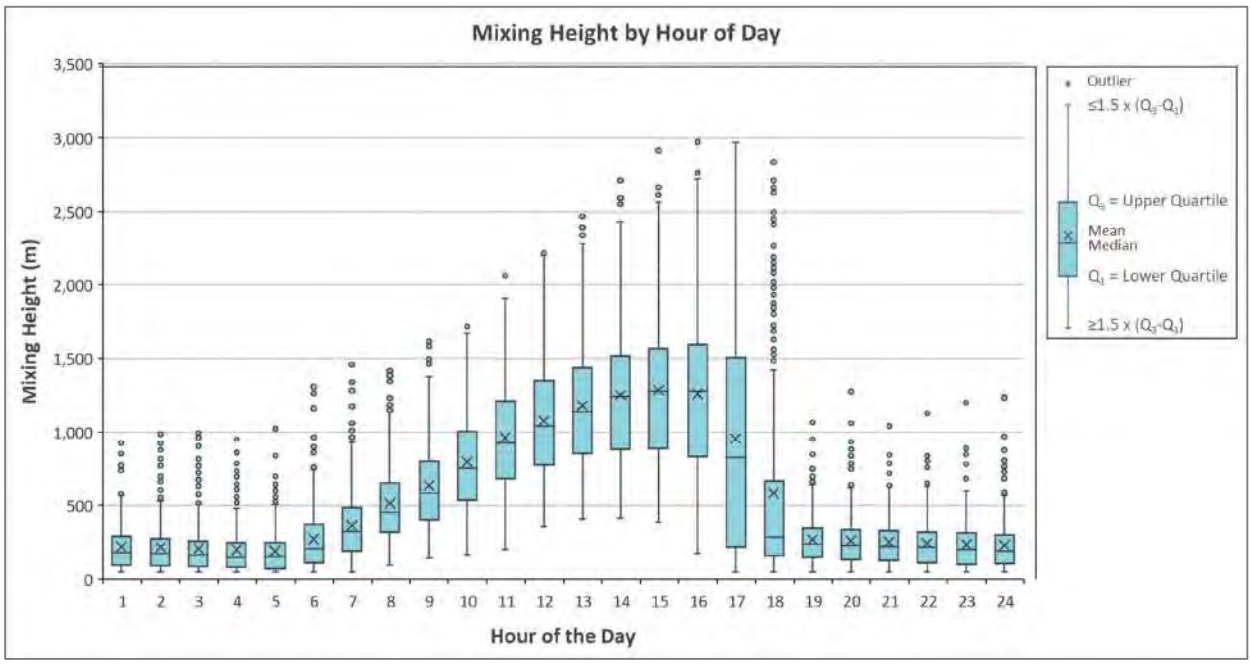
Figure A3 Stability Class Distribution Predicted by CALMET for the Project Site (2019)



Mixing Heights

The diurnal variations in the mixing heights predicted by CALMET at the Project site are illustrated in Figure A4. As would be expected, there is an increase in the mean mixing height during the morning due to the onset of vertical mixing following sunrise. Mean maximum mixing heights occur in the mid to late afternoon, due to the dissipation of ground-based temperature inversions and the growth of the convective mixing layer.

Figure A4 Mixing Heights Predicted by CALMET for the Project Site (2019)



Meteorological Model Validation

A comparison of model-predicted and measured wind data at the South Lake AQMS for 2019 is presented in Figure A5. The South Lake wind data were not used as an input to the meteorological models, and therefore provide an independent verification of the model performance.

This comparison shows that the predicted wind data are in reasonably good agreement with that measured by the monitoring station, with similar predominant wind directions. The frequency of high wind speed conditions (>8 m/s) was slightly underestimated by the modelling, however given that emissions from the power station stacks will be more rapidly dispersed under higher wind speed conditions, the use of predicted three-dimensional wind data with a lower frequency of high wind speeds would result in conservative (over)estimates of pollutant concentrations at the surrounding sensitive receptors than may otherwise be predicted.

Table A4 provides a summary of the model performance statistics, while Figure A6 and Figure A7 present the observed and predicted wind speed and wind direction frequencies, respectively. The WRF/CALMET predictions generally under-predict the wind speeds and could therefore be considered conservative for modelling purposes.

Figure A5 Comparison of Measured and Model Predicted Wind Data at South Lake AWS (2019)

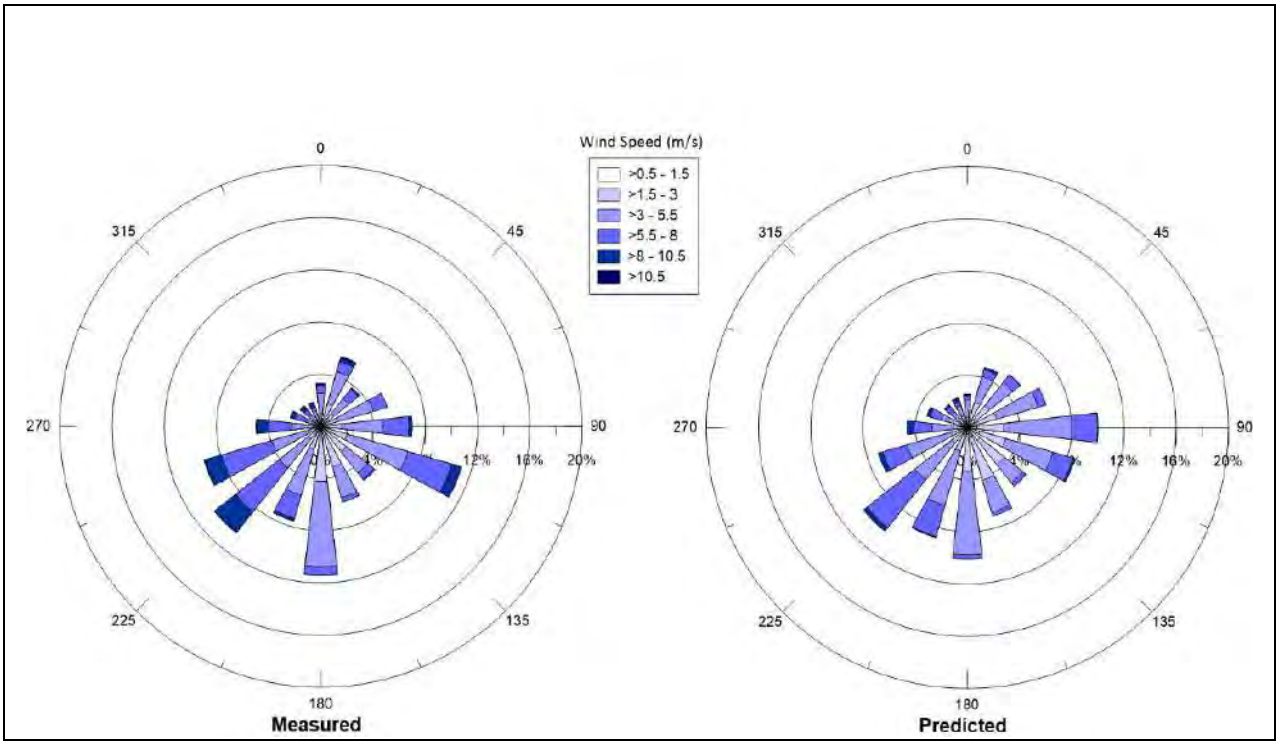


Table A4 Model Performance Statistics

Parameter	Statistic	Observed	Predicted
Wind Speed	Mean	4.6	4.1
	Standard deviation	2.3	1.9
	Index of agreement[1]	0.90	
Wind Direction	Mean[2]	166	166
	Standard deviation	84.9	84.9
	Index of agreement[1]	0.83	

1. The index of agreement (IOA) is a measure of the overall agreement between modelled and observed time series. It ranges between zero for no agreement and 1 if the two timeseries are identical. The IOA shows no agreement if the timeseries are different by orders of magnitude, even if they happen to be correlated, and hence is a more stringent measure of performance than the correlation coefficient. IOAs of 0.7 - 0.8 are considered to indicate good dispersion model performance.

2 Scalar mean.

Figure A6 Wind Speed Frequency Comparison

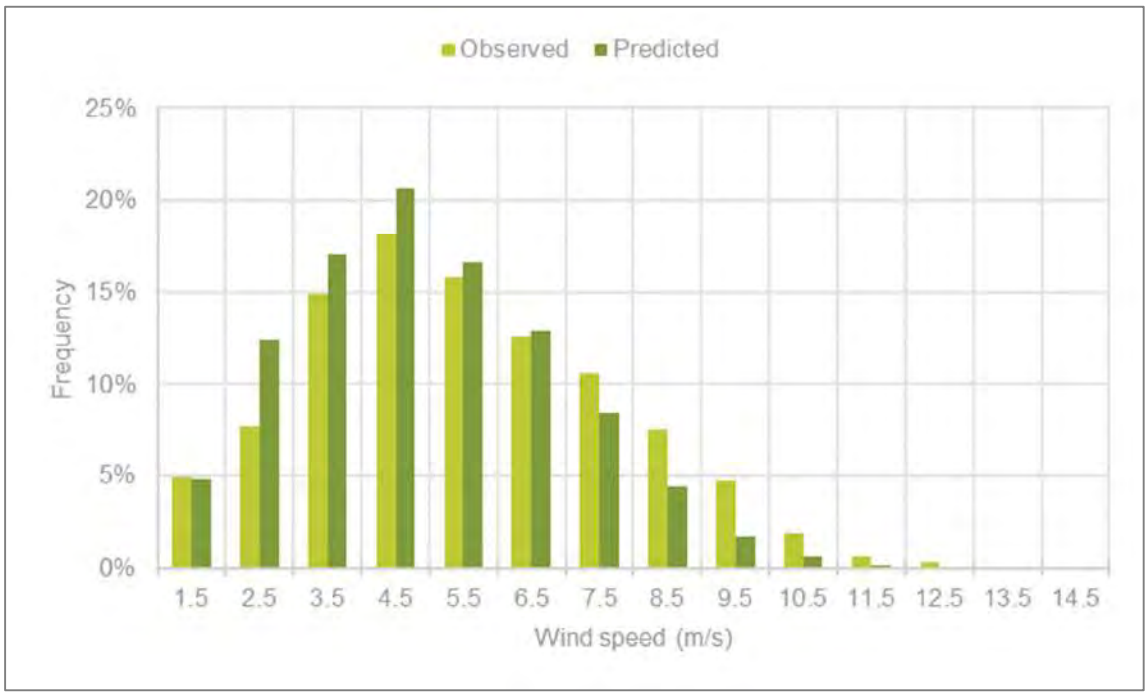
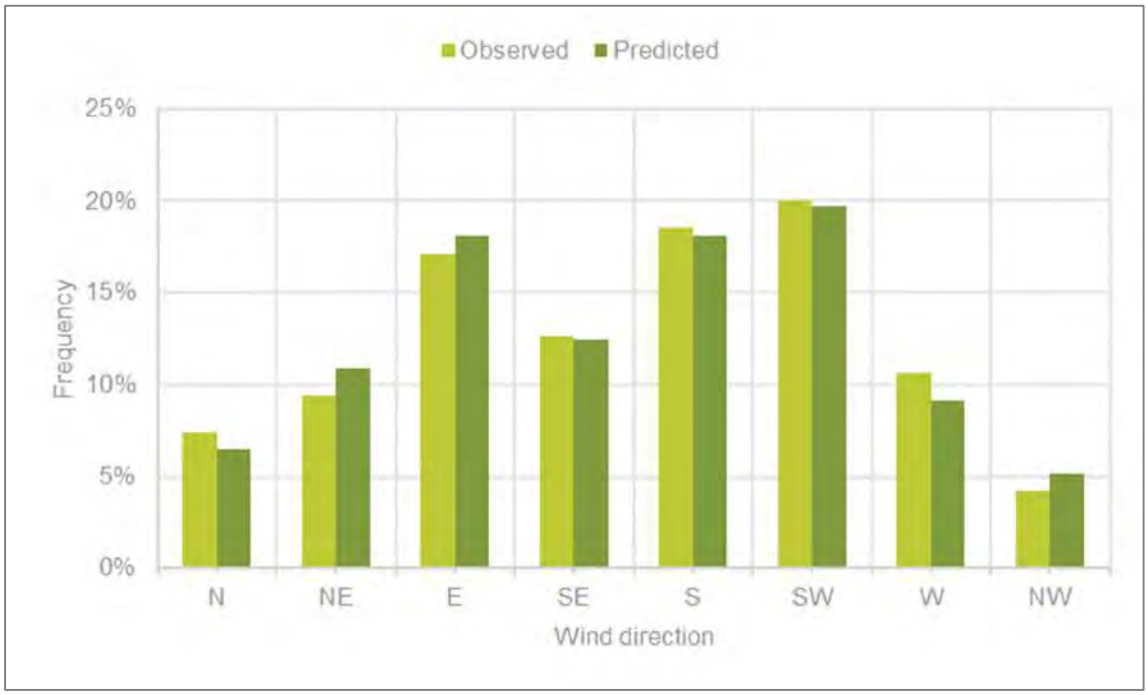


Figure A7 Wind Direction Frequency Comparison



Overall, WRF predictions are concluded to adequately represent the observed wind speeds and wind directions recorded by the South Lake AQMS station. It is expected that WRF solution extracted at the Project is likely to be a good representation of the conditions experienced at that location.

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ECOGRAF BATTERY ANODE MATERIAL FACILITY

8 February 2022

Project Number: 2164

DRAWING LIST		
Sheet Number	Sheet Name	Current Revision
DA-001	SITE PLAN	F
DA-002	STREETSCAPE ELEVATIONS	A
DA-101	CLUSTER 1 - SHEET 1	B
DA-102	CLUSTER 1 - SHEET 2	B
DA-103	CLUSTER 2	B
DA-104	CLUSTER 3	B
DA-105	3D VIEWS	A

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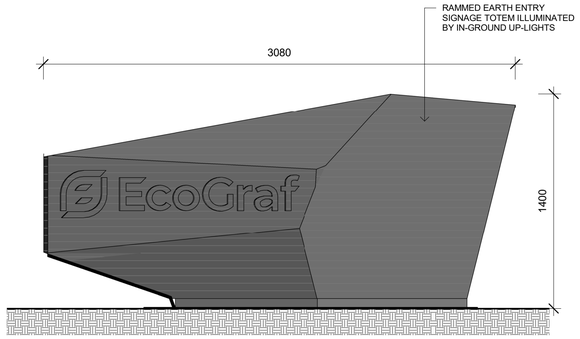
1 STREET ELEVATION - ZIRCONIA DRIVE
1 : 350

3 SHED SIGNAGE DETAIL - STREET VIEW
1 : 200

2 STREET ELEVATION - ALUMINA ROAD
1 : 350



4 ENTRY SIGNAGE DETAIL - FRONT VIEW
1 : 20

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REV.	DESCRIPTION	DATE
A	ISSUE FOR DEVELOPMENT APPLICATION	08-02-2022

STATUS
DEVELOPMENT APPLICATION

DRAWING TITLE
STREETSCAPE ELEVATIONS

DRAWN BY

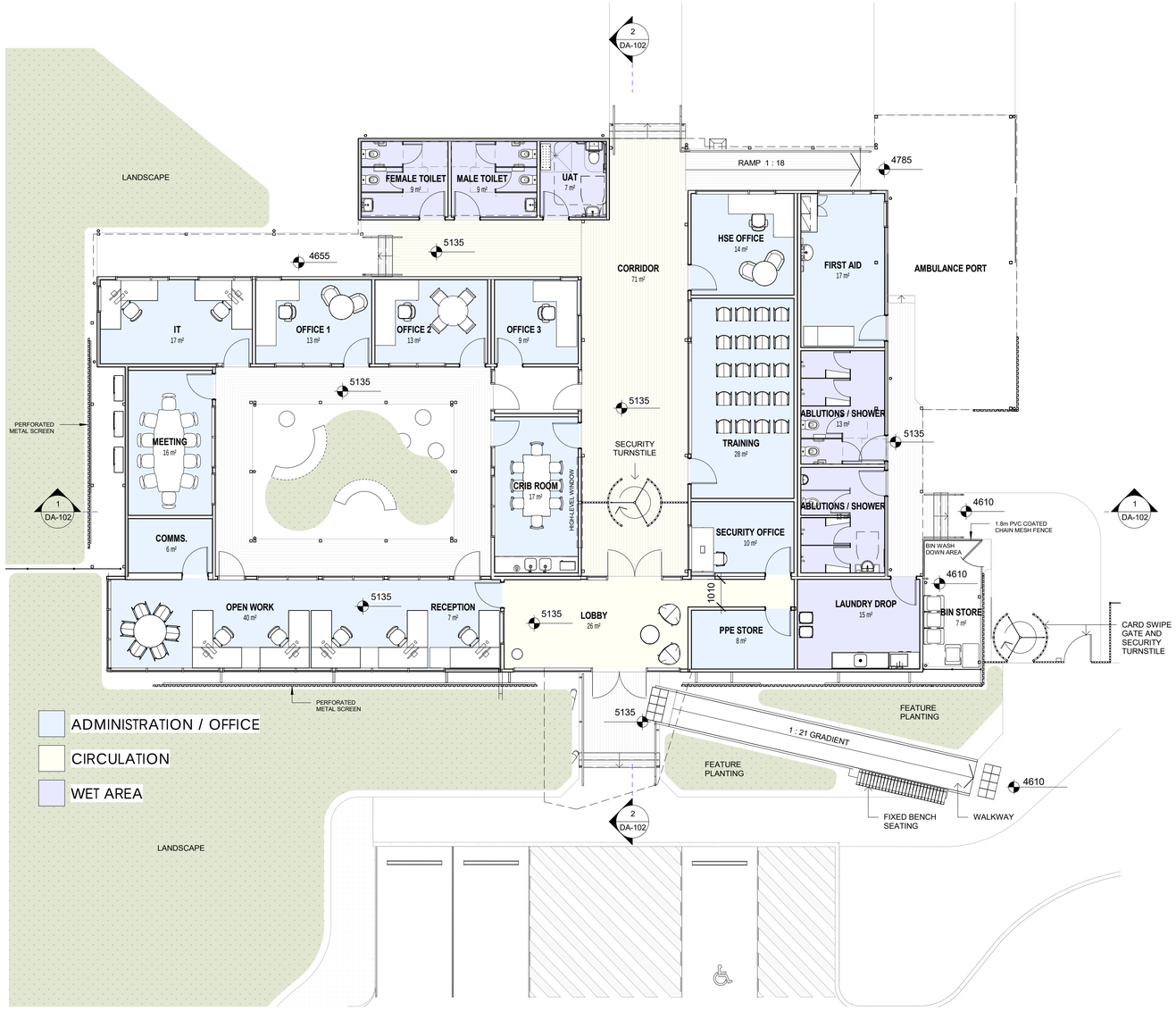
APPROVED
SAS

PROJECT No.
2164

DRAWING No.
DA-002

REV No.
A

DATE
01/27/22



1 DA-102 PLAN - CLUSTER 1 - ADMINISTRATION AND SECURITY

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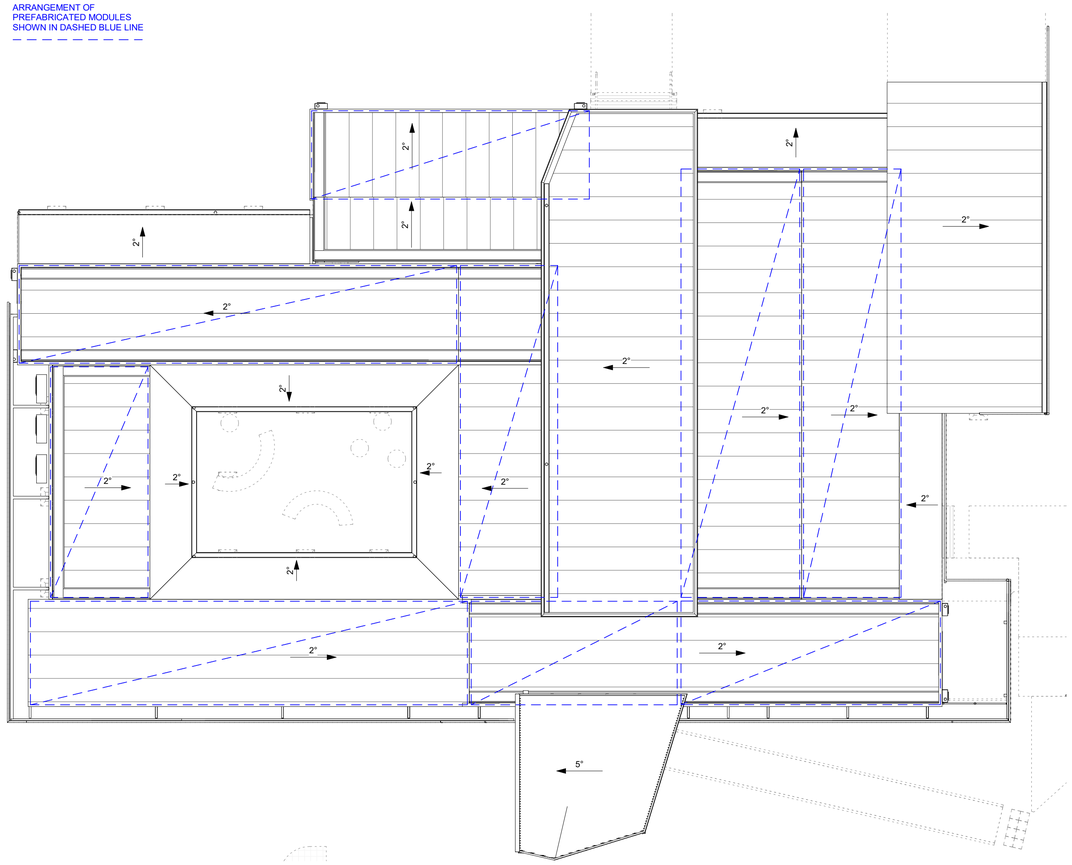
ARRANGEMENT OF PREFABRICATED MODULES SHOWN IN DASHED BLUE LINE



2 DA-104 Plan - Cluster 1 - ROOF PLAN

1 : 100

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REV.	DESCRIPTION	DATE
A	DRAFT ISSUE	25-01-2022
B	ISSUE FOR DEVELOPMENT APPLICATION	08-02-2022

NORTH

SCALE 1:100 @ A1

0m 2m 4m 6m 8m 10m

STATUS
DEVELOPMENT APPLICATION

DRAWING TITLE
CLUSTER 1 - SHEET 1

DRAWN BY
Author

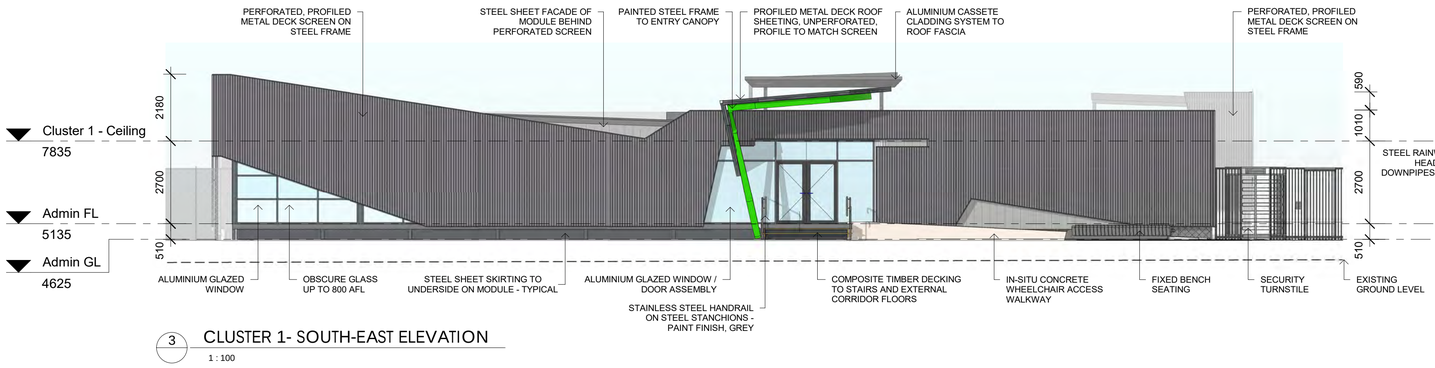
APPROVED
SAS

PROJECT No.
2164

DRAWING No.
DA-101

REV No.
B

DATE
01/27/22



3 CLUSTER 1- SOUTH-EAST ELEVATION

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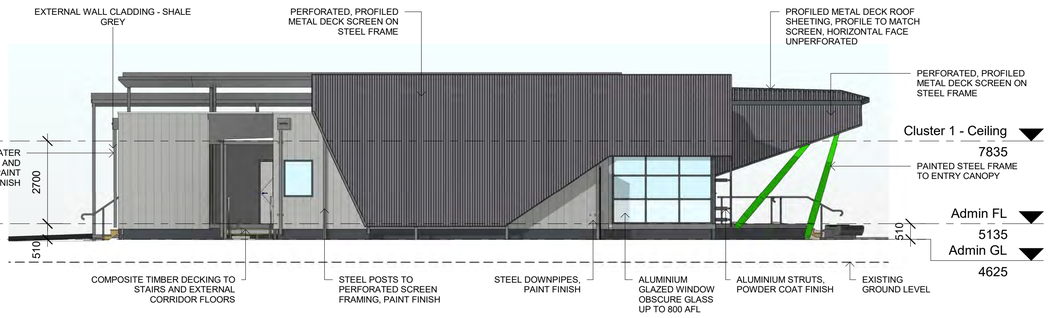

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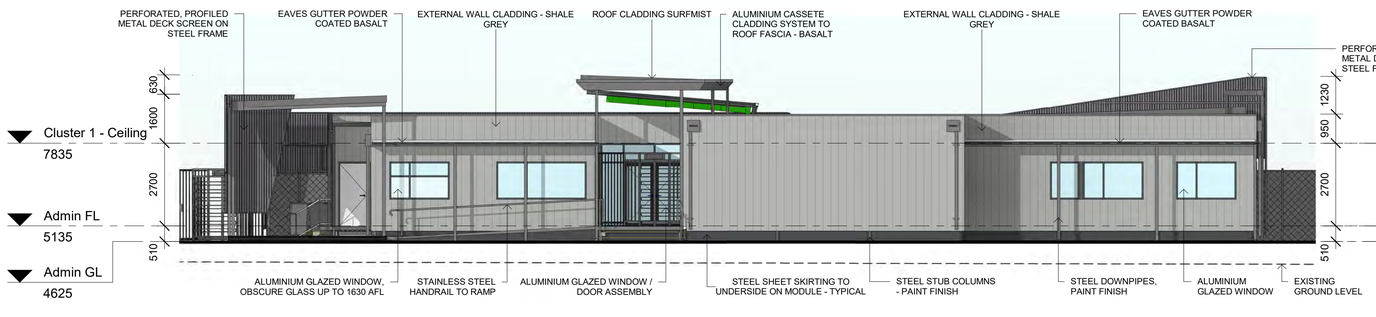
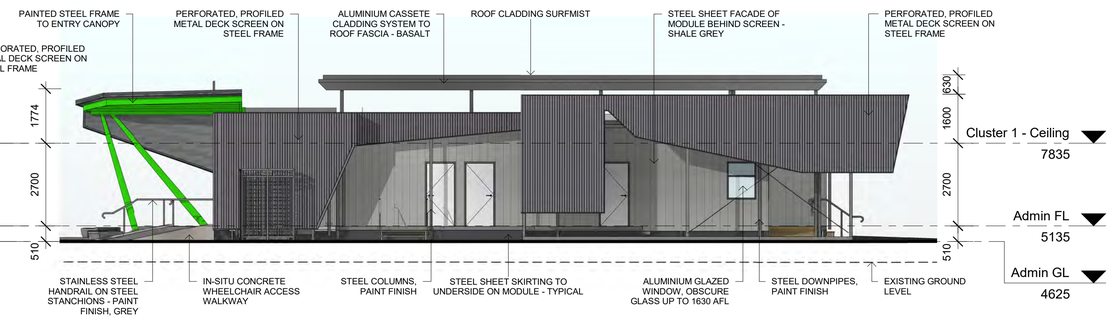


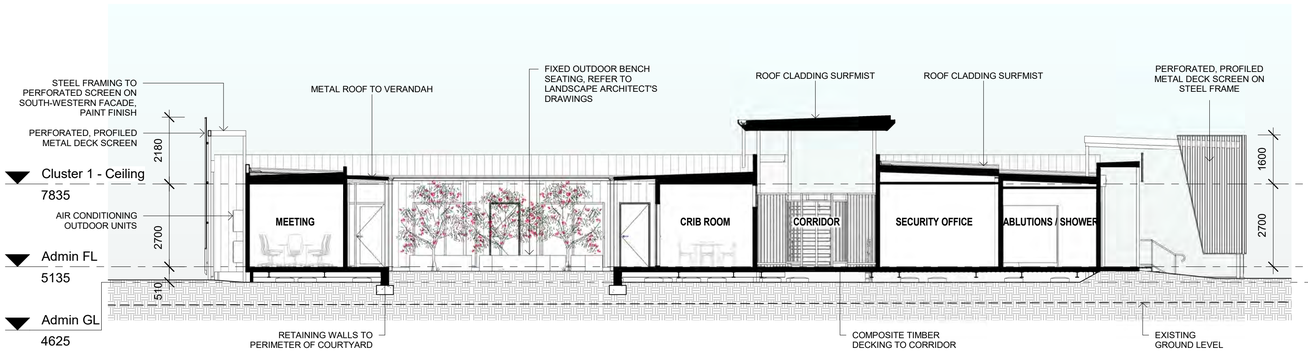
5 CLUSTER 1 - NORTH - WEST ELEVATION

1 : 100



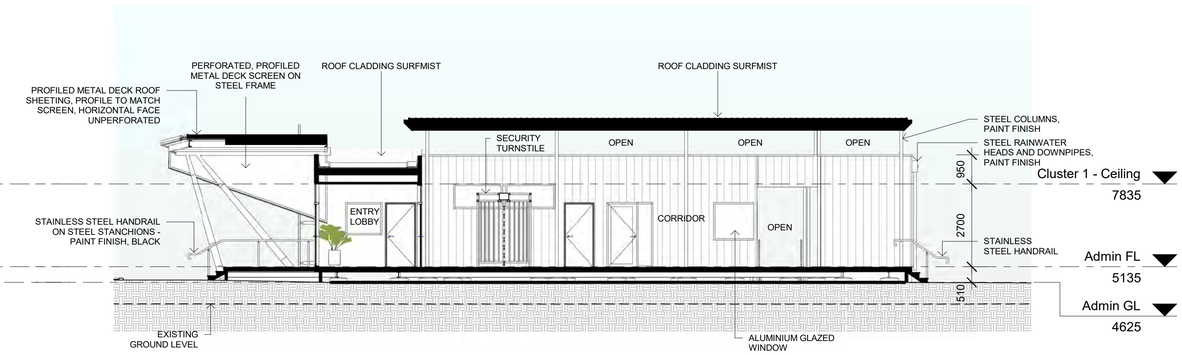
6 CLUSTER 1 - NORTH - EAST ELEVATION

1 : 100



1 SECTION 1 (DA-101)

1 : 100



2 SECTION 2 (DA-101)

1 : 100

HUNT ARCHITECTS

ABN 67 297 805 649
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T + 61 8 9322 6033
office@huntarchitects.com.au

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ECOGRAF

PROJECT
ECOGRAF BATTERY ANODE MATERIAL FACILITY

NOTES
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REV.	DESCRIPTION	DATE
A	DRAFT ISSUE	25-01-2022
B	ISSUE FOR DEVELOPMENT APPLICATION	08-02-2022

SCALE 1:100 @ A1
0m 2m 4m 6m 8m 10m

STATUS
DEVELOPMENT APPLICATION

DRAWING TITLE
CLUSTER 1 - SHEET 2

DRAWN BY
Author

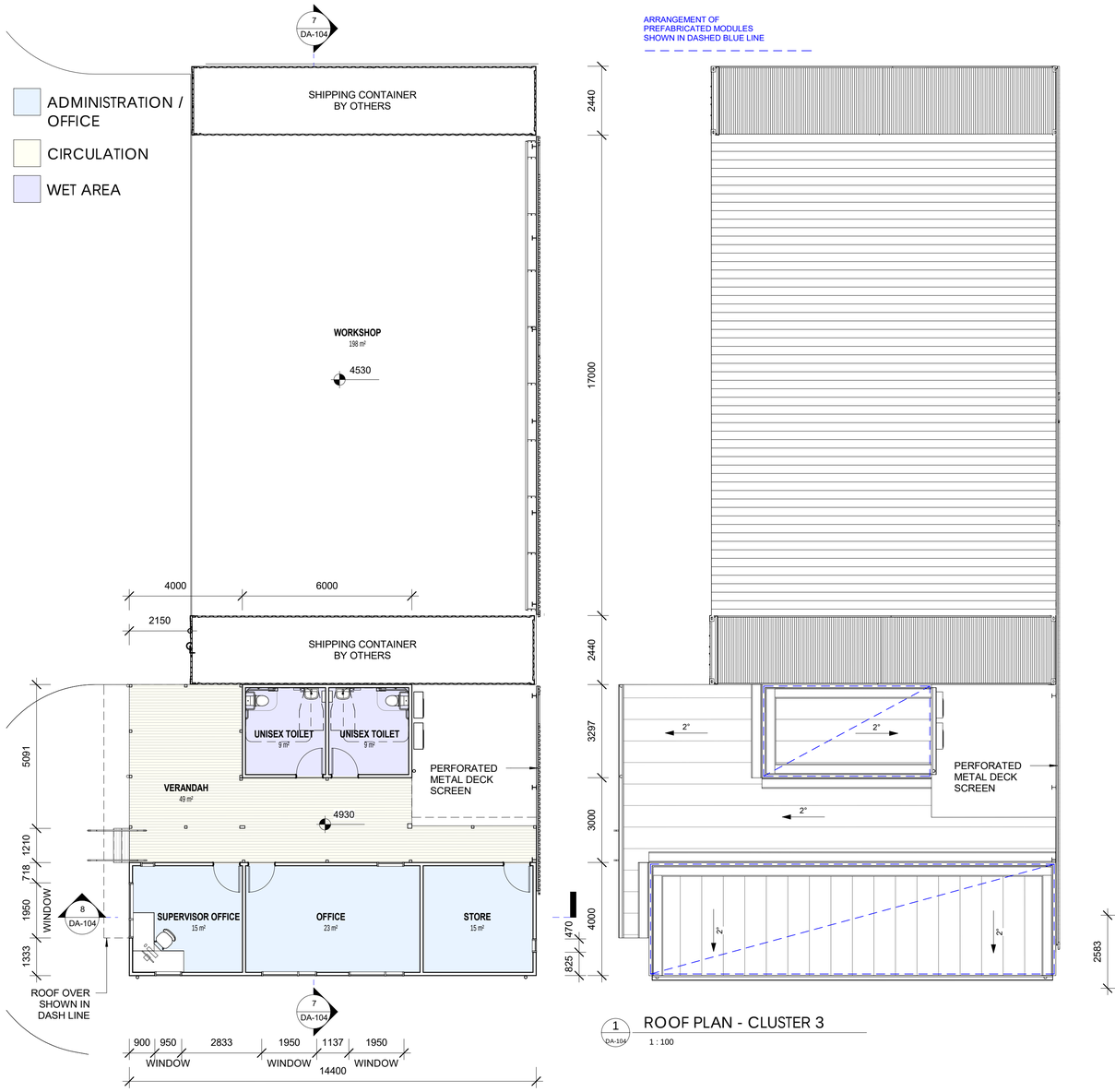
APPROVED
Approver

PROJECT No.
2164

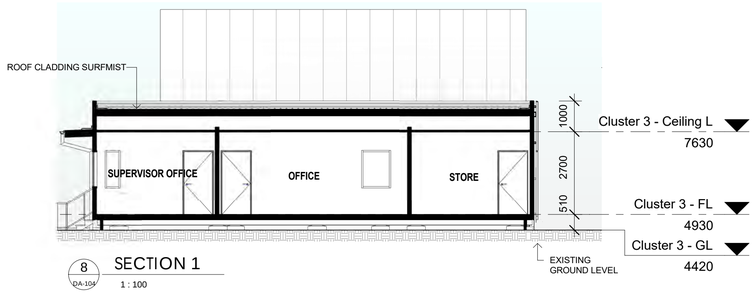
DRAWING No.
DA-102

REV No.
B

DATE
01/12/22



1 DA-104 ROOF PLAN - CLUSTER 3
1 : 100



8 DA-104 SECTION 1
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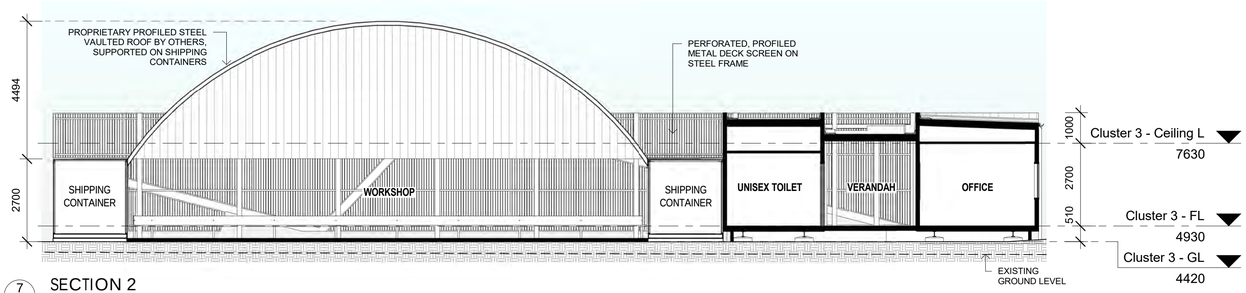
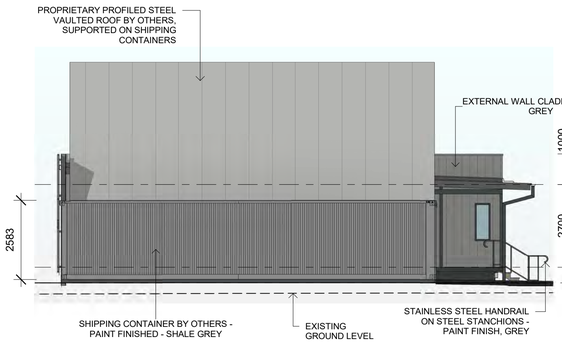
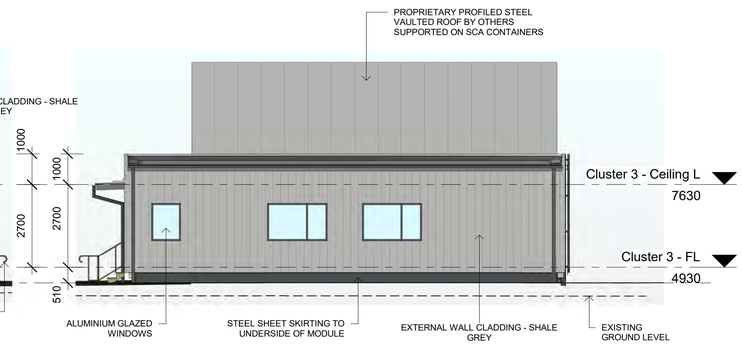


7 DA-104 SECTION 2
1 : 100

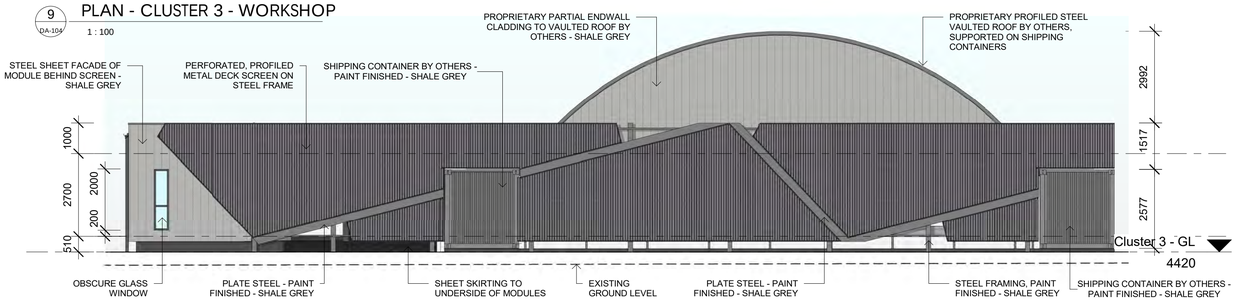


3 CLUSTER 3 - NORTH ELEVATION
1 : 100

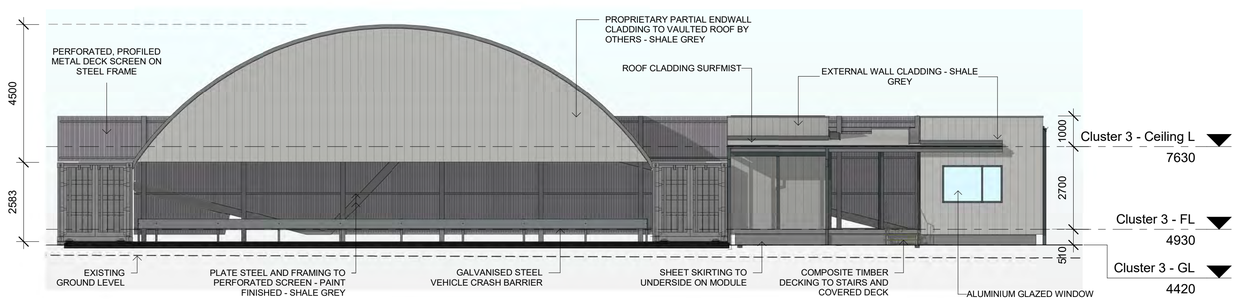


5 CLUSTER 3 - SOUTH ELEVATION
1 : 100

9 DA-104 PLAN - CLUSTER 3 - WORKSHOP
1 : 100



4 CLUSTER 3 - EAST ELEVATION
1 : 100



6 CLUSTER 3 - WEST ELEVATION
1 : 100

HUNT ARCHITECTS
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office@huntarchitects.com.au

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PROJECT
ECOGRAF BATTERY ANODE MATERIAL FACILITY

NOTES
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REV.	DESCRIPTION	DATE
A	DRAFT ISSUE	25-01-2022
B	ISSUE FOR DEVELOPMENT APPLICATION	08-02-2022

NORTH

SCALE 1:100 @ A1
0m 2m 4m 6m 8m 10m

STATUS
DEVELOPMENT APPLICATION

DRAWING TITLE
CLUSTER 3

DRAWN BY
ZI

APPROVED
SAS

PROJECT No.
2164

DRAWING No.
DA-104

REV No.
B

DATE
01/12/22

VIEW FROM ALUMINA ROAD

VIEW FROM CAR PARK

VIEW FROM ZIRCONIA ROAD

VIEW FROM CAR PARK

HUNT ARCHITECTS

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REV.	DESCRIPTION	DATE
A	ISSUE FOR DEVELOPMENT APPLICATION	08-02-2022

STATUS
DEVELOPMENT APPLICATION

DRAWING TITLE
3D VIEWS

DRAWN BY
Author

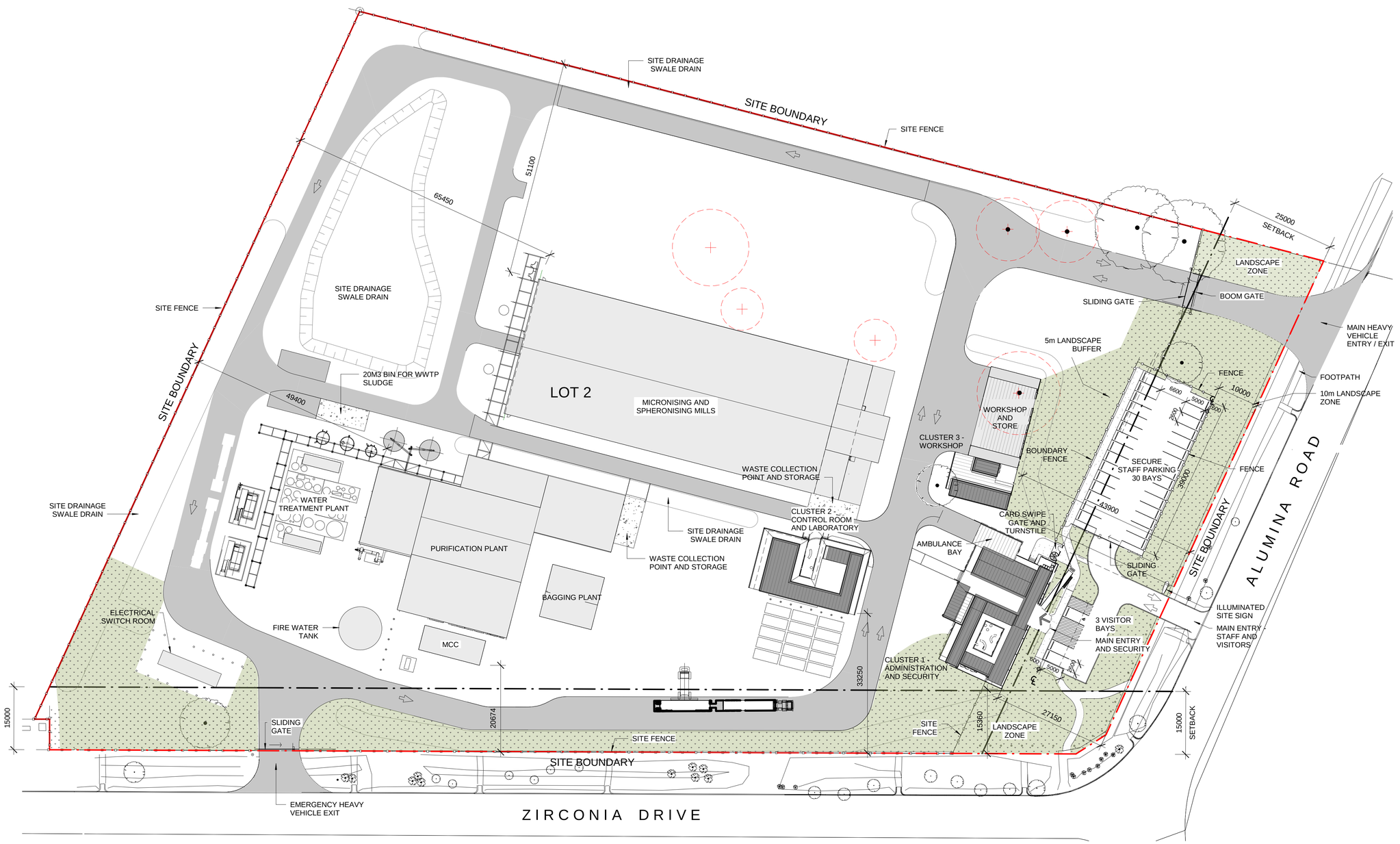
APPROVED
SAS

PROJECT No.
2164

DRAWING No.
DA-105

REV No.
A

DATE
01/27/22



LEGEND

- NON-PROCESS INFRASTRUCTURE BUILDING (MODULAR)
- PROCESS INFRASTRUCTURE BUILDING (IN-SITU)
- LANDSCAPE ZONE - REFER LANDSCAPE PLAN
- NEW SEALED BITUMEN ROAD
- EXISTING TREE TO BE PROTECTED AND RETAINED
- TREE TO BE REMOVED
- SITE BOUNDARY FENCE. 2.4m HIGH, BLACK PVC COATED CHAIN MESH WITH BLACK POSTS

1 SITE PLAN
1 : 500

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REV.	DESCRIPTION	DATE
A	DRAFT ISSUE FOR COMMENT AND COORDINATION	12-01-2022
B	DRAFT ISSUE FOR COMMENT AND COORDINATION	13-01-2022
C	DRAFT ISSUE FOR COORDINATION	18-01-2022
D	DRAFT ISSUE FOR COORDINATION	24-01-2022
E	DRAFT ISSUE	25-01-2022
F	ISSUE FOR DEVELOPMENT APPLICATION	08-02-2022
G	ISSUED FOR COORDINATION	14-06-2022
H	ISSUE FOR DEVELOPMENT APPLICATION	20-06-2022

NORTH

SCALE 1:500 @ A1
0m 10m 20m 30m 40m 50m

STATUS
DEVELOPMENT APPLICATION

DRAWING TITLE
SITE PLAN

DRAWN BY
TC

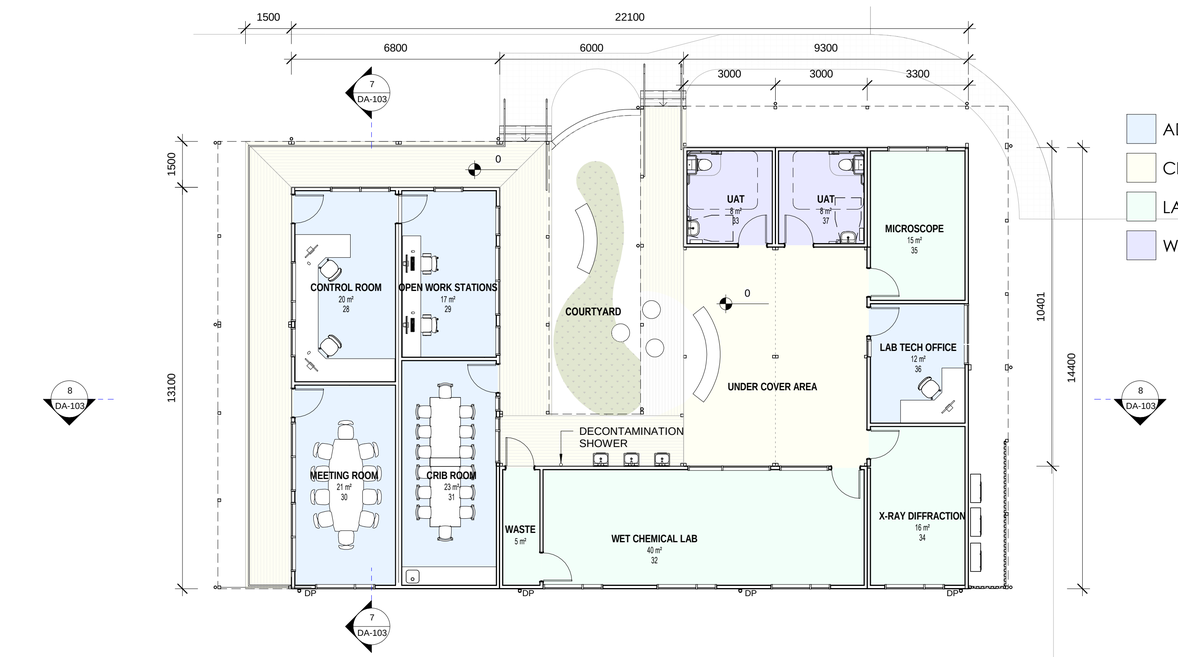
APPROVED
SAS

PROJECT No.
2164

DRAWING No.
DA-001

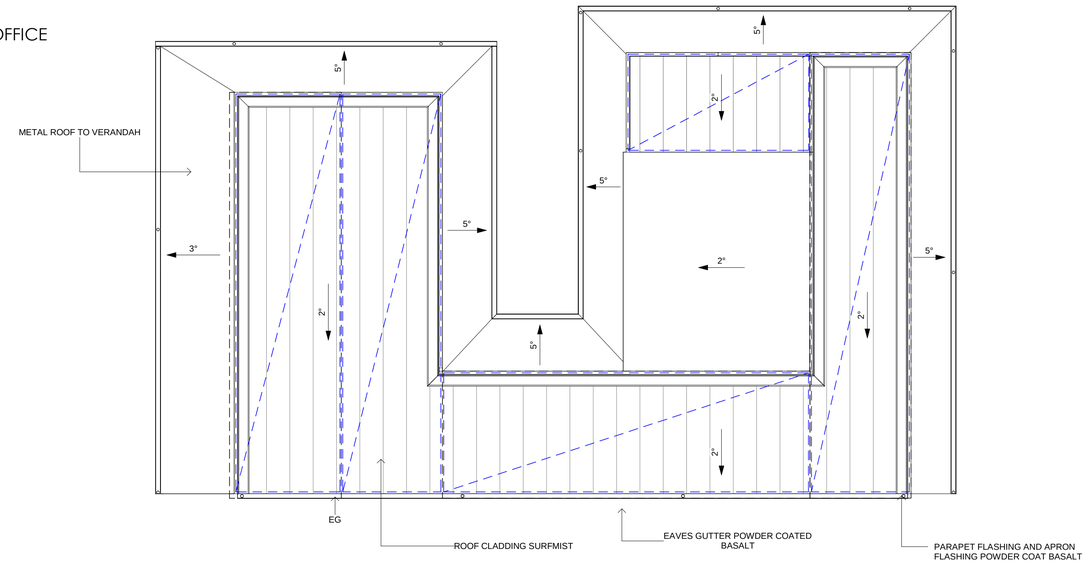
REV No.
H

DATE
27/01/2022

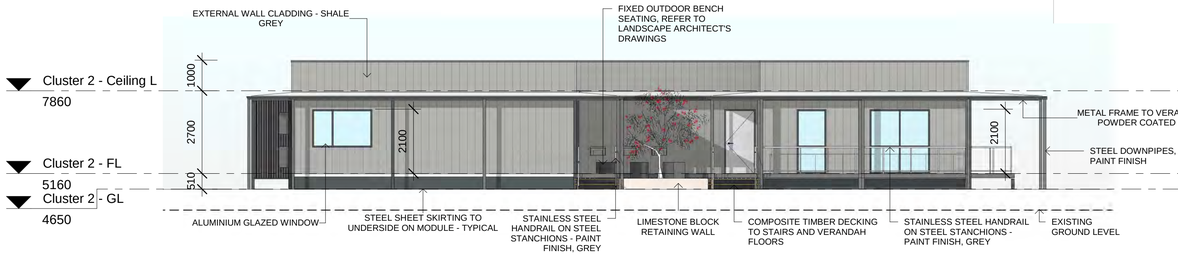


ADMINISTRATION / OFFICE
CIRCULATION
LABORATORY
WET AREA

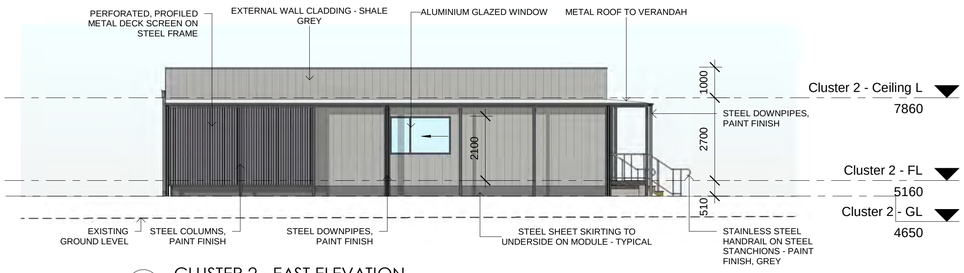
ARRANGEMENT OF PREFABRICATED MODULES SHOWN IN DASHED BLUE LINE



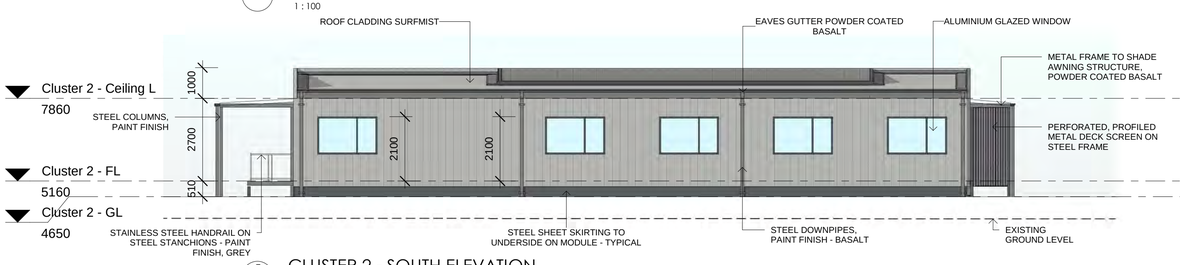
1 CLUSTER 2 - FLOOR LEVEL
1 : 100



2 CLUSTER 2 - ROOF PLAN
1 : 100



3 CLUSTER 2 - NORTH ELEVATION
1 : 100



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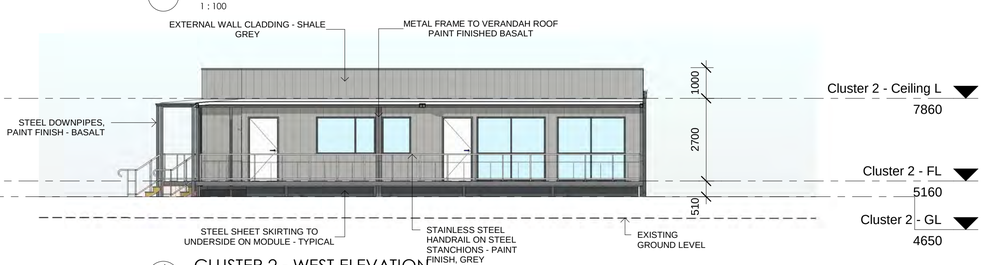
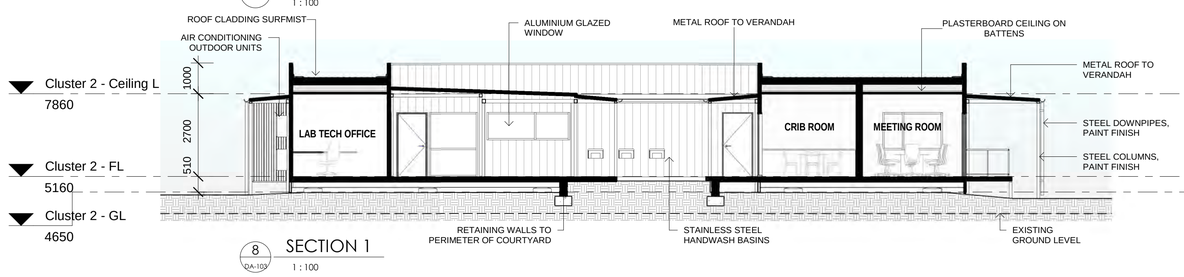
1 : 100

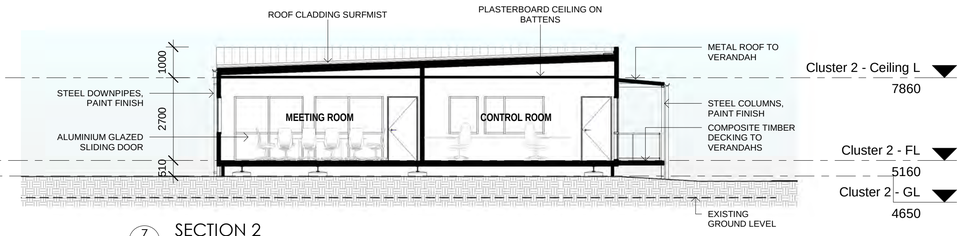


5 CLUSTER 2 - SOUTH ELEVATION
1 : 100



8 SECTION 1
1 : 100

6 CLUSTER 2 - WEST ELEVATION
1 : 100



7 SECTION 2
1 : 100

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ABN 67 297 805 649
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office@huntarchitects.com.au

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C	ISSUE FOR DEVELOPMENT APPLICATION	20-06-2022

NORTH

SCALE 1:100 @ A1
0m 2m 4m 6m 8m 10m

STATUS
DEVELOPMENT APPLICATION

DRAWING TITLE
CLUSTER 2

DRAWN BY
AR

APPROVED
SAS

PROJECT No.
2164

DRAWING No.
DA-103

REV No.
C

DATE
01/12/22

Schedule of Submissions
Proposed Industrial Graphite Processing Plant - Lot 2 Zirconia Drive, East Rockingham

PUBLIC SCHEDULE OF SUBMISSIONS		
Name	Address	Comment
1. Ms Rebecca Hickey	2/138 Lewington Street ROCKINGHAM WA 6168	Objection I would like to submit an objection to this proposal due to the detrimental health effects of fine graphite particles to people with compromised lung capacity and associated illnesses including asthma. Continued exposure may cause a build up of graphite in the system resulting in lung scarring. I reviewed the Environmental report, which claims that the 1.5km distance from residences is sufficient to minimise exposure, but the strong coastal breezes will increase this impact. Damage from exposure may build up over the years and not be noted in the immediate future. I feel the positioning of this site needs to be further isolated from residencies. This will 100% factor into my reasoning to move away from my current address.
2. Mr Jarl Anderson	19 McKenzie Road SHOALWATER WA 6169	The proposed Ecograf Battery Anode Facility graphite treatment plant presents as a well researched project in terms of location, purpose, design, process methodology (excluding of the use of hydrofluoric acid), water management and environmental setting. The selected site can take advantage of Strip industry synergies, by being in close proximity to chemical industries in the area, presumably capable of supplying acid/caustic reagents for use in the cleaning of the graphite. It should translate to low risk haulage of hazardous chemicals (no long haulage on public roads). Also, the East Rockingham WWTP is virtually across the road for efficient processing of contaminated plant waste water. This, in further combination with waste/recycling processing industries in the region, makes the proposal environmentally viable. Pollution management (microscopic dust particles escaping into the atmosphere), safe waste disposal and especially safe management of waste water is crucial. The objective of producing processed graphite for use in battery technology for the benefit of the rapid electrification evolution, assisting Australia's international commitments to ensure world temperature increase stays <2cd by 2050, makes it an absolute worthwhile enterprise. The proposal has capacity for the employment of 37 full time staff. The Ecograf Battery Graphite Process Facility should definitely be given the green light.

Enquiries: John McDonald on (08) 9323 6210
Our Ref: 22/1462 (D22#157132)
Your Ref: 20.2022.31.1

22 March 2022

Chief Executive Officer
City of Rockingham
PO Box 2142
Rockingham DC WA 6967

Email: customer@rockingham.wa.gov.au (via email)

Dear Sir/Madam,

EXTERNAL REFERRAL REQUEST - MAIN ROADS – PROPOSED INDUSTRIAL GRAPHITE PROCESSING PLANT 20,000 TONNES PA.

In response to your correspondence received on 16 February 2022 please be advised Main Roads has no objections subject to the following condition being imposed:

Condition

1. This approval is limited to production of 20,000 tonnes per annum purified spherical graphite.

Main Roads advises that it offers a free of charge pre-lodgement consultation service. Main Roads encourages Local Government, when liaising with applicants, to promote and capitalise on this free advisory service offered by the road authority prior to lodgement of strategic or statutory planning proposals, especially where development plans involve land adjacent to or have the potential to impact on the State road network.

Further information on the pre-lodgement consultation process can be found on Main Roads website at mainroads.wa.gov.au > Technical & Commercial > Planning & Development

Main Roads requests a copy of the City's final determination on this proposal to be sent to planninginfo@mainroads.wa.gov.au. If you have any queries please do not hesitate to contact John McDonald on 9323 6210.

Yours sincerely

mthornely.

Maryanne Thornely
Road Access and Planning Manager/A

From: Grero, Andrew
To: City of Rockingham
Subject: Submission Response - Proposed Industrial Graphite Processing Plant
Date: Tuesday, 8 March 2022 4:03:03 PM
Attachments: image001.png

Good afternoon

PTA has no objections to the proposal. The development may be within the vicinity of an option for alignment for the proposed Westport infrastructure. Please refer to Westport for consideration regarding its future planning of freight rail in the vicinity.

Kind regards

Andrew Grero
Land and Corridor Officer | IP&LS
Public Transport Authority of Western Australia
Public Transport Centre, West Parade, Perth, 6000
PO Box 8125, Perth Business Centre, WA, 6849
Tel: (08) 9326 2374
Email: wapcreferrals@pta.wa.gov.au | Web: www.pta.wa.gov.au

2019RAP-signature

From: Symons, Freya
To: David Banovic
Cc: Casey Gillespie; Kruger, Zo; Davey, Erin
Subject: RE: Proposed Industrial Graphite Processing Plant
Date: Thursday, 10 March 2022 10:14:49 AM
Attachments: image018.jpg
image019.jpg
image020.jpg
image021.jpg
image022.jpg
image023.jpg
image024.jpg
image025.png
image026.png
image027.png
image028.png
image001.jpg
image002.jpg
image003.png
image004.png
image005.png
image006.png

Hi David,

Yes, no objective to the proposal.

Thanks,

Freya Symons
Project Manager - Land and Constraints Management | Westport Office
140 William Street, Perth WA 6000
Tel: (08) 65516339 |
Email: Freya.Symons@westport.wa.gov.au | Web: http://www.westport.wa.gov.au/

From: David Banovic <David.Banovic@rockingham.wa.gov.au>
Sent: Thursday, 10 March 2022 10:08 AM
To: Symons, Freya <Freya.Symons@westport.wa.gov.au>
Cc: Casey Gillespie <Casey.Gillespie@rockingham.wa.gov.au>; Kruger, Zo <Zo.Kruger@westport.wa.gov.au>; Davey, Erin <Erin.Davey@westport.wa.gov.au>
Subject: RE: Proposed Industrial Graphite Processing Plant

Hi Freya,

Thank you for your email.

Am I right to assume Westport has no objection to this proposal based on your comments?

Regards

David Banovic - Senior Projects Officer

PO Box 2142 Rockingham DC WA 6967
Civic Boulevard Rockingham Western Australia
telephone **+61 8 9528 0374** facsimile **+61 8 9592 1705**
email **david.banovic@rockingham.wa.gov.au**
web **rockingham.wa.gov.au**

From: Symons, Freya <Freya.Symons@westport.wa.gov.au>
Sent: Thursday, 10 March 2022 9:34 AM
To: David Banovic <David.Banovic@rockingham.wa.gov.au>
Cc: Casey Gillespie <Casey.Gillespie@rockingham.wa.gov.au>; Kruger, Zo <Zo.Kruger@westport.wa.gov.au>; Davey, Erin <Erin.Davey@westport.wa.gov.au>
Subject: RE: Proposed Industrial Graphite Processing Plant

Good Morning David,

Thanks for providing the details of the proposed graphite processing plant within the Rockingham Strategic Industrial Area.

As background, the Department of Transport, and subsequently Westport, has investigated a number of possible realignment options for the Kwinana Balloon (CBH) Loop. This realignment is aimed at relieving pressure on the Kwinana Triangle by providing a secondary access point into the Strategic Industrial Areas as well as freeing up the land within the loop for development.

Westport intends to undertake a more detailed assessment of an alternative alignment identified by the Westport Taskforce in 2019.

This is likely to occur in 2022, with the outcomes of the assessment to inform next steps, i.e. an amendment to the MRS, planning control area and/or land acquisition.

A quick review of this alignment against this DA shows that there is unlikely to be an impact.

I'll also note that as a JDAP decision, Westport will be formally referred the application by the Department of Planning, Lands and Heritage.

Thanks again for raising this with us and happy to discuss any aspects of this further,

Kind Regards,

Freya Symons
Project Manager - Land and Constraints Management | Westport Office
140 William Street, Perth WA 6000
Tel: (08) 65516339 |
Email: Freya.Symons@westport.wa.gov.au | Web: http://www.westport.wa.gov.au/

From: David Banovic <David.Banovic@rockingham.wa.gov.au>
Sent: Thursday, 10 March 2022 8:23 AM
To: Davey, Erin <Erin.Davey@westport.wa.gov.au>
Cc: Symons, Freya <Freya.Symons@westport.wa.gov.au>; Casey Gillespie <Casey.Gillespie@rockingham.wa.gov.au>
Subject: RE: Proposed Industrial Graphite Processing Plant

Noted.

We will await to hear from Freya.

Regards

David Banovic - Senior Projects Officer

PO Box 2142 Rockingham DC WA 6967
Civic Boulevard Rockingham Western Australia
telephone **+61 8 9528 0374** facsimile **+61 8 9592 1705**
email **david.banovic@rockingham.wa.gov.au**
web **rockingham.wa.gov.au**

From: Davey, Erin <Erin.Davey@westport.wa.gov.au>
Sent: Thursday, 10 March 2022 8:10 AM
To: David Banovic <David.Banovic@rockingham.wa.gov.au>
Cc: Symons, Freya <Freya.Symons@westport.wa.gov.au>
Subject: RE: Proposed Industrial Graphite Processing Plant

Hi David,
Thanks for this, I have forwarded the email to my colleague Freya Symons (cc'd above).
Freya is Westport's project manager – land and constraints management and is a former planner, so is best-placed to consider this from Westport's perspective.

Kind regards,
Erin

Erin Davey
Westport Stakeholder Engagement Lead | Westport Office
140 William Street, Perth WA 6000
Tel: (08) +618 6551 6288 | | Mob: 0424 145 619
Email: Erin.Davey@westport.wa.gov.au | Web: http://www.westport.wa.gov.au/

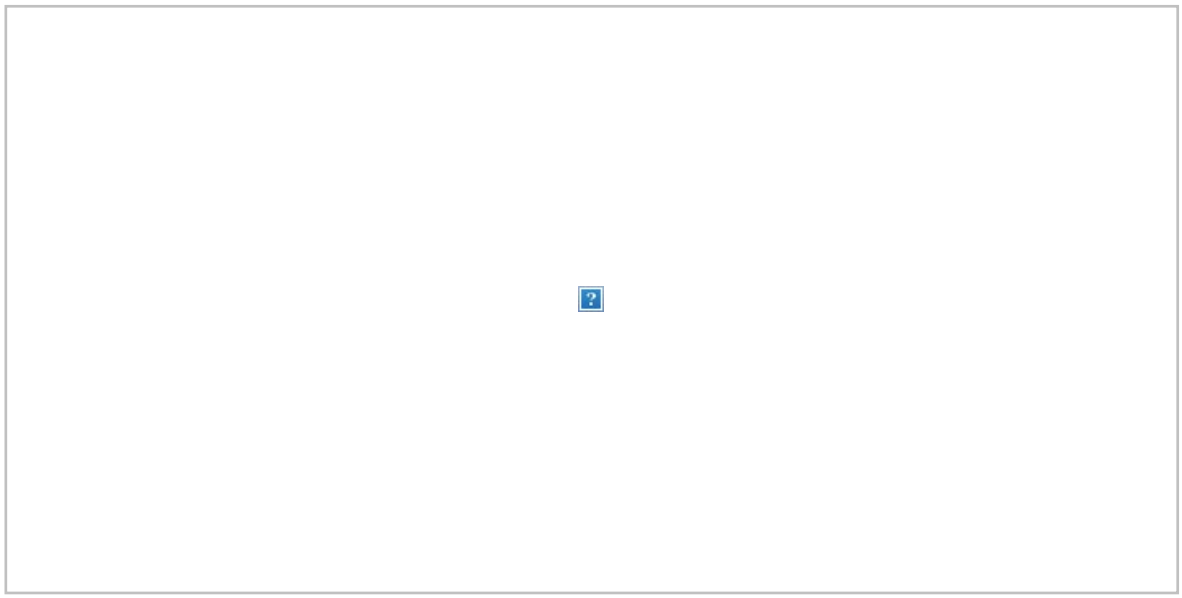
From: David Banovic <David.Banovic@rockingham.wa.gov.au>
Sent: Thursday, 10 March 2022 7:27 AM
To: Davey, Erin <Erin.Davey@westport.wa.gov.au>
Cc: Casey Gillespie <Casey.Gillespie@rockingham.wa.gov.au>
Subject: Proposed Industrial Graphite Processing Plant

Good morning Erin,

It was nice talking to you yesterday.

As explained, PTA had advised that the City consult Westport on the Development Application for the proposed Graphite Processing Plant, as the development may be within the vicinity of the future planned rail infrastructure – refer to attachment.

The proposed development is located at Lot 2 Zirconia Drive in East Rockingham. For context, to the north-west on the opposite side of Patterson Road is the BHP Nickel Refinery site and to the east of the subject site, the Water Corporation Wastewater Treatment Plant.



Attached link - Industrial Graphite Processing Plant - City of Rockingham provides a comprehensive information package on the proposal, includes plans and accompanying reports in support of the Development Application. The content is available for viewing by no later than Friday, 25 March 2022, which is the cut-off date for external agency submissions.

The application is required to be determined by the Metro Outer Joint Development Assessment Panel (JDAP). The City is only a referral agency in this instance as cost of the development exceeds $10million. The City currently has until the close of business on 9 May 2022 to provide its Responsible Authority Report, its recommendation and forward any submissions received to the DAP Secretariat by this date, however, it is anticipated that this timeframe will be pushed out to June/July as the City will be seeking further clarification from the proponent prior to presenting its RAR.

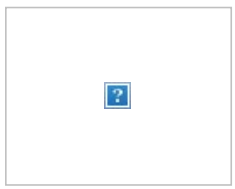
For further information on the DAP process refer to the attached link - Development Assessment Panels (www.wa.gov.au).

I acknowledge that Westport's formal position is unlikely to be received by the due date based on our discussion. At this stage the City is able to extend Westport's submission period by an additional **14 days i.e. by 8 April 2022**.

A longer timeframe would need to be negotiated with the applicant.

Should the Project Manager or yourself require any further clarification please let me know.

Regards,



David Banovic - Senior Projects Officer

PO Box 2142 Rockingham DC WA 6967
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Development Services
629 Newcastle Street Leederville WA 6007
PO Box 100 Leederville WA 6902
T (08) 9420 2099
F (08) 9420 3193

Your Ref: 20.2022.31.1 – AD22/26178
Our Ref: 131689898 (DEV383495)
Enquiries: Brett Coombes
Direct Tel: 9420 3165
Email: land.planning@watercorporation.com.au

25 March 2022

Chief Executive Officer
City of Rockingham
P.O. Box 2142
ROCKINGHAM WA 6967

Attention: Casey Gillespie

Re: Industrial Graphite Processing Plant - Lot2 Zirconia Drive, East Rockingham

Thank you for your letter of 16 February 2022 inviting comments on the above proposal.

Water and sewerage services can be made available to the development site. Depending on the proponent's water demands, the water service to the development may need to be dealt with under the Water Corporation's Major Customer framework. The proponent should be advised to liaise with the Water Corporation regarding their projected future water demands.

The Water Corporation has a major (900mm diameter) treated wastewater outfall pipeline from the East Rockingham WWTP that runs within a pipe reserve approximately 20m from the northern boundary of the site. The proponent must be advised to consider the impacts of any ground disturbing works on the site and to make application through the Corporation's Protection of Assets portal for any works that could potentially impact on the pipe:
https://www.watercorporation.com.au/Developing-and-building/Working-near-assets/Approval-for-works/Apply-for-approval-to-work-near-our-assets

This buildings and structures will require approval by our Building Services section prior to the commencement of works. Infrastructure Contributions and fees may be required to be paid prior to approval being issued. For further information about building applications, please use the following link:
https://www.watercorporation.com.au/Developing-and-building/Building/Lodging-a-building-application

The information provided above is subject to review and may change. If the proposal has not proceeded within six months, it is recommended that the proponent should be advised to contact the Corporation to confirm if the above information is still valid.

If you have any queries, please contact the Enquiries Officer.

Brett Coombes
Senior Development Planner
DEVELOPMENT SERVICES

Government of **Western Australia**
Department of **Health**

Your Ref: 20.2022.31.1-D22/27197
Our Ref: F-AA-03231 D-AA-22/75537
Contact: Phill Oorjitham 9222 2000

Mr Michael Parker
Chief Executive Officer
City of Rockingham
PO Box 2142
ROCKINGHAM DC WA 6967

Attention: Mrs Casey Gillespie

Via email: customer@rockingham.wa.gov.au

Dear Mr Parker

PROPOSED INDUSTRIAL GRAPHITE PROCESSING PLANT - LOT 2 ZIRCONIA DRIVE, EAST ROCKINGHAM

Thank you for your letter of 17 February 2022 requesting comments from the Department of Health (DOH) on the above proposal.

The DOH provides the following comment:

1. Water Supply and Wastewater Disposal

In relation to the management of sewage, the proposal highlights wastewater generated from the project will undergo treatment to ensure it meets the Water Corporation Trade Waste receival requirements. Please advise the Department of Health if domestic wastewater is accepted on this industrial wastewater deep sewerage line, if there is a separate connection required to deep sewerage for domestic wastewater or if an alternative method is proposed.

2. Public Health Impacts

With reference to Appendix E "Environmental Assessment" of the submission, it notes that 14.5kL of acids (HF) and alkalis will be stored in iso-containers in a partly enclosed bunded area on site. Production will be within a sealed positive pressure building with air scrubbers to remove $PM_{10/25}$ dusts and other gaseous emissions. The submission makes no reference to air quality monitoring or appropriate risk-based air quality standards.

The nearest sensitive residential uses are 1.5km to the west although there are other industrial uses (depot, wastewater treatment and other industrial manufacturing units) within 250m of the proposed facility. The EPA (2005) Separation Distance guidelines does not provide a default separation distance for this new and evolving industry and recommends in such cases that an emission/risk assessment is conducted. However, comparable fine particle (TiO) manufacture does require 3km, and sulphuric acid

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storage and use also requires 3km. On this basis the actual 1.5km separation is likely to not be sufficient.

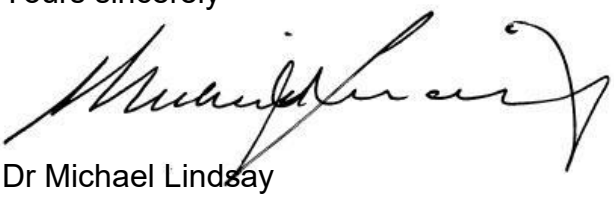
The public health (air/dust and gas (HF) issues affecting the suitability of the site and as described in the information provided have not be assessed in sufficient detail. DoH recommends that public health emissions and risk assessments (air/dust and gases) and appropriate monitoring and management measures will be required at Works Approval and as operating license conditions.

The site is not recorded on the Contaminated Sites Database. The proponent should submit a Basic Summary of Records search to complete their enquiries.

https://www.der.wa.gov.au/images/documents/your-environment/contaminated-sites/Forms/Form_2_June_2020.pdf

Should you have any queries or require further information please contact Vic Andrich on 9222 2000 or eh.eSubmissions@health.wa.gov.au

Yours sincerely



Dr Michael Lindsay
EXECUTIVE DIRECTOR
ENVIRONMENTAL HEALTH DIRECTORATE

29 March 2022

Government of Western Australia
Department of Water and Environmental Regulation

Your ref: AD22/16608
Our ref: RF2042-06 & PA47662
Enquiries: Mark Hingston

City of Rockingham
PO Box 2142
ROCKINGHAM DC, WA, 6967

Attention: Casey Gillespie

Dear Casey

RE: LOT 2 ZIRCONIA DRIVE, EAST ROCKINGHAM – GRAPHITE PROCESSING

Thank you for providing the abovementioned development application received on 16 February 2022 for the Department of Water and Environmental Regulation (the Department) to consider. The Department has identified that the proposed graphite processing plant has the potential for impacts on water resource values and/or management. In principle the Department does not object to the proposal however key issues, recommendations and advice are provided below and these matters should be addressed.

Issue: Stormwater management
Recommendations
The proponent should manage stormwater in accordance with the *'Decision process for stormwater management in WA (DoW 2016)'* and the *'Stormwater Management Manual for Western Australia (DoW 2004–2007)'.*

The Surface Water Management Strategy provided uses the Perth Groundwater Atlas to determine the maximum groundwater level (MGL) The use of the Perth Groundwater Atlas to determine MGL for stormwater infrastructure design is not supported as MGLs are based on levels for May when MGLs are lower. The Department prefers the use of historical MGL levels as it gives a higher degree of confidence in drainage basin design given the natural variations in yearly rainfall and likely increase in groundwater levels that occur through development. The Department's Lower Serpentine Region Groundwater Contours records a historical MGL in the area of Lot 2 of between 2.5 – 2.75 metres AHD and this level should be used when determining inverts of drainage basins and biofiltration basins.

Kwinana Peel Region
107 Breakwater Parade Mandurah Ocean Marina Mandurah Western Australia 6210
PO Box 332 Mandurah Western Australia 6210
Telephone: 08 9550 4222 Facsimile: 08 9581 4560
www.dwer.wa.gov.au

At-source infiltration of the first 15 mm of stormwater runoff from carpark areas should be integrated into the carpark design and should undergo water quality treatment via biofiltration.

The proposed parabolic channel drains should be converted to vegetated biofiltration swales rather than be lined with bituminous geomembrane. Vegetated biofiltration swales will increase at-source infiltration and potentially reduce the required size of drainage basins. Biofiltration areas should be lined with amended soil with a PRI of at least 10. The amended soil should have a minimum thickness of 300 mm.

Issue: Industrial Regulation
Advice
The *Environmental Protection Act 1986* makes it an offence to undertake any work which causes a premises to become, or become capable of being, a Prescribed Premises unless the work is undertaken in accordance with a works approval. It is also an offence under the EP Act to alter the nature and/or volume of any emissions, unless done so in accordance with a works approval or licence or a registration (for operation) is held for the premises.

The Department has received and is currently assessing a Works Approval application for this proposed graphite processing plant under the Processing Sector - Category 31: chemical manufacturing.

Issue: Native Vegetation
Advice
Under section 51C of the *Environmental Protection Act 1986* (EP Act), clearing of native vegetation is an offence unless:

- it is undertaken under the authority of a clearing permit
- it is done after the person has received notice under Section 51DA(5) that a clearing permit is not required
- the clearing is subject to an exemption

Exemptions for clearing that are a requirement of written law, or authorised under certain statutory processes, are contained in Schedule 6 of the EP Act. Exemptions for low impact routine land management practices outside of environmentally sensitive areas (ESAs) are contained in the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004* (the Clearing Regulations).

Based on the information provided, the proposal is likely to be exempt from the requirement for a clearing permit under either Regulation 5, Item 1 of the Clearing Regulations (clearing for a building or structure), or under Schedule 6 Clause 2 of the EP Act, noting that proposed industrial development of the lot was assessed by the Environmental Protection Authority, and subsequently approved under Ministerial Statement 863, subject to conditions.

This exemptions are described in the Departments 'A Guide to the Exemptions and Regulations for Clearing Native Vegetation'. It is the applicant's responsibility to determine compliance with these exemptions and therefore whether a clearing permit is required. If there is uncertainty, then the precautionary principle should be applied, and it is recommended applicants apply for a clearing permit.

Based on the information provided, should development approval be issued, the proposal is likely to be exempt from the requirement for a clearing permit under Regulation 5, Item 1 of the Clearing Regulations.

Note that this exemption does not apply prior to development approval being issued.

If further clarification is required, please contact DWER's Native Vegetation Regulation section by email (admin.nvp@dwer.wa.gov.au) or by telephone (6364 7098).

Issue: Groundwater
Advice
The subject property is located within the Cockburn Groundwater Area (Wellard subarea) as proclaimed under the *Rights in Water and Irrigation Act 1914*. Any groundwater abstraction in this proclaimed area for purposes other than domestic and/or stock watering taken from the superficial aquifer, is subject to licensing by the Department of Water. The issuing of a groundwater licence is not guaranteed but if issued will contain a number of conditions that are binding upon the licensee.

It is important to note there may be difficulties securing groundwater in the Cockburn Groundwater Area. Should the applicant be considering using groundwater for irrigation the applicant should contact the licensing section at the Department's Mandurah office on 9550 4222 for further advice.

Should you require any further information please contact Mark Hingston on 9550 4209.

Yours sincerely

Jane Sturgess
Acting Program Manager – Planning Advice
Kwinana Peel Region

16 / 03 / 2022