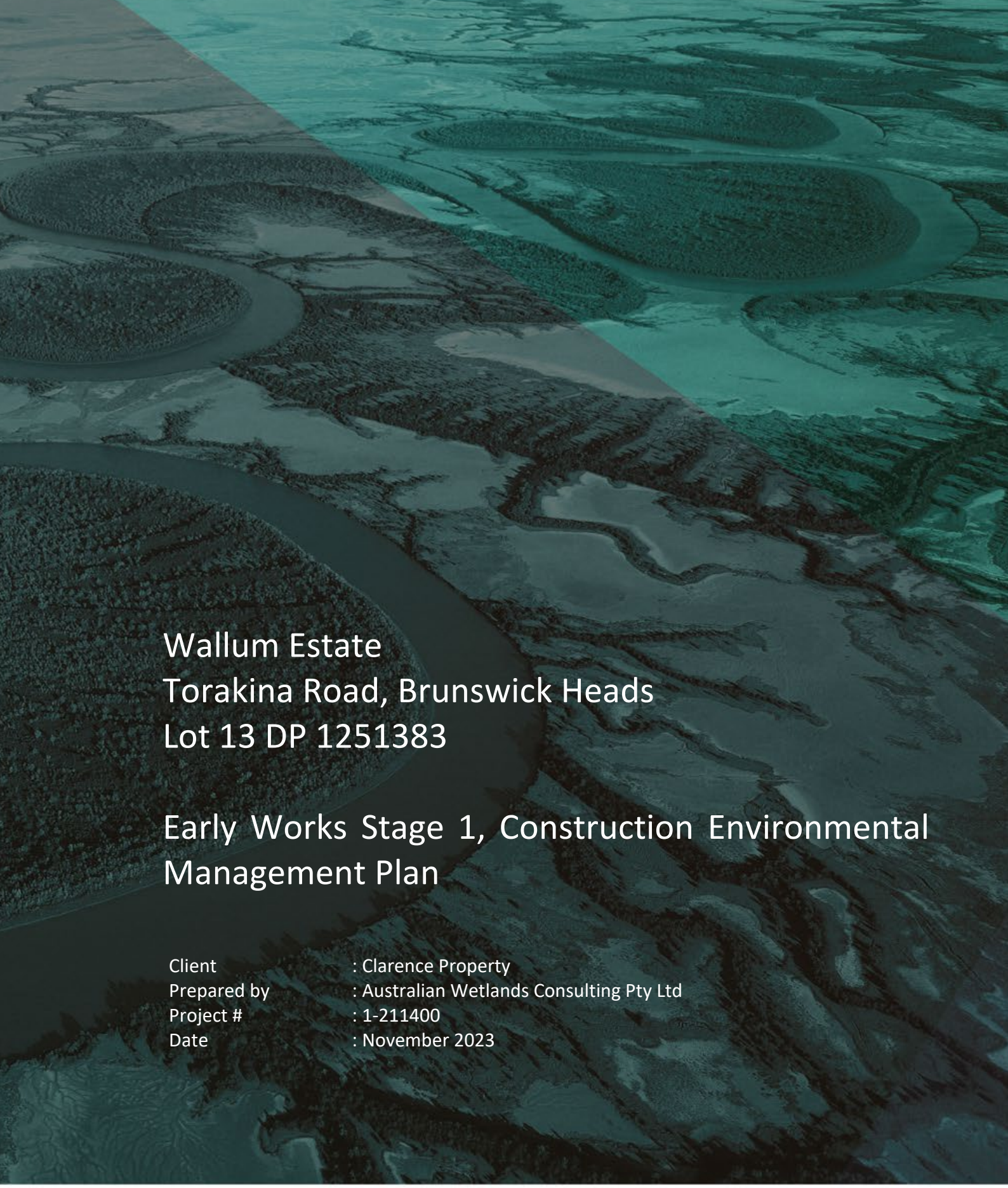

Wallum Estate
Torakina Road, Brunswick Heads
Lot 13 DP 1251383

Early Works Stage 1, Construction Environmental Management Plan

Client	: Clarence Property
Prepared by	: Australian Wetlands Consulting Pty Ltd
Project #	: 1-211400
Date	: November 2023

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AWC

Wallum Estate
Torakina Road, Brunswick Heads
Lot 13 DP 1251383

Early Works Stage 1, Construction Environmental Management Plan

Project control

Project name: **Wallum Estate**
Construction Environmental Management Plan

Job number: 1-211400
Client: Clarence Property
Contact: James Fletcher

Prepared by: Australian Wetlands Consulting Pty Ltd

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Date:	Revision:	Prepared by:	Reviewed by:	Distributed to:
12/8/2022	A	Adrian Leader	Damian McCann	James Fletcher
20/06/2023	B	Adrian Leader	Katie Menzies	James Fletcher
07/11/2023	C	Adrian Leader	Jesse Munro	James Fletcher
30/11/2023	D	Adrian Leader	Minor Amendments	James Fletcher

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1 Introduction and Background

1.1 Introduction

Australian Wetlands Consulting (AWC) has been engaged by Clarence Property Pty Ltd to prepare a Construction Environmental Management Plan (CEMP) for Early Works Stage 1 of the proposed residential subdivision at Wallum Estate at Torakina Road in Brunswick Heads (Lot 13 DP 1251383). This CEMP relates to "Early Stage 1: Ecological Rehabilitation Works" and covers the works related to Management Zones 2a, 2b, 3b and 4 as shown on Figure 4.1. The Surface and Groundwater Management Plan (AWC, 2023) and this CEMP will be updated to accompany the "Eary Stage 2: Bulk Earthworks for Civil Stages 1, 2 and 3" application to include a Drainage Line Management and Monitoring Plan for the construction of the North-South drain in Management Zone 3a, as this is part of Early Stage 2 works.

The CEMP for Early Stage 2 including the independent environmental audit of compliance with the CEMP, will be submitted to Council for approval prior to issue of a Subdivision Certificate for Early Stage 2.

1.2 The Site

The subject site is located immediately south of Brunswick Heads and has an area of approximately 30.5 ha (refer Figure 1-1 Wallum Estate site location

The majority of the site is dominated by low heath which has been maintained by regular slashing. The site is bound by residential development to the north with areas of regrowth and remnant forest to the west and south of the site. The eastern boundary of the site is bound by Simpsons Creek. The property is bisected north-south by a constructed drainage line ('the central drain') which feeds into Everitts Creek to the south which connects to Simpsons Creek in the east. A road reserve of 20 m width runs through the eastern portion of the site and continues into adjacent land to the south (Lot 4 DP 576360).

1.3 Proposed Development

The proposed development has been granted development approval (DA10.2021.575.1) and comprises a staged subdivision to create 131 lots upon land described as 15 Torakina Road, Brunswick Heads (Lot 13 in DP 1251383). The subdivision will form 123 residential lots, three (3) medium density lots, one (1) residue lot and three (3) public reserves together with associated public roads and infrastructure services (water, sewer, drainage and stormwater management works), bulk earthworks, tree removal and vegetation management works (refer Figure 1-2).

The development occupies approximately 13.33 ha (43.7 %) of the site. Residual land outside of the development footprint (~17.2 ha) will be managed for biodiversity and comprises public reserves (P1, P2 and P3) and land to be retained in private ownership (Lot B128). Public reserves will be dedicated to Council once required works are completed. The portion of the site east of the road reserve flanking Simpsons Creek (10.24 ha) will also be dedicated to Council.

There will be excavation works to form a secondary drainage line (realigned north south drain) and formation of habitat areas. Soil disturbance will be due to all proposed works on site, however much of the disturbance area is limited to the surface; large areas of fill are proposed. The main area of excavation will be along the

secondary drainage line, acid frog habitat development (ponds) and for trenching of services including sewer pump stations. Refer civil design plans by Civil Tech.

Table 1-1 below describes the works associated with each stage of the Wallum Estate subdivision.

Table 1-1 Wallum Estate subdivision stage works

Subdivision Stage	Description
Early Stage 1	Ecological rehabilitation works to Lot 324, 402 and 521
Early Stage 2	Bulk Earthworks for Civil stages 1, 2 and 3 Eastern precinct earthworks and NS drain to be constructed
Civil Stage 1	30 Lots + 3 medium density lots
Civil Stage 2	23 lots
Civil Stage 3	33 lots
Civil Stage 4	17 lots Western precinct earthworks to be constructed in Civil stages 4 and 5
Civil Stage 5	20 lots + Lot 251 Western precinct earthworks to be constructed in Civil stages 4 and 5

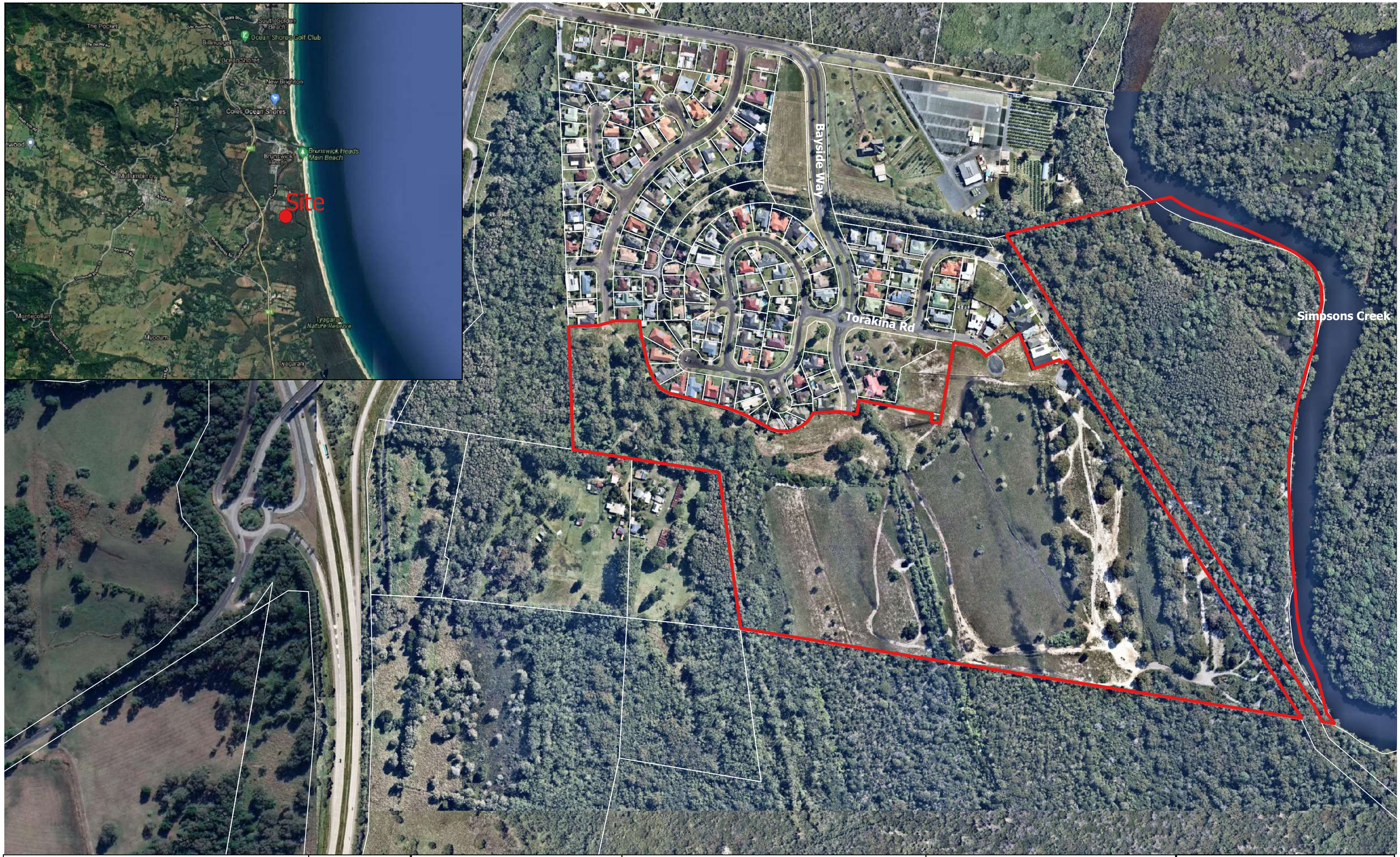


Figure:	1.1 Subject Site
File:	1-211400-BaysideBrunswick_ClarenceProperty
Source:	Aerial Image - Near Maps 2021

0 50 100 150 200 250 m

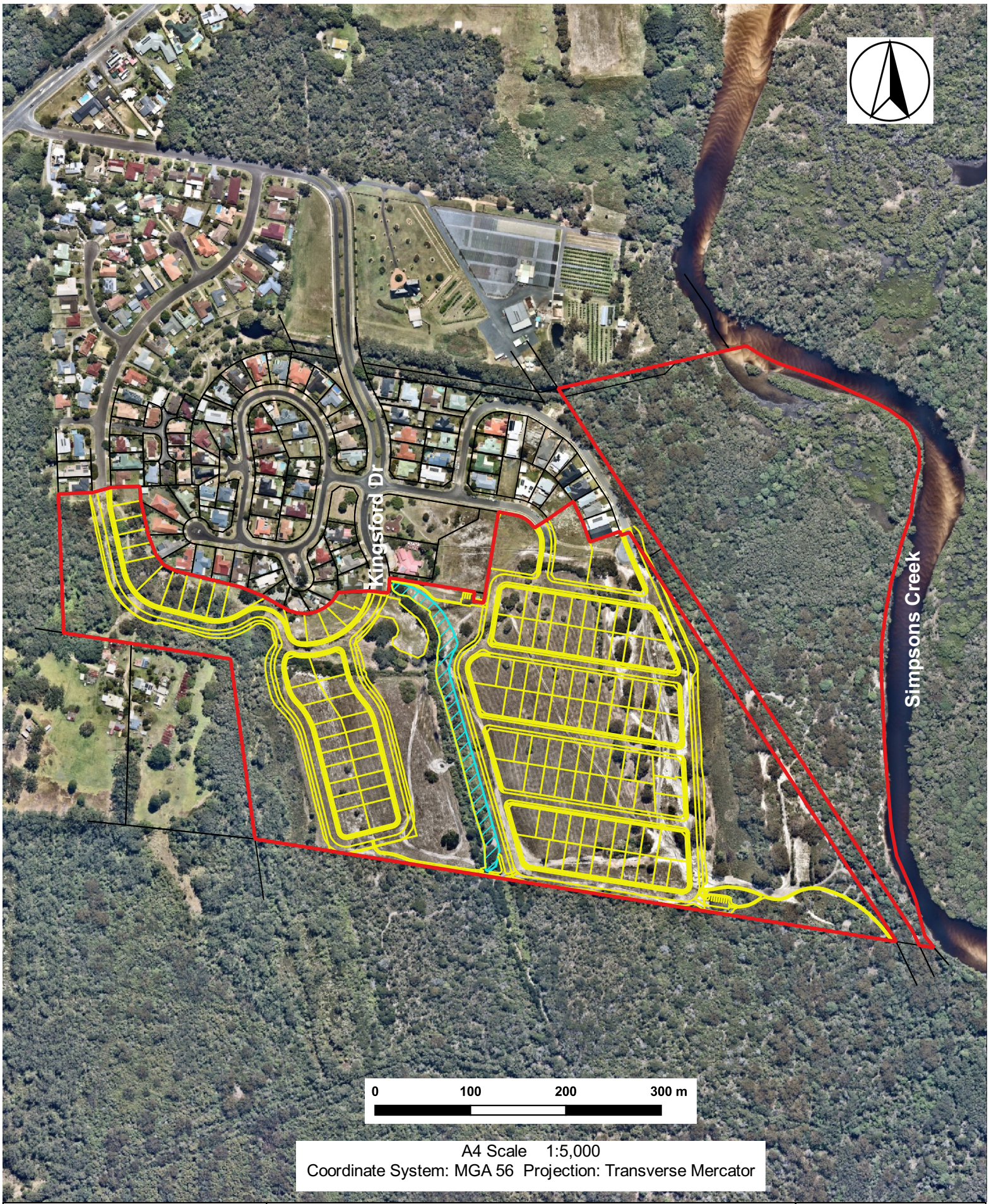
Legend

- Site Boundary
- Stage 1A (Approved)
- Cadastre

Care was taken in the creation of this map. AWC should be consulted as to the suitability of the information shown herein prior to the commencement of any works based on the information provided. AWC cannot accept any responsibility for errors, omissions or positional accuracy. There are no warranties expressed or implied as to the suitability of this map for a particular purpose. However, notification of any errors will be appreciated.

A3 Scale 1:4000
Coordinate System: MGA 56 Projection: Transverse Mercator

Date: 17-8-21



A4 Scale 1:5,000
Coordinate System: MGA 56 Projection: Transverse Mercator

AWC

Disclaimer:
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Legend

- Site
- Layout
- Side Swale

Figure 1.2 Proposed Development

Data source:
Aerial - Nearmaps
Layout - Cilviltech

Date:7-09-22
Job No:211400
Drawn:ED
Checked:DM

1.3.1 Reference Documents

This CEMP should be read in conjunction with the following documents which detail the works to be undertaken:

- *Wallum Estate, Vegetation Management Plan, Revision K (AWC, 2023)*
- *Wallum Estate, Wallum Froglet Management Plan, Revision G (AWC 2023)*
- *Wallum Estate, Acid Sulfate Soil Management Plan, Revision D (AWC 2023)*
- *Wallum Estate, Surface and Groundwater Management Plan, Revision E (AWC 2023)*
- *Wallum Estate, Construction Establishment and Establishment & Operational Management Plan, Revision C (AWC, 2023)*
- *Wallum Estate Subdivision, Dewatering Management Plan, Revision 1.3. (ENV Solutions 2023).*
- *15 Torakina Road, Brunswick Heads, NSW 2483 (Lot 13 DP1251383) Noise and Vibration Management Pla, Revision 1.3 (ENVSolutions, 2023)*
- *Wallum Estate, 15 Torakina Road, Brunswick Heads, NSW 2483, Unexpected Finds Plan (ENVSolutions, 2023)*

1.4 Aim

The primary aim of this CEMP report is to provide contractors with information and guidance to fulfil their responsibilities to minimise the impacts to the environment and wider community during the works. The scope and application of this CEMP are outlined in Table 1-2.

This CEMP outlines measures that will be undertaken by the construction contractor to manage impacts to the natural environment and prevent foreseeable nuisance and health impacts on sensitive receivers as a result of the construction works.

This CEMP provides management measures to mitigate impacts to water quality, vegetation, fauna, air quality, noise and cultural heritage. This CEMP applies to the lead contractor, sub-contractors and Byron Shire Council personnel working on the site and any workers or visitors onsite. Table 1-2 will be the basis for the recommended adaptive management approach towards environmental management and any audits completed as discuss below in the following sections.

Table 1-2 Scope and Application of this CEMP

Question	Answer
Who?	This CEMP applies to all personnel onsite (Council, lead contractor, sub-contractors and site visitors).
What?	This CEMP applies to all construction works of the project and details management action for: • Noise • Air quality and dust • Fauna • Cultural heritage • Acid Sulfate Soils • Dewatering • Contamination management • Vegetation • Water quality • Sediment and erosion control • Stormwater
When?	This CEMP applies from the site preparation/early works through to the completion of construction.
Where?	This CEMP applies to the entire site.
Why?	The purpose of the CEMP is to minimise the risk of environmental harm, to satisfy legal obligations and ensure best environmental practice during the construction of the project.

1.4.1 Applicable Legislation

The following legislation is applicable to the construction works. The contractor is responsible for ensuring

the requirements of this (and any other) legislation are satisfied.

- Protection of the Environment Operations Act 1997 (POEO Act)
- Biodiversity Conservation Act 2016 (BC Act)
- NSW Occupational Health and Safety Act 2000.
- Environmental Planning & Assessment Act 1979 (EP&A Act)
- Waste Avoidance and Resource Recovery Act 2001(WARR Act)
- Water Management Act 2000 (WM Act)

1.4.2 Standards & Guidelines

The following guidelines, standards and regulations are referred to in this report:

- Draft Construction Noise Guideline (EPA, 2020)
- AS 1319-1994 Safety Signs for the Occupational Environment
- Protection of the Environment Operations (Waste) Regulation 2014
- Erosion & Sediment Control Guidelines (IECA 2016)
- Acid Sulfate Soils Management Advisory Committee (NSW E&H, 1998)
- National Occupational Health and Safety Commission (NOHSC) Code of Practice for the Safe Removal of Asbestos, 2nd edition [NOHSC:2002(2005)]
- Radiation From Mineral Sands Fact Sheet (Northern Rivers Contaminated Land Program, 2021)
- DECCW Interim Construction Noise Guideline (DECCW 2009)
- NSW Industrial Noise Policy (EPA 2000)
- Assessing Vibration: A Technical Guideline (DEC 2006)

2 Environmental Management

2.1 Roles and Responsibilities

All project personnel will be responsible for following the codes of conduct outlined in the Work Health and Safety Act 2011 and the Work Health and Safety Regulation 2017. The primary contactor must ensure all personnel undertake a suitable Work Health and Safety induction prior to commencing work activities on site. The principal contactor should provide an OHS Risk Management System to support a systematic way of managing the various obligations, at all levels of the organisation. The system needs to meet to the OHS legislative and government policy requirements in managing hazards associated with the activity. The induction should also acknowledge, detail and explain how the environment and heritage constraints, as specified by this CEMP, apply to the activity. A suitably qualified person shall be appointed to the positions of Project Manager and Works Supervisor for the entirety of the activity prior to the project commencing.

The role and responsibility of key and project personnel, including sub-contractors, concerning to environmental management is detailed in Table 2-1. These responsibilities are categorised in relation to relevant positions and level of authority. The nominated Environmental Manager for the project is Damian McCann, his resume is attached in Appendix N along with Jesse Munro's resume. Once civil and environmental contractors are appointed, the Environmental Manager role may be transferred to a representative nominated by the contractor.

The head contractor is to nominate a competent Environmental Manger and engage Environmental Consultants to ensure that this CEMP is understood and implemented in full.

Table 2-1 Roles and Responsibilities

Role	Responsibility
Project Manager	• Implement the CEMP for the Project • Liaise with the Environmental Manager and approval authorities as required • Allow for sufficient resources to be made available to implement the CEMP • Participate (as requested) during the environmental review meeting • Report to the client in relation to compliance with the CEMP as required, ensuring that the CEMP is implemented in accordance with Project requirements through the construction program • Ensure all licences and approvals are in place relating to environmental management • Liaise with the client and project stakeholders in relation to Environmental management issues • Coordinate reporting requirements from the CEMP • Manage environmental incidents and investigations • Undertake site inspections, audits and provide results of the audits • Respond to action requests issued by council • Facilitate environmental induction and training of all employees, subcontractors, suppliers and consultants • Implement environmental control measures within nominated time frames
Site Supervisor & Engineers/ Environmental	• Ensure environmental management controls are in place prior to commencement of construction activities • Undertake monitoring and inspections in accordance with the requirements of the CEMP

Role	Responsibility
Representative / Environment Manager	• Initiate remedial works to ensure environmental controls are effectively maintained • Maintain records of all monitoring and inspection activities • Oversee the implementation of the CEMP on site • Supervise and instruct all project personnel regarding implementation and maintenance of environmental protection measures • Advise the Project Manager on potential conflicts between environmental management objectives and construction requirements • Undertake project works in accordance with the CEMP • Stop works and report all incidents or unexpected finds to the Project Manager • Undertake site inspections, audits and provide results of the audits to Project Manager • Respond to action requests issued by council • Facilitate environmental induction and training of all employees, subcontractors, suppliers and consultants • Respond to requests for information from council • Implement environmental control measures within nominated timeframes
Project Employees	• Maintain environmental control measures as required • Restrict all access into exclusion zones • Attend toolbox and training sessions • Report all incidents and emergencies to the Site Supervisor • Implement environmental control measures within nominated timeframes
Sub-Contractors	• Maintain environmental control measures as required • Attend project induction, toolbox sessions and training as required • Follow directions given by Site Supervisor • Report all incidents and emergencies to the Site Supervisor • Implement environmental control measures within nominated timeframes

2.2 Project Personnel Contacts

At project inception, contact details for key project personnel with the responsibility to implement the CEMP should be confirmed. Those responsible for responding to incidents and emergencies should be detailed in Table 2-2 once they are known. The names and contact details of the Environmental Manager must be provided to Council and a prestart meeting with relevant Council Officers arrange prior to the commencement of any groundworks.

Table 2-2 Roles and Contact details (to be finalised when contract awarded)

Name	Role	Contact
Damian McCann	Environmental Manager Refer Appendix N for resume	damian@awconsult.com.au ph. 0408471077
Jesse Munro	Senior Environmental Scientist Refer Appendix N for resume	jesse@awconsult.com.au ph. 0437012014

3 Training and Awareness

3.1 Site Induction

All personnel (including contractors/subcontractors) working on the project must attend the Project Specific Induction. The Project Specific Induction shall be conducted as per the requirements of this CEMP. As well as OH&S, the site induction must include training regarding environment and heritage aspects specific to on-site operations.

The environmental aspects of the project are those activities that interact with the environment and may lead to impacts or larger scale change, including:

- Vegetation removal
- Fauna disturbance
- Surface and groundwater contamination
- Dewatering
- Excavation and soil disturbance
- Storage of fuels and chemicals
- Placement of onsite amenities
- Material stockpiling and transport
- Waste generation and fuel consumption

Environmental impacts are changes to the environment caused by construction activities. These changes can be both positive and negative. The works phase of the project may have the following environmental impacts that need to be managed:

- Disturbance and/or loss of flora and fauna
- Uncontrolled erosion and sediment discharge
- Noise and vibration
- Reduced water quality
- Dust and reduced air quality
- Chemical spills
- Increased dust and reduced air quality
- Waste creation
- Contamination
- Disturbance to cultural heritage items

An environmental due diligence site induction training plan must be developed and implemented and shall include control measures to mitigate the risk of environmental impacts from the activity. Control measures are detailed in Section 4. The *Site Environmental Management Plan Induction Form*, provided in Appendix A, is to be completed following site inductions.

3.1.1 Daily Pre-Work Briefings

All supervisors are required to carry out daily briefings at the commencement of each shift to ensure environmental issues specific to the work being performed are being addressed. This forum shall be used to provide a framework for employees to raise and discuss environmental/safety and quality issues. If additional hazards are identified, they will be detailed at the Toolbox talks with all personnel involved with site works

to sign onto prior to commencing activities.

3.1.2 Toolbox Talks

Toolbox talks will be conducted prior to the start of construction on specific work elements where there is a substantial environmental risk or when required to reinforce ongoing environmental issues. Toolbox training will ensure that relevant information is communicated to the workforce and that feedback can be provided on issues of interest or concern. Toolbox meetings may be used as a forum to provide training to site personnel.

The Project Manager shall ensure that there are suitable provisions in the subcontract conditions for such meetings to occur as and when required. Toolbox meetings shall be recorded.

3.1.3 Project Management Meetings

Meetings will be held as required to discuss the construction program and any ongoing environmental and safety concerns or issues that arise in the upcoming works. The Project Management Team including the Project Manager, Engineers, Site Supervisor and Environmental Representative will attend these meetings. Minutes of these meetings are to be documented.

4 Environmental Safeguards and Management

4.1 Hygiene Management

Management measures must be implemented during construction works to ensure personnel, machinery and plant do not introduce weed seed, pests or propagules to the site. The 'Arrive Clean, Leave Clean' guidelines (2015) (refer Appendix B) shall be adopted and implemented for the duration of the works.

Hygiene management measures must be implemented during construction works to minimise the introduction and spread of Myrtle Rust, Chytrid Fungus, Cinnamon Fungus and Phytophthora. Weed seeds, mud, soil and organic matter must be removed from all clothing, footwear, tools, equipment, machinery and vehicles before entering the project site. A disinfectant kit must be located at all site entry/exit points. Each kit should consist of a hard brush and spray bottle or footbath containing disinfectant solution of 70% ethanol or methylated spirits in 30% water.

To minimise risks to frogs from chytrid fungus, frogs should only be handled by an ecologist in accordance with the *Saving Our Species Hygiene Guidelines* (DPIE, 2020). Further information on managing risks to frogs from chytrid fungus are provided in these guidelines, these should be referred to for further information on considerations for amphibian chytrid fungus.

4.2 Vegetation Management

A focus of this CEMP is to minimise direct impacts of construction works on vegetation (e.g., damage to trees) through machinery movement, sediment deposition or unwarranted removal. Section 5 of the *Wallum Estate, Vegetation Management Plan, Revision K* (AWC, 2023) (VMP) identifies various management and restoration activities for each of the Management Zones (MZs) that aim to restore existing vegetation/habitat and re-establish vegetation within formerly cleared areas. Section 5 of the VMP stipulates that no stockpiling or storage is permitted within any MZs to eliminate the risk of sedimentation and contamination within these areas.

Four MZs have been identified at the site (refer *Figure 4-1*). Details of MZs are described in *Table 4-1* while a summary of prescribed management actions within each Management Zones is provided in *Table 4-2*.

Table 4-1 Vegetation Management Zones

MZ	Details	Vegetation
1	Largest MZ, occupying residual land in the east of the site (10.3 ha). Lot B128 in the Landscape Plan.	Mangrove forest (*Avicennia marina*, *Aegiceras corniculatum*), Swamp forest (*Casuarina glauca* +/- *Melaleuca quinquenervia*) and brackish swamp (*Juncus kraussii, Acrostichum speciosum*), Dune sclerophyll forest (*Eucalyptus racemosa, Allocasuarina littoralis, Banksia aemula*).
2a	South-east corner of the site west of the road reserve. Identified Wallum Froglet habitat. Lot P1 in the Landscape Plan.	Sedge swamp/wet heath
2b	South-east corner of the site west of the road reserve. Additional plantings will be implemented within degraded tracks. Lot P1 in the Landscape Plan.	Dune sclerophyll forest
3a	Drainage reserve (to be constructed).	Slashed heath and regrowth

MZ	Details	Vegetation
3b	Central drainage area Northern portion where weed management will be completed comprises approximately (0.3 ha). Lot P2 in the Landscape Plan.	North: Slashed grassland; two isolated patches of *Eucalyptus robusta*. Central drain: Regrowth vegetation retained (*Allocasuarina littoralis, Nematolepis squamea*)
4	Western portion of site. Includes Wallum Froglet habitat; additional plantings will be implemented along degraded access track. Lot P3 in the Landscape Plan.	Swamp forest, Dune sclerophyll forest

In the construction period, the following points apply to all of the MZs to protect existing vegetation and habitat:

- No stockpiling or storage (etc.) is permitted within any MZs.
- No works (except for tracks for pedestrian access or for essential environmental management purposes) is permitted within any MZs.
- Vehicular access, apart from for essential environmental management purposes, is not permitted within any MZs

4.2.1.1 Trees to be Retained and Fenced

Trees to be retained are to be protected by a fence as to minimise disturbance to existing ground conditions within the dripline of trees. Each fence should be constructed as follows:

a) With a minimum height of 1.2m
b) Outside the drip line of the tree
c) Of steel star pickets at a maximum distance of 2m between pickets
d) Using a minimum of 3 strands of wire
e) To enclose the tree and
f) With orange barrier mesh or similar attached to the outside of the fence and continuing around its perimeter

The fence should be maintained for the duration of the site clearings and construction works. Refer to Appendix C for locations of retained trees across the site.

Table 4-2 Summary of management actions

MZ	Weed control	Planting	Ripping	Habitat Maintenance*	Rubbish Removal	Fencing (Construction)	Exclusion (Occupation)	Nest box installation
1	✓ (minor)	✓	✓	✓*	-	✓	✓	✓
2a	✓ (As required)	✓	-	✓*	-	✓	✓	
2b	✓ (minor)	✓	✓	-	-	✓	✓	✓
3a		✓		✓*	-	✓	✓	
3b		✓		✓*	✓	✓	✓	
4	✓	✓	✓	✓*		✓	✓	✓

*For the long-term habitat maintenance of wet heath and sedgeland, damp leaf little layers and microclimates (Acid Frog and threatened species habitat i.e., Mitchell's Rainforest Snail), incursions of woody vegetation (e.g., eucalypts, wattles etc which may form a closed canopy) must be removed to maintain suitable habitat.

LEGEND

- PROPERTY BOUNDARY
- EXISTING DRAIN
- REALIGNED DRAIN
- PROPOSED CONSERVATION AREA
- PROPOSED PUBLIC OPEN SPACE
- PROPOSED DRAINAGE RESERVE
- ROAD RESERVE

AWC
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25 LESLIE ST, BANGALOW NSW 2479
P (02) 6687 1550 | 1300 998 514
www.awconsult.com.au

CLIENT: CLARENCE PROPERTY

DRAWING:
FIGURE 4.1
LAND DEDICATION PLAN

PROJECT:
WALLUM ESTATE

REV.	ISSUE / AMENDMENTS	DATE
A	*FOR APPROVAL*	*21.09.22*

ADDRESS:
LOT 13 DP 1251383, TORAKINA DR BRUNSWICK HEADS

SCALE 0 50 100m

REV. **A**

DESIGNED	IC/SS	CAD FILE No. **1-211400_WALLUM.DWG**
DRAWN	SS	
CHECKED	DMc	DWG No. **1-211400_WALLUM_**

4.2.2 Management Zone 1

Management actions for MZ 1 include:

- Control of Whiskey Grass by a professional experienced bush regenerator.
- Informal trail management:
    - Shallow ripping (multi-tine ripper to 300 mm depth) of compact sand on informal tracks to stimulate germination.
    - Repurpose vegetation removed i.e., large branches and logs from within the development footprint to restrict further access to informal tracks. Conduct brush matting to promote revegetation.
    - If regeneration rates are low, infill and compensatory plantings shall be implemented.
    - Monitoring informal trails for signs of continued disturbance from disturbance from the public recreational activities, vehicles and motorbikes.
    - Monitoring of plantings on informal trails as required. Compensatory plantings for individual plants lost must be conducted at a 1:1 ratio.
- Conduct shallow ripping (multi-tine ripper to 300 mm depth) of areas compact sand to promote germination, monitor for signs of regeneration and brush mat as required.
- Maintenance of wetland and heath communities.
- Protection of Pink Nodding Orchids. Key risks to these plants are theft and trampling. The orchid colony will be protected by temporary construction fencing during installation of the eastern walkway and a buffer planting installed to screen the orchids from view. Signage stating 'Protected habitat – please keep out' (or words of similar intention) shall be installed along the walkway and at the walkway entry point.

4.2.2.1 Mitchells Rainforest Snail

Areas of suitable habitat for Mitchell's Rainforest Snail within MZ1 consist of slightly elevated ground on the margins of coastal wetlands or narrow strips of rainforest vegetation with a well-developed moist leaf litter layer with dead palm fronds. Management actions with these areas will consist of:

- Maintenance of microclimates surrounding areas of suitable habitat in proximity to the development footprint through:
    - Staged weed control i.e., removal of portions large weed infestations followed by infill plantings to increase canopy cover if required.
- Hand weeding and no herbicide use in areas that provide suitable habitat.
- Retention of a dense leaf litter layer and dead palms fronds
- Establishment of 'No-Go Zones' in areas where suitable habitat is identified, and where no weed control works are required.

4.2.3 Vegetation Management Zone 2a and 2b

Management actions for MZ 2 include:

- Fence the western side of MZ 2 to prohibit entry by vehicles during construction. Informal entry to MZ 1 will be restricted during the occupation phase to control public access. This will be achieved by installation of bollards along the edge of the perimeter road and car park to restrict vehicle access.
- Dense plantings along the proposed creek access pathway to restrict residential access to bushland and further discourage opportunities for the creation of informal pathways.
- Installation of signage at strategic locations stating, *"Regeneration area, No Entry"* or "*Sensitive Ecological Area – No Entry*".
- Control of Whiskey Grass by a professional experienced bush regenerator.

- Ripping sandy soils on informal tracks (as per MZ 1) (2b).
- Installation of compensatory and infill plantings (2b).
- Maintenance of heath and wetland habitats (2a).
- Monitoring of plantings and ripping actions (2b).

The delineation of MZ 2a and 2b is shown in *Figure 4-1*

Notes:

- Incursions of eucalypt species fringing the proposed carpark area must be removed from the heathland in order to maintain light levels and prevent shading out (MZ 2a).
- For the long-term habitat maintenance of wet heath and sedgeland habitat within MZ 2a (acid frog habitat), incursions of woody vegetation (e.g., eucalypts, wattles etc. which may form a closed canopy) must be removed to maintain biodiversity values associated with existing high-quality habitat.

4.2.4 Management Zone 3a

MZ 3a comprises the drainage reserve east of the existing drain, where a second stormwater channel and swales will be constructed. Drain construction will require disturbance of all existing vegetation in this zone, therefore post construction planting may only occur when works are complete and signed off by the project engineer and stormwater consultant. Management actions for MZ 3a are limited to landscape plantings to establish wallum sand heath and a treatment swale, as specified in the landscape plan at Appendix C. Monitoring of the plantings will be required following installation.

Notes:

- For the long-term habitat maintenance of wet heath, incursions of woody vegetation (e.g., eucalypts, wattles etc., which may form a closed canopy) must be removed to maintain biodiversity values associated with adjacent existing high-quality habitat.

Management actions for MZ 3a therefore are limited to:

- Landscape plantings to establish Wallum Sand Heath and a treatment swale, as specified in the Landscape Plan and Habitat Creation Revision C.2 at Appendix C. The landscape plan will specifically include a dense planting of sedges and grasses to widths of up to 5m (space permitting) along mapped watercourses to restrict cane toad incursions (refer to Appendix C.).

4.2.5 Management Zone 3b

The majority of MZ 3b will be managed as Wallum Froglet habitat (refer WFMP). In the northeast of MZ 3b two isolated patches of Swamp mahogany occur within mown grassland. Several woody weeds occur within this area along with some dumped building refuse and concrete. Areas of mown grassland will be retained as open space. Planting will occur within the bioswale and new drain to be constructed east of the existing drain. These plantings are detailed in the Early Ecological Works Package (AWC 2023) (refer Appendix C). Designated vegetation communities must maintained as per the VMP.

Note that the existing central drain will not be subject to any works and all existing regrowth flanking the drain will be retained in-situ. This vegetation is in good condition, weed free and is regenerating well; no further management is required.

Management actions for MZ 3b therefore are limited to:

- Removal/control of weed and exotic plant species (refer Figure 3.2) by a professional experienced bush regenerator.

- Rubbish removal.
- Maintaining Wallum Froglet habitat in accordance with the Wallum Froglet Management Plan (WFMP) (AWC 2023).
- Landscape plantings to establish Wallum sand heath and a treatment swale, as specified in the Landscape Plan at Appendix C. The landscape plan will specifically include a dense planting width of up to 5m (space permitting) along mapped watercourses to restrict cane toad incursions (refer to Appendix C.).

Notes:

- For the long-term habitat maintenance of wet heath and sedgeland habitat within MZ 3b (acid frog habitat), incursions of woody vegetation (e.g., eucalypts, wattles etc., which may form a closed canopy) must be removed to maintain biodiversity values associated with adjacent existing high-quality habitat.

4.2.6 Management Zone 4

MZ 4 flanks the western boundary of the site and is partly bisected by powerlines and an access track in the northern portion. Vegetation in the north outside of these disturbed areas is in excellent condition. At the boundary with the adjacent property to the south several mature Coral Tree and Umbrella Tree occur. Old vehicle tracks in this area have regenerated significantly with Bracken and regenerating heath. The southern portion of MZ 4 is in excellent condition and no works are required. Substantial regeneration of Prickly Teatree (*Leptospermum juniperinum*) flanks the eastern edge of adjacent swamp forest. The southern portion of MZ 4 comprises acid frog habitat as acknowledged in the WFMP.

Management actions for MZ 4 include:

- Installation of bollards along the edge of the perimeter road to restrict vehicle access.
- Installation of signage at strategic locations stating, *"Regeneration area, no entry"* (or words of similar intention).
- Removal/control of exotic species by a professional experienced bush regenerator.
- Ripping sandy soils on informal tracks (as per MZ 1).
- Installation of compensatory and infill plantings (refer Section 4.2.6).
- Monitoring of plantings and ripping actions.
- Maintenance of appropriate heath and wetland vegetation.

4.2.7 Infill Plantings (MZ 1, MZ 2b, MZ 4)

All infill plantings within informal tracks and extensive weed control areas will be planted at spacings 5 metre centres. Tree and shrub plantings will be installed following initial ripping works. All trees and shrubs will be installed as planted tube stock, be sourced from a reputable supplier of native plants, be in good health and free of pests and disease and ideally be of native provenance. The planting methodology will consist of:

- Digging a hole that is deeper and wider than the tube.
- Addition of terraform as required. Notably if planting occurs in drier seasons.
- Backfill the hole ensuring no smooth surfaces and create a water dish
- Mulch with weed free materials i.e., site tub grinds or tea tree mulch.
- Water in thoroughly and install a tree guard.

Any plants lost must be replaced at a 1:1 ratio and representative of the species lost.

Note the requirement regarding eucalypt landscaping around the carpark in the south-east of the site (MZ 2b): Incursions of eucalypts species from the proposed plantings fringing the carpark in MZ 2a must be removed in order to maintain light levels within the heathland.

A watering regime applies to all planted trees as follows:

- Initial watering and daily watering for five days
- Watering every 3 days for four weeks.

Additional watering may be required should adverse conditions occur; this will be completed at the discretion of the appointed contractor. A planting list is provided at Table 4-3 represents common species within Scribbly Gum open forest at the site while Table 4-4 describes species for infill planting for MZ4. Species chosen include resources for the Koala and Glossy Black-cockatoo.

Note: Infill planting must not alter the composition of vegetation communities as described in the VMP.

Table 4-3 Infill plantings – species schedule

Scientific name	Common name	Growth form
Acacia suaveolens	Sweet Wattle	Shrub
*Allocasuarina littoralis**	Black She-oak	Tree
Banksia aemula	Wallum Banksia	Tree
Elaeocarpus reticulatus	Blueberry Ash	Tree
*Eucalyptus racemosa^*	Scribbly Gum	Tree
*Eucalyptus robusta***	Swamp Mahogany	Tree
Leptospermum polygalifolium	Tantoon	Shrub
Persoonia stradbrokensis	Geebung	Shrub

*Glossy Black-cockatoo feed tree

**Primary Koala feed tree (Note: not to be planted in Pink Nodding Orchid buffer planting)

^ Secondary Koala feed tree

Table 4-4 Infill Planting MZ4 for PCT 1230

Scientific name	Common name	Growth form
Acacia maidenii	Maiden's wattle	Shrub
Cordyline stricta	Narrow-leaved palm lily	Shrub
Banksia aemula	Wallum banksia	Shrub
Glochidion ferdinandi	Cheese tree	Shrub
Leptospermum juniperinum	Prickly Tea-tree	Shrub
Leptospermum polygalifolium	Jellybush	Shrub
Baloskion tetraphyllum	-	Sedge
Gahnia siberiana	Red-fruit saw-sedge	Sedge
Hypolepis mueller	Harsh Ground Fern	Fern
Ischaemum australe	-	Grass
Xanthorrhoea fulva	-	Grass

4.2.8 Landscape Plantings (MZ 3a)

Establishment of Wallum sand heath and swale plantings will be completed in accordance with landscape specifications (refer Appendix C.) following construction of stormwater facilities.

4.2.9 Vegetation Monitoring

Baseline monitoring within each Management Zone will be completed prior to initial works taking place via the establishment of permanent plots and photo points. Following commencement of works, monitoring will be completed at 12-month intervals for a total period of five years (5 monitoring events). A brief report should be produced annually that outlines the progress of revegetation and restoration works over each monitoring event.

As there are various methods for revegetation and restoration works prescribed within this VMP, monitoring methods differ for planting and ripping. Monitoring requirements are as follows:

4.2.9.1 Infill Plantings

Monitoring methods include:

- In year one, two 5 x 5 m plots will be established within each Management Zone to monitor areas that have been planted.
- Each plot will be surveyed with a GPS unit and permanently marked with star pickets. Permanent photo points will be established at each plot.
- Inspection of plots site at 12-month intervals with tasks including:
  - Inspection of plant health and vigour
  - Identify any plant mortalities within the plot and within each Management Zone in general
  - Assessment of weed cover
  - Photographs from set photo points (locations to be agreed at project inception)
  - Assess mulch cover and tree guards.

4.2.9.2 Ripping (Assisted Regeneration)

Monitoring methods include:

- Two 5 x 5 m plots will be established within each Management Zone where areas have been ripped in order to determine the success of seed germination following disturbance.
- Each plot will be surveyed with a GPS unit and permanently marked with star pickets. Permanent photo points will be established at each plot.
- Inspection of the plots at 12-month intervals with tasks including:
  -Inspection of plant health and vigour
  - Identify species regenerating and species cover
  - Assessment of weed cover (if relevant)
  - Photographs from set photo points (locations to be agreed at project inception)

4.2.9.3 Informal tracks and trails

Monitoring methods include:

- Photographs of informal tracks and positions of repurposed vegetation for established photo monitoring positions
- Inspection of informal track areas at 12-month intervals for signs of regeneration, further signs of degradation or any increases in alternative informal track routes.
- Assessment of weed cover (if relevant).

4.2.10 Vegetation Reporting

Reporting on the progress of works relating to this VMP is required to demonstrate that KPIs (refer Table 4-5) are being met. Annual monitoring reports are to be completed by either a qualified bush regenerator or ecologist and reports will be supplied to the proponent and Council. Annual reports shall include the following information:

- A timetable of restoration and maintenance works completed in that year.
- The results of the monitoring completed regarding KPIs.
- Comments on any problems at the site (e.g., vandalism, informal track making, rubbish dumping etc.) and how these have been managed.
- Photographs from fixed photo points in order monitoring the progress of the planting and ripping over the lifetime of the VMP.
- A log detailing herbicide uses during maintenance operations.
- Any other relevant information or recommendations for future maintenance.
- Details on the replacement of any dead or unhealthy tube stock or plantings where relevant
- State how no compliances have been addressed

Table 4-5 *Management actions and KPIs for VMZs*

Phase	Actions	Location*	Timing	KPIs	Responsibility
1 (Establishment phase)	Remove environmental weeds and implement ripping within degraded areas/ informal tracks.	MZ 1-4	Prior to construction works and be completed within one year. YEAR 1	• 90% of woody weeds and exotic groundcover removed. • Ripping completed within all areas of degraded land/informal tracks. • Existing and emergent weeds controlled by initial treatment following ripping. • Rubbish removed (where relevant).	Appointed contractor
1 (Establishment phase)	Installation of 'no go' fencing prior to and during construction.	MZ 1-4	Prior to construction works. YEAR 1	• Vegetation management zones fenced off to restrict access by vehicle/plant and signage installed stating all MZs are 'no go' zones	Project manager/developer
2 (Establishment phase)	Follow up removal of environmental weeds and monitor areas where ripping has been completed.	MZ 1-4	To be continued during the second year of construction. Monitoring to be completed. YEAR 2	• 95% of woody weeds and exotic groundcover removed. • Initial ripping of sandy areas produces a minimum native groundcover of 20% within monitoring plots, • 90% survival of planted trees. • Any dead plants are replaced as required. • Fencing maintained.	Appointed contractor
3 (Maintenance phase)	Follow up removal of environmental weeds and monitor areas where ripping has been conducted to assess required plant densities has been achieved.	MZ 1-4	To be continued during the third year of construction and completed prior to the end of second year of construction. YEAR 3	• Native cover of 30% achieved within ripped areas. • 90% survival of planted trees. • Emergent weeds controlled and comprise ≤5% total cover within all MZs. • Any dead plants are replaced as required. • Fencing maintained.	Appointed contractor
4 (Maintenance phase)	Prescribed densities of plants from ripping and/or planting sandy areas are achieved as per monitoring requirements	MZ 1-4	All actions to be completed by the end of 4th year from construction initiation date. YEAR 4	• Native cover of 40% achieved within ripped areas. • Minimum 90% native plant survivorship (plantings) achieved by end of 4th year of on ground works, • Emergent weeds continue to be controlled and comprise ≤5% total cover within all MZs • Any dead plants are replaced as required. • Removal of tree guards.	Appointed contractor

Phase	Actions	Location*	Timing	KPIs	Responsibility
5 (Completion phase)	Prescribed densities of plants from ripping and/or planting sandy areas are achieved as per monitoring requirements	MZ 1-4	All actions to be completed by the end of 4th year from construction initiation date. YEAR 5	• Native cover of 50% achieved within ripped areas. • Minimum 90% native plant survivorship (plantings) achieved by end of 5th year of on ground works, • Emergent weeds continue to be controlled and comprise ≤5% total cover within all MZs • Any dead plants are replaced as required.	Appointed contractor
Occupation – vegetation management	Removal of all non-heath vegetation within MZ 2a and MZ 3a/3b to maintain biodiversity values.	MZ 2a, MZ 3a/3b	Annually	• MZ 2a must remain as a wetland/wet heath community (acid frog habitat). Any incursions of Eucalypts or other sclerophyllous trees which may close out the canopy must be removed. (i.e.. intervention management). • MZ 3a/3b must remain as heath which provides acid frog and threatened species habitat. Any incursions of Eucalypts or other sclerophyllous trees which may close out the canopy must be removed. (i.e.. intervention management).	MZ owner

4.3 Fauna Management

The contractor shall minimise the impacts on native fauna at the site during the proposed works. In areas of proposed vegetation clearing including grubbing of native vegetation (MZ2 & MZ3) a fauna spotter catcher will be required to ensure native fauna are not killed or injured as a result of the works.

Prior to vegetation clearing and translocation from impacted sedge vegetation within MZ2 to newly constructed WF ponds, the Project Ecologist will need to complete trapping and relocation of frogs and any other animals from these areas to areas of retained similar habitat as close to the capture site as possible. Any injured fauna is to be taken to a veterinarian for appraisal and care. All captured fauna are to be released in areas of retained similar habitat as close to the capture site as possible.

4.4 Hollow/Nest Box Management

The installation of the hollows and/or nest boxes is required to offset the removal of 22 hollow bearing trees that provide hollows suitable for Glossy Black-Cockatoo (*Calyptorhynchus lathami*) and arboreal mammals, provide immediate habitat for displaced fauna and minimise the Key Threatening Processes (KTPs). The hollows and/or nest boxes will be installed as a part of the early works stage of the development.

Prior to the removal of hollow bearing trees, 70% of the hollows and/or nest boxes must be installed to ensure suitable habitat is available for displaced fauna as a result of the clearing. The remaining 30% of the hollows and/or nest boxes must be installed once the clearing of hollow bearing trees has ceased. A total of 50 nest boxes will be installed in MZ1, MZ2b and MZ4 for candidate species including:

- 16 nest boxes for Glossy Black-Cockatoo (*Calyptorhynchus lathami*)
- 7 nest boxes for Brush-tailed Phascogale (*Phascogale tapoatafa*)
- 6 nest boxes for Eastern Ringtail Possum (*Pseudocheirus peregrinus*)
- 6 nest boxes for Feathertail Glider (*Acrobates pygmaeus*)
- 2 nest boxes for Mountain Brushtail Possum (*Trichosurus caninus*)
- 5 nest boxes for Squirrel Glider (*Petaurus norfolkensis*)
- 8 nest boxes for Sugar Glider (*Petaurus breviceps*)

An additional 15 Microbat boxes are proposed to be installed in addition to the 50 nest boxes to further offset any potential loss of habitat such as and hollows and reduce mosquito abundance.

Nest boxes must be attached utilising the Habisure system (Franks and Franks, 2006) to a structurally sound tree limb preferably facing north-east, north-west or south-east where possible to avoid extreme weather impacts such as high temperatures and severe storms. Microbat boxes may benefit from westerly orientations in order to provide thermoregulatory benefits from the afternoon, however they should be orientated away from proposed and existing buildings to avoid light impacts. Preferred nest box specifications heights for each of the candidate species are outlined in Table 4-6. Anti-Myna baffles are detailed in Figure 4-3 and will be included on the nest box where applicable.

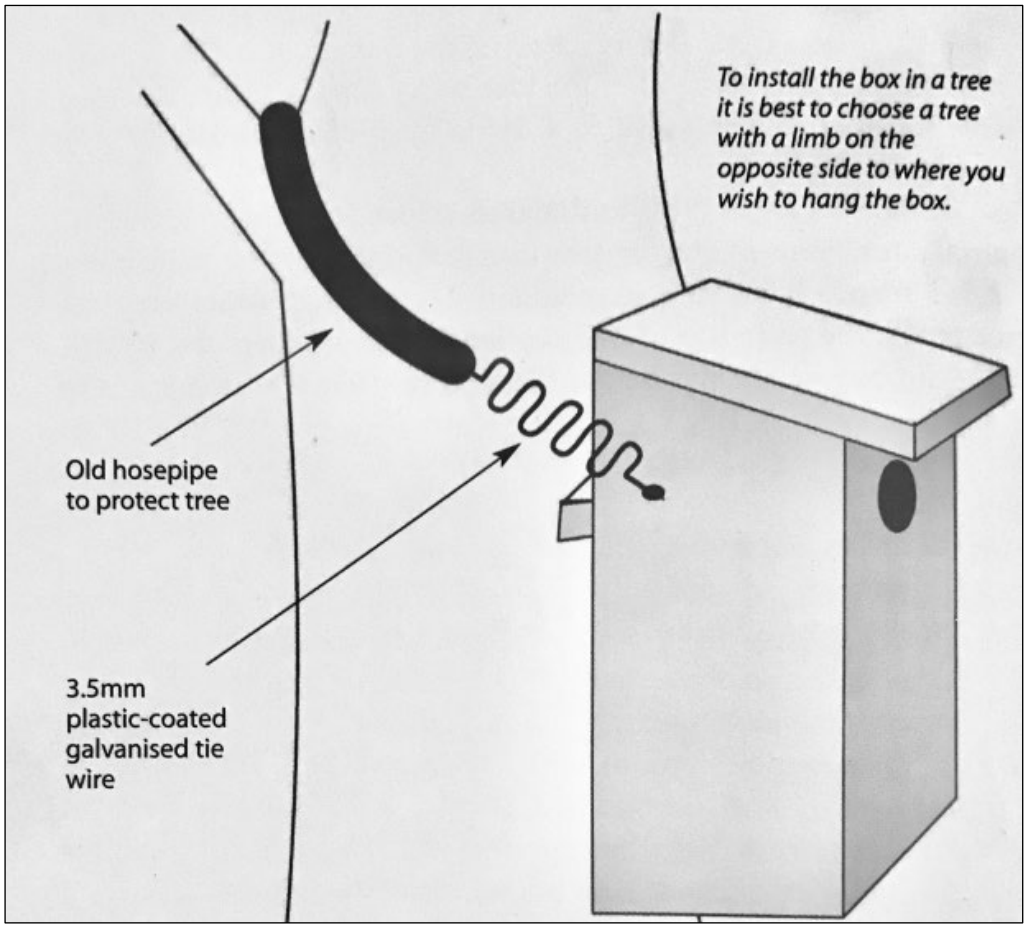


Figure 4-2 Habisure system

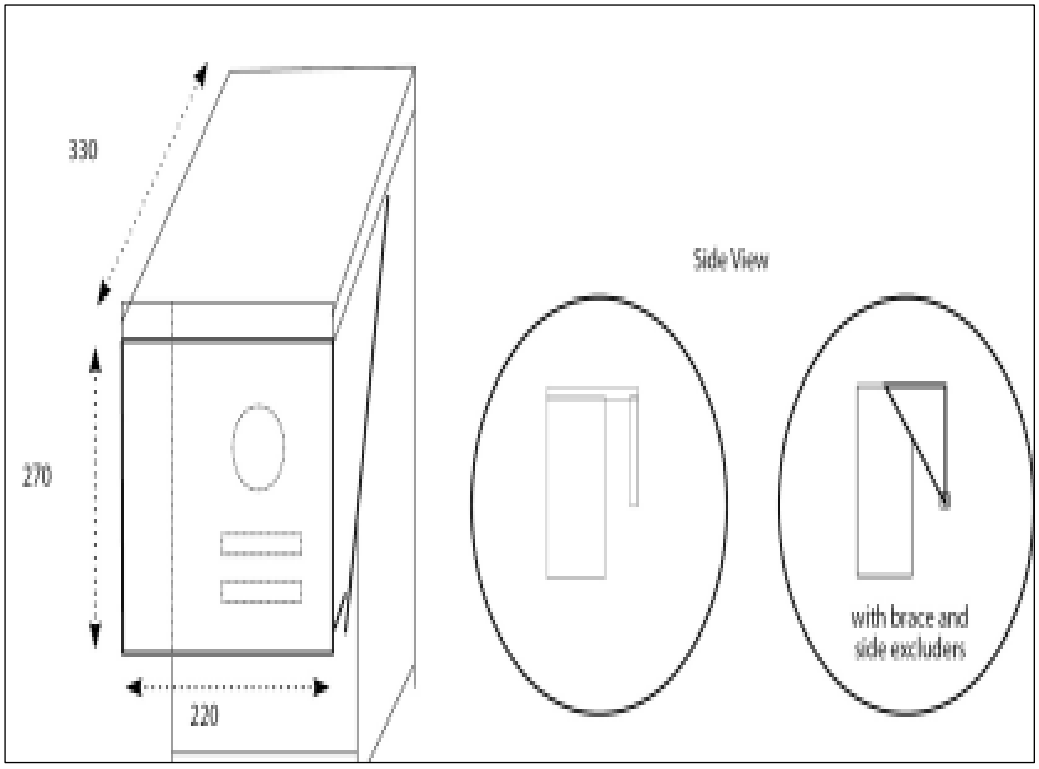


Figure 4-3 Anti-Myna Baffle

4.4.1 Hollow/Nest Box Monitoring

Hollow and nest box monitoring should be conducted by a suitably qualified Ecologist and assessed and checked utilising an inspection camera on a pole or a ladder (ensuring working at heights and ladder safety is adhered to).

The following data will be collected during the nest box monitoring:

- Time and dates, weather conditions and person(s) conducting the monitoring.
- Nest box number
- Species utilising the nest boxes – both native and invasive/introduced and including, number of individuals, maturity and health condition.
- Indirect evidence of occupancy such as scats, guano, pellets, fur or nesting material
- Signs of degradation and damage to nest boxes
- Any adaptive management measures such as maintenance required and controls to limit invasive species utilising the next boxes.

Key Performance Indicators (KPIs) relating to the hollow and nest box monitoring are outlined in Table 4-6.Timeframes for nest box installation, monitoring and maintenance are outlined in *Table 4-7*. Nest box locations within each MZ are outlined in *Figure 4-4*, noting that locations may be adjusted in consultation with the nest box supplier and an updated locations map provided.

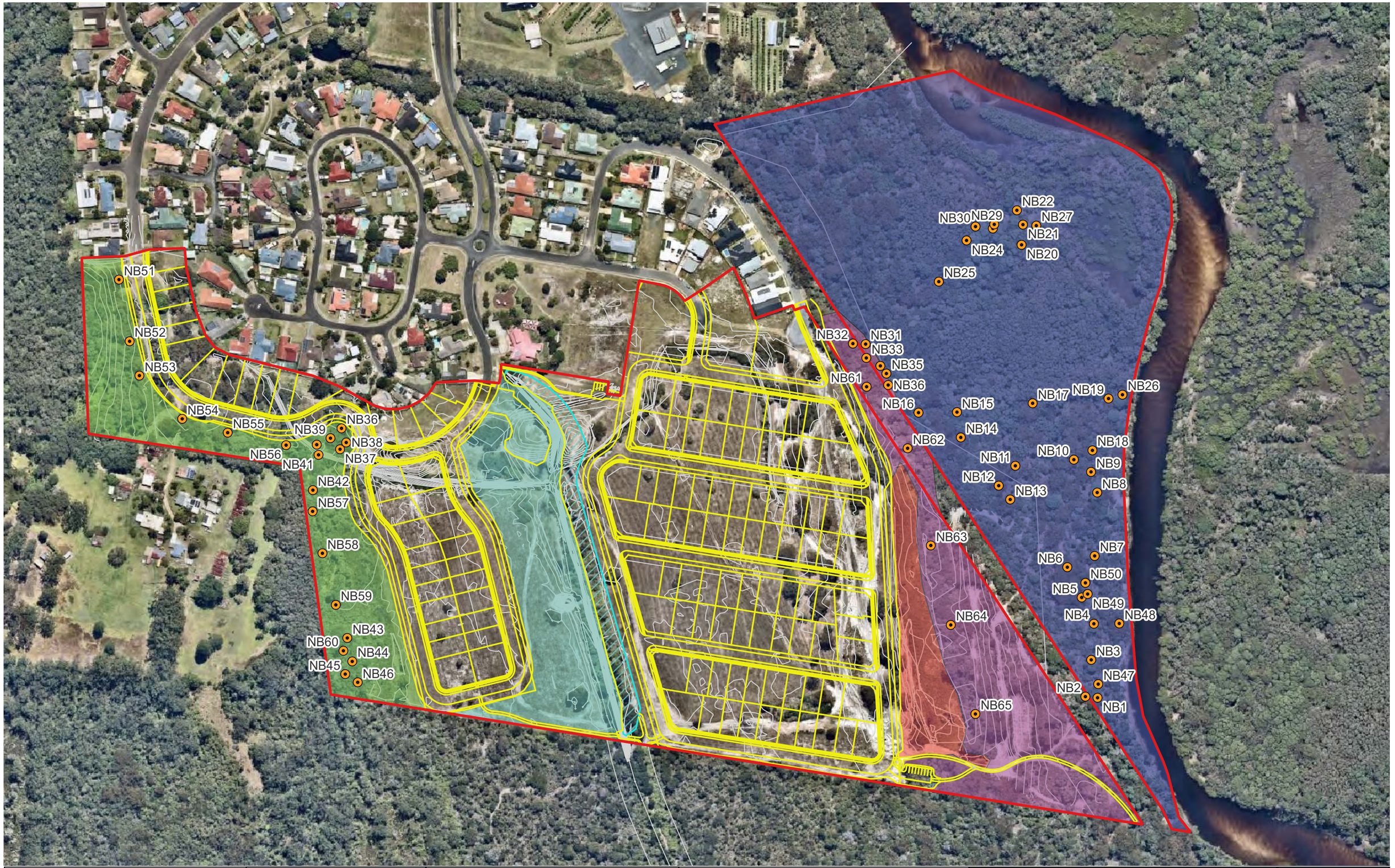
Table 4-6 Nest boxes Key Performance Indicators

KPI	Adaptive management	Responsibility	Outcome
Hollow or nest box not being used by target candidate species	Review the location, type and number of hollows or nest boxes used and site observations, consider if relocation is appropriate	Development project manager and consulting ecologist	Increased occupancy of candidate species during the next monitoring periods.
Hollow or nest box being used by invasive vertebrates of invertebrates	• Review the hollow location, or location, type and number of nest boxes used. • Research into pest control methods. • Potential removal and destruction of nest box affected.	Development project manager, consulting ecologist and pest animal contractor.	Reduction in hollows and nest boxes being utilised by invasive species.
Nest box fallen from tree	• Review the location and type of nest boxes used. • Repair nest box and re-attached to tree	Consulting ecologist.	Increase in repaired nest box reattached to trees.

KPI	Adaptive management	Responsibility	Outcome
Nest boxes deteriorating rapidly and requiring maintenance or replacing	• Review the location nest boxes used. • Research into alternative nest box materials or measures to slow deterioration. • Repair or replace nest boxes that cannot be repaired	Development project manager, consulting ecologist.	Decease in the deterioration of nest box and increased longevity, preferably to 20 years.

Table 4-7 Nest Box Monitoring Timeframes

Task	Early works stage 1	Early works stage 2	Construction Stage 1	Construction Stage 2	Construction Stage 3	Construction Stage 4	Construction Stage 5
Installation							
Hollow and nest box installation – pre-clearing 70% / post clearing 30%	✓	-	-	-	-	-	
Monitoring							
Spring	-	✓	✓	✓	✓	✓	✓
Winter	-	✓	✓	✓	✓	✓	✓
Maintenance							
Nest boxes fallen down deteriorating rapidly and requiring maintenance or replacing.	-	✓	✓	✓	✓	✓	✓



AWC

Source:	Imagery: Nearmaps 2023 Nest box locations: AWC 2023 Management Zones: AWC 2023
Disclaimer:	Care was taken in the creation of this map. AWC should be consulted as to the suitability of the information shown herein prior to the commencement of any works based on the information provided. AWC cannot accept any responsibility for errors, omissions or positional accuracy. There are no warranties expressed or implied as to the suitability of this map for a particular purpose. However, notification of any errors will be appreciated.

0 50 100 150 200 250 300 m

A4 Scale 1:5,000

Coordinate System: MGA 56 Projection: Transverse Mercator

Legend

- Site
- 22.08.18_Wallum_Base_Layout entities
- Nest Boxes

VMZs
- 1
- 2a
- 2b
- 3a
- 3b
- 4

Figure: 4.4 Nest box locations

Job No:	211400
Drawn:	AW
Checked:	DM
Date:	9-6-23

4.5 Wallum Frog Management

Threats to the Wallum froglet (WF) habitat from development of the site may occur during both the construction and occupation stages of the development. Retained and embellished acid frog habitat requires active management to ensure WF populations are sustained. The Wallum Froglet Management Plan (WFMP) (AWC, 2023) details the management requires to sustain WF at the site. These requirements are summarised in this section.

As shown at *Figure 4-5*, 2.6 ha of WF habitat will be retained, with a further 1.9 ha of habitat created/restored. Habitat to be retained comprises some good quality and some degraded habitat due to impacts including slashing and motorbikes. Degraded habitat will be restored and additional habitat areas will be created. *Table 4-8* provides details of WF habitat loss and retention.

Table 4-8 Wallum Froglet habitat to be retained and created at the site

Wallum Froglet habitat portion	Area (ha)
Existing WF habitat	3.9 ha
Retained WF habitat	2.6 ha
Created/offset WF habitat	1.9 ha
Removed WF habitat	1.3 ha
Net habitat increase (created – removed)	0.6 ha

4.5.1 Wallum Froglet Habitat Creation and Translocation

Areas of WF habitat creation/offset will include the construction of WF breeding ponds. Pond base levels have been designed to replicate a hydroperiod suitable for WF through groundwater expression. Each pond will have batters surrounding each constructed pond and have a grade of 1:3-1:6. WF breeding ponds and batters will be planted with species representative of WF habitat (refer Appendix C). Planting and vegetation management should not occur within constructed WF habitat zones until ground works have taken place and ponds have been established.

WF habitat creation follows four general stages:

1. Construction mark-out
2. Topsoil stripping and bulk earth works
3. Topsoil spreading
4. Pond and batter planting.

Further management actions include:

- Define the perimeter of all WF habitat areas
- Exotic species control
- Monitor and maintain vegetation
- Management of Chytrid Fungus via adoption of suitable hygiene measures.

4.5.2 Management Zones

Of the four management zones (refer *Figure 4-1*) on the site, WF management will be undertaken in three. Management for WF in each zone is summarised in the sections below. Note: there are no works for WF habitat proposed in Management Zone 1.

4.5.2.1 Management Zone 2 - Actions

Existing/retained and created/offset WH habitat is proposed in this zone (Refer Sheet 07 in Appendix C). Six constructed WF breeding ponds have been proposed though this will be confirmed during detailed design phase.

This area is generally in poor condition with many informal tracks exposing areas of compacted sand. Much of this area has been previously cleared with regrowth occurring patchily throughout. Restoration of WF habitat is to be undertaken in this zone.

4.5.2.2 Management Zone 3 - Actions

This zone includes the retention of the primary and lateral drainage line and associated WF habitat. Two large areas of existing WH habitat are retained with the remaining land to be created/offset WF habitat. Eighteen constructed WF breeding ponds have been proposed though this will be confirmed during detailed design phase.

4.5.2.3 Management Zone 4 - Actions

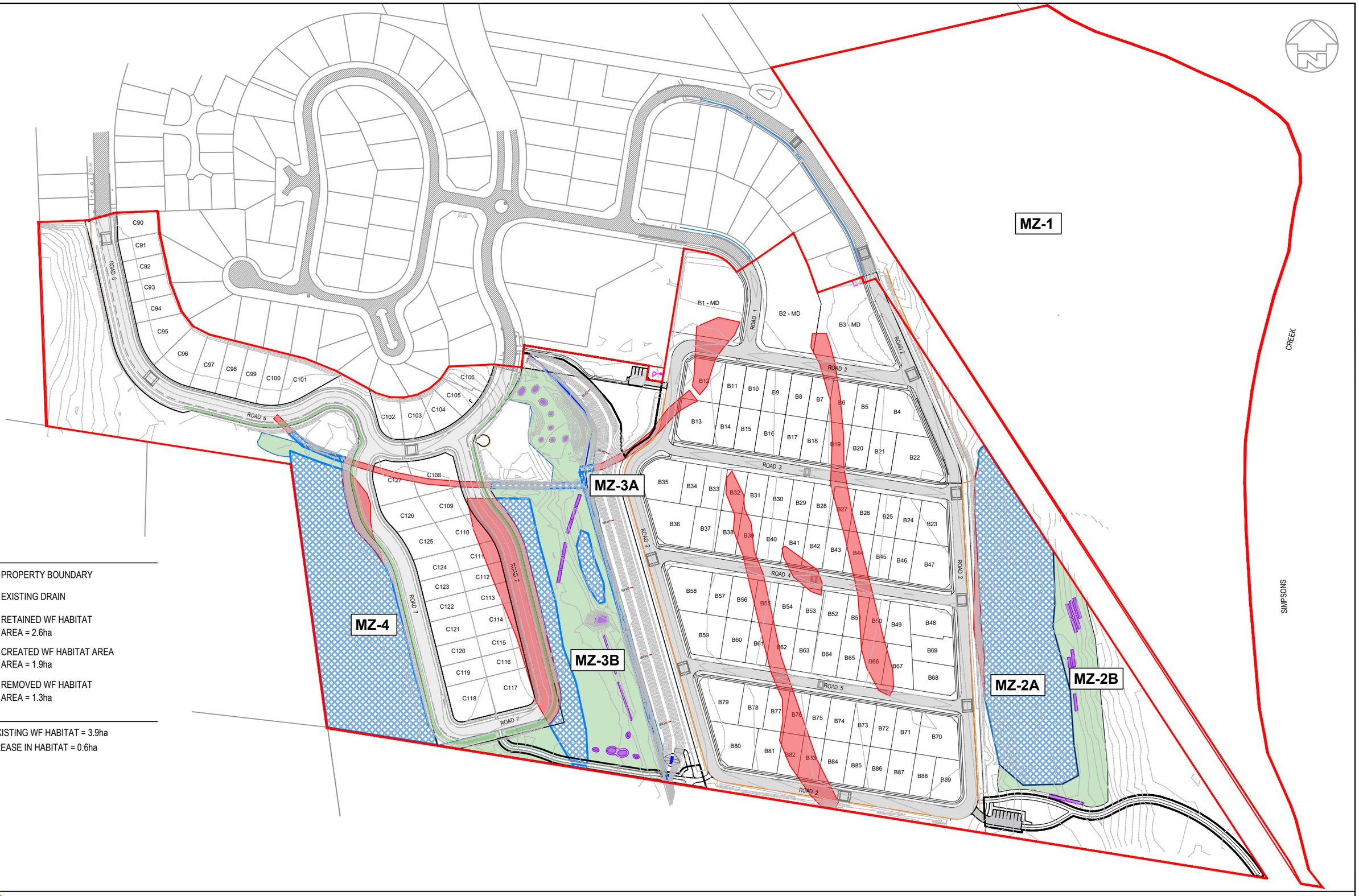
There is approximately 2.6ha of existing retained WF habitat proposed; this is high quality habitat with many depressions and suitable flora species present.

4.5.3 General Construction Stage - Management Actions

The following management actions apply to general aspects applying to the construction/establishment of the site.

4.5.3.1 Staging

Staging and timing matters associated with the development relevant to acid frog habitat protection and creation are summarised at *Table 4-9*. A summary of all management actions for the construction period is shown in Table 4-10.



LEGEND

- PROPERTY BOUNDARY
- EXISTING DRAIN
- RETAINED WF HABITAT AREA = 2.6ha
- CREATED WF HABITAT AREA AREA = 1.9ha
- REMOVED WF HABITAT AREA = 1.3ha

TOTAL EXISTING WF HABITAT = 3.9ha
NET INCREASE IN HABITAT = 0.6ha

AWC
Australian Wetlands Consulting Pty Ltd
25 LESLIE ST, BANGALOW NSW 2479
P (02) 6687 1550 | 1300 998 514
www.awconsult.com.au

CLIENT: CLARENCE PROPERTY

DRAWING:
FIGURE 4.5- WALLUM FROGLET HABITAT MAPPING

PROJECT:
WALLUM ESTATE

REV.	ISSUE / AMENDMENTS	DATE
A	FOR APPROVAL	21.09.22

ADDRESS:
LOT 13 DP 1251383, TORAKINA DR BRUNSWICK HEADS

SCALE 0 50 100m

REV. A

DESIGNED	IC/SS	CAD FILE No. 1-211400_WALLUM.DWG
DRAWN	SS	DWG No. 1-211400_WALLUM_
CHECKED	DMc	

Table 4-9 Staging and timing sequence

Stage No.	Works required. (WF Mgt)	Wallum Froglet mitigation actions
1	Management Zone 2 & (part) 3 North South (N/S) Drain works	a) Preparation and approval of a CEMP incorporating strategies and recommendations in the WFMP Plan b) Fencing of all protected WF habitat in Management Zones 2 and 3 c) Erosion and sediment controls installed along N/S drain d) Project ecologist to nominate translocation slabs from areas of removed/existing WF habitat e) Installation of WF breeding ponds f) Monitoring of created habitat areas for WF presence, vegetation establishment, water quality (etc.)
2	none	-
3	Management Zone 3 (west of N/S drain) and Management Zone 4	a) Installation of required erosion and sediment controls b) Fencing of all protected WF habitat in Management Zone 3 and Management Zone 4 c) Installation of WF breeding ponds d) Project ecologist to nominate translocation slabs from areas of removed/existing WF habitat e) Installation of translocated material to WF habitat f) Monitoring of created habitat areas for Wallum Froglet presence, vegetation establishment, water quality (etc.)
-	General construction works (earthworks, services etc.)	a) Maintenance of exclusion fencing and signage (as installed previously) during construction until permanent fencing and signage is installed around habitat areas b) Installation and maintenance of erosion and sediment controls c) Wallum Froglet habitat monitoring (retained and created habitat)
Post Construction phase		
-	Stage releases and occupation	a) Monitoring and maintenance of all WF habitat in Management Zones 2, 3 and 4 prior to handover to Council
-	Ongoing occupation	a) Hand-over of Wallum Froglet habitat in Management Zones 2 & 3 to Council b) Ongoing monitoring and maintenance by Council to ensure wallum habitats are maintained

Table 4-10 Summary of mitigation strategies for potential impacts on acid frog habitats during the construction phase

Matter	Objective	Mitigation	Responsibility
Environmental induction	All personnel are clearly aware of environmental matters relating to the site with specific information on acid frog habitats.	- Ecologist to provide input to induction material - Copies of relevant maps provided	Site foreman/principal contractor/ Ecologist
'No go' zones are clearly marked and maintained	Acid frog habitats are protected from disturbance by plant, machinery and vehicles.	- 'No go' zones are clearly marked and checked on a regular basis - Updates to all personnel are provided where any changes to 'No go' zones occur	Site foreman/principal contractor/ Ecologist
Appropriate signage is in place	Acid frog habitats are protected from disturbance by plant, machinery, vehicles and construction activities.	- Appropriate signage is in place to demarcate 'No go' zones, refueling points, erosion and sediment protection zones (etc.) and is maintained and/or amended during the life of the project	Site foreman/principal contractor/ Ecologist
The CEMP is aligned with recommendations in WFMP	The CEMP is consistent with the WFMP recommendations and practice to reduce potential for ambiguity/confusion regarding works in or near acid frog habitat.	- Liaison between project ecologists and consultant preparing the CEMP	Ecologist/ principal contractor
Sediment and erosion controls	Acid frog habitats are appropriately protected from activities likely to result in sediment/erosion.	- Preparation of Sediment and Erosion Control Plan (SECP) in consultation with this Plan and/or project ecologists - SECP not to be implemented until approved by relevant authorities - Implementation and maintenance of all sediment and erosion control as per the approved plan for the life of the project	Principal contractor
Habitat translocation	Removal of suitable acid frog vegetation, and potentially translocate individuals, for use in compensatory habitat areas.	- Translocation measures defined within VMP - Identification of suitable donor material where acid frog habitat will be removed - Establishment of on-site nursery if required - Translocation process supervised by project ecologist or other appropriately qualified personnel in liaison with site foreman	Ecologist/consultant

4.5.3.2 Contractor Actions

For the construction phase of the project, several amelioration measures should be enforced/maintained throughout the construction period by appointed contractors. These include:

- Appropriate induction of all construction personnel
- Fencing of all 'no go' areas prior to construction commencing and maintenance throughout the construction period and installation of appropriate signage
- Installation and maintenance of sediment and erosion controls throughout the construction period guided by an approved Sediment and Erosion Control Plan (refer Appendix D)
- Use of sterile grasses (e.g., sorghum, millet) for erosion control and stockpile stabilisation if required
- Translocation of vegetation (sedges/reeds) out of habitat areas to be removed either directly into compensatory habitat areas or established nursery areas on-site until receiving compensatory environments are established.

- NPWS Frog Hygiene Protocol (DPIE 2022) to be followed when working within WF habitat and handling WF to ensure no risk of Chytrid Fungus to the population.

4.5.3.3 Habitat Protection

All Wallum Froglet habitat to be retained on-site must be clearly fenced and signposted to exclude machinery and personnel. This must be completed prior to any work being initiated at the site. Exclusion fencing and signage must remain in place until construction works are complete. Similarly, exclusion fencing must be installed and maintained to protect all habitat within the eastern portion of the site zoned for environmental protection.

4.5.3.4 Filling

As the site requires low volumes of fill, it is essential that fill is sourced locally and certified as free from contaminants, weed propagules etc. If fill is stockpiled on site, stockpiling protocols must be followed. Filling must not occur in any areas of Wallum Froglet habitat within the development footprint until suitable donor material is translocated into areas of created habitat.

4.5.3.5 Compensatory Habitat

Compensatory habitat adjacent to the central drain and in the south-east of the site must be established in accordance with approved plans (refer Appendix C) and signed off by the site supervisor and project ecologist.

4.5.4 Occupation Stage - Management Actions

4.5.4.1 Habitat Protection

To provide information to residents, signage will be installed at strategic locations to provide information about the Wallum Froglet and the need to retain the integrity of habitat areas.

4.5.4.2 Water Quality

As acid frogs breed in oligotrophic waters, increased nutrients from urban run-off may adversely affect habitat by reduction of water quality and the creation of conditions conducive to weed establishment. Toxicants such as oils and surfactants may also negatively affect wetland areas in which acid frogs occur where they accumulate following urban runoff.

Changes in hydrology may occur through changes in water quality (i.e., water chemistry), water drainage and hydroperiod (water persistence). Changes in water chemistry make conditions unsuitable for acid frog species (e.g., from elevated pH levels), while diversion of drainage lines or alteration to groundwater ecology may have significant effects on the suitability of habitat areas in the long term.

Groundwater considerations are particularly important regarding compensatory wetland ponds, where the intent is to excavate ‘windows’ into the groundwater layer whereby groundwater expression provides an appropriate water source rather than surface water flows. Impacts to water quality will be minimised through sediment and erosion control, stormwater management and monitoring during the construction and occupation establishment phases of the development. Twelve months of groundwater monitoring will be conducted post construction phase at the locations outlined in Figure 4-8.

4.5.4.3 Cane Toads

Cane Toads occur at the site and may respond well to further development due to increased lighting, open spaces and scavenging opportunities. While Wallum Froglet habitat areas will be ephemeral and are unlikely

to contain standing water for any extended period, Cane Toads may occupy and shelter within these areas. Dense fringing plantings of species of sedges, rushes and grasses (refer Appendix C for a planting list) around all areas of created habitat shall be installed to limit access to Cane Toads and hence reduce breeding opportunities and movement.

4.5.4.4 Mosquito Fish

The Mosquito Fish (*Gambusia holbrooki*) is an introduced species common within NSW waterways which occurs within the central drain on the site. Mosquito Fish are known to predate on the eggs and tadpoles of young froglets and compete for habitat and food sources. This raises concern about the potential impacts that this species may have on the Wallum Froglet population. Seasonal drying within constructed drains and WF breeding ponds will control Mosquito Fish.

4.5.4.5 Weed Control

Although the site occurs on low-nutrient sands, increased nutrients and earthworks/disturbance may enhance conditions for the establishment of weed species within acid frog habitat areas (e.g., Setaria, Vasey Grass). Where invasive weed species are recorded, appropriate control methods will be implemented as required.

4.5.4.6 Long-term Management

As Council will ultimately be responsible for the management of Wallum Froglet habitat areas there is a need to develop Key Performance Indicators (KPI) prior to the handover of habitat areas. These are prescribed in Section 4.5.9. A key requirement is to ensure appropriate vegetation is maintained such that frog habitat is not lost via regeneration of incompatible species.

4.5.5 WF Monitoring

For monitoring to be successful, the various phases of development must be defined and the roles and responsibilities for each of the seven construction phases clearly identified. Monitoring requirements for the phases of development (Prior to translocation sampling, Pre-Construction (including habitat translocation), Construction and Occupation), are outlined in Table 4-11. Monitoring post construction should continue for five years.

4.5.6 Prior to Translocation Sampling:

Prior to translocation of any Wallum Froglet (WF) habitat for the proposed house lot area Wallum froglet population sampling will be conducted and consist of the following methodology:

- Population surveys before and after rainfall events. Before rainfall monitoring events will be determined by a 50% chance of rainfall and optimal weather conditions consisting of temperatures greater than 15°C, low wind strength <20km/h and when humidity levels are high >50%. This will be outlined by current meteorological data provided by the Bureau of Meteorology (BOM).
- WF populations will be determined by density and distribution within the habitat proposed for translocation (refer Figure 4-5). The density and distribution of the existing population will be identified using call playbacks and opportunistic observations within audio strip transect surveys. A 30 x 2 meter wide transect will be established within each of the areas of habitat proposed to be removed with sampling proportionate to the area surveyed i.e., increased over larger areas.
    - Aural and any visual observations will be counted over the transect at 10-meter intervals to determine areas of high, medium and low density and therefore distribution. Low density will consist of 1-5 individuals, medium density 5-20 and high density >20 individuals.
    - Surveys and sampling should be conducted during the peak breeding season, within optimal weather conditions and repeated once across sampling locations.

- Water quality sampling and vegetation assessments will also be conducted over the sampling period and consist of temperature, pH, conductivity, turbidity, tannin. Vegetation assessments will consist of observations of vegetation condition, structure and weed presence.

4.5.7 Translocated Habitat Monitoring:

Baseline monitoring will be conducted prior to the translocation of any WF habitat as outlined in Section 4.5.6 (Prior to Translocation Sampling). The prior to translocation sampling methodology will be replicated in areas of translocated habitat to determine the success of the habitat translocation and for consistency. Translocation monitoring will be conducted within 6 months from the establishment of translocated habitat constructed during the early ecological works of the development.

4.5.8 Retained Habitat Monitoring:

- Baseline monitoring recorded at retained WF habitat areas – vegetation assessment and water quality sampling (temperature, pH, conductivity, turbidity, tannin) prior to any works commencing at the site.
- Monitoring of retained WF habitat areas three times annually (i.e., every four months) – nocturnal survey and counting of WF within the two retained habitat areas; call playback used to elicit response; water quality sampled if standing water present; records of incidental species records at the site to be included; basic weather conditions recorded (temperature, relative humidity, rainfall).
    - Brief summary to be completed, with annual report provided to Council/DPIE
- Frog surveys should be conducted during periods of peak breeding activity and only during suitable weather conditions (habitat inundated with water, night-time air temperatures exceed 15°C, and wind strength is low and humidity levels are high).
- Surface and groundwater depth should be routinely recorded during each population monitoring event using permanent ground and surface water depth markers, which should be installed at several representative sites throughout the range of retained, rehabilitated and created Wallum Froglet habitats.
- Monitoring of created habitat areas in lateral benches as soon as vegetation translocation is completed.
- Install six water level loggers in constructed WF breeding ponds, and existing depressions in retained WF habitat, spread generally spatially evenly over the development site.
- Monitoring as for retained habitat areas.
- For monitoring during maintenance periods refer to Table 4-12

Table 4-11 Wallum Froglet monitoring requirements for development phases

Phase	Monitoring requirements	WF Habitat Type	Responsibility
Prior translocation monitoring	• Identify suitable areas for audio strip transect surveys prior to sampling period. • Conduct one sampling event across each of the proposed translocation habitat areas. • Establish a baseline WF density and distribution within proposed translocated habitat areas.	Removed habitat.	Ecologist
Pre-Construction	• 'No-go' areas maintained, and frog habitat protected. • Implementation and maintenance of sediment and erosion controls • Establish baseline data for all factors identified in the nominated monitoring objectives	Retained and created habitat.	Site foreman/ Ecologist and/or appointed contractors
Construction	• 'No-go' areas maintained, and frog habitat protected. • Water quality monitoring • Vegetation condition including weed control. • Implementation and maintenance of sediment and erosion controls • Monitoring of retained and created habitat areas	Retained and created habitat.	Site foreman/ Ecologist and/or appointed contractors
Occupation (Five years)	• 'No-go' areas maintained, and frog habitat protected. • Water quality monitoring • Vegetation condition including weed control. • Pest species control as required. • Hydrology – water level loggers in constructed WF breeding ponds. • Monitoring of retained and created habitat areas. • Conduct ground water monitoring of the retained and created habitat areas for 12 months post construction.	Retained and created habitat.	Ecologist

If no Wallum Froglets are recorded within either of the compensatory habitat areas within two years following monitoring commencement, (and prevailing climatic conditions are considered suitable for frog activity) more intensive sampling using pitfall trapping should be completed for three nights in succession, three times annually. If Wallum Froglets are detected by this means, sampling may revert to aural detection methods as implemented previously after the completion of the three pitfall trapping events.

In the event of the failure of compensatory habitat areas to establish, an adaptive response should be implemented, with the developer having the option to complete further habitat works where suitable donor material remains in undeveloped portions of the construction site, or planting of tube stock consisting of species of sedges, rushes and grasses (refer species schedule at Appendix C). A combination of both approaches may be utilised following advice from the project ecologist.

Table 4-12 Wallum Froglet monitoring tasks during maintenance period

Monitoring Requirements	Monitoring Tasks	Frequency, timing and length
Measure pond water quality and hydroperiod	At six monthly intervals the quality of water will be measured in all created and retained Wallum Sedgefrog/acidf frog habitat ponds/polygons. Hydroperiod data from the six installed loggers will also be downloaded biannually.	Six monthly
Survey Vegetation	A sample of created Wallum Sedgefrog/acid frog habitat ponds will be surveyed every six (6) months, randomly selected from the created Wallum Sedgefrog/acid frog ponds. Vegetation type and cover will be assessed within each pond, of which is defined from top of bank to top of bank. A sample of 20m^2 nested vegetation monitoring quadrats will be permanently established and monitored on a six (6) monthly basis for % cover of native and non-native species consistent with Success Criteria 7 and 8. Photographic monitoring locations will be established on the north-east corner of each quadrat, shooting to the south-west.	
Wallum Froglet monitoring	Survey both created and retained Wallum Sedgefrog habitats for the presence of Wallum Sedgefrog/acid frog or predator/ competitor species.	
Wallum Froglet presence assessment (retained habitat)	Undertake Wallum Froglet presence/absence assessment to determine the extent of habitat use.	Biannually, between October and April depending on climatic conditions. Monitoring period of 3 years or until KPI's are addressed
Wallum Froglet density and distribution (constructed habitat)	Undertake Wallum Froglet density and distribution assessment to determine the density and distribution of WF in the constructed habitat.	
Vegetation assessment	Undertaken quantitative vegetation assessment of to ensure created compensatory Wallum Froglet habitat supports semi-aquatic emergent vegetation consistent with a vegetation community consistent with that measured within existing Wallum Froglet habitat	
Water quality assessment and hydroperiod	Undertake pH, conductivity and Tannin measurements of water within both created compensatory and existing retained Wallum Froglet habitat area to confirm suitability. Download data from the hydroperiod loggers	

4.5.9 Performance Criteria

Recommended performance criteria for the monitoring program are summarised in Table 4-13 and may be adapted for pre-construction, construction and occupation periods of the development. Monitoring will be conducted over several breeding seasons after completion of the urban development to detect potential impacts of the completed urban stormwater design at full capacity on surface and groundwater hydrology and water quality. Monitoring will be performed for five consecutive years after completion of the final project stage to ensure that such potential impacts have been assessed adequately.

Performance criteria must consider prevailing climatic conditions which may adversely affect created habitat and Wallum Froglet populations. There is a strong possibility that no individuals will be detected during low rainfall periods.

Note that management of frog habitat zones 3A and 3B will become the responsibility of Council after initial restoration and monitoring works by the developer.

Table 4-13 Summary of Wallum Froglet monitoring performance criteria

Item	Performance Criteria	Responsibility
Retained habitat areas		
Water quality	Water chemistry: pH in a range of 3 – 5, and low values/concentrations of turbidity, salinity (conductivity), and nutrients Water quality monitoring includes both surface and groundwater	Appointed ecologist/consultant
Vegetation	Native vegetation continues to persist and is not degraded or disturbed. The results of the vegetation monitoring collected as part of the VMP will be referred to when analysing the results of the wallum froglet population and habitat monitoring.	Appointed ecologist/consultant
Weed control	Environmental weeds comprise < 10% total within each Wallum Froglet habitat area	Appointed contractor for implementation of the VMP
Wallum Froglet populations	Existing/known habitat areas continue to be utilised by Wallum Froglets.	Appointed ecologist/consultant
Cane Toads	Threshold numbers remain low, appropriate control measures are implemented if required.	Appointed ecologist/consultant
Mosquito Fish	Monitor Mosquito Fish population – to include the drying out of water courses to control fish numbers.	Appointed ecologist/consultant
Constructed habitat areas		
Water quality	As above	Appointed ecologist/consultant
Weed control	Environmental weeds comprise < 10% total within each identified	Appointed contractor for

Item	Performance Criteria	Responsibility
	frog compensation area per precinct.	implementation of the VMP
Habitat establishment	Survival rate of greater than 90% of all plantings and translocated material	Appointed contractor for implementation of the VMP
Wallum Froglet populations	Utilisation by Wallum Froglets and persistence at constructed habitat areas over time.	Appointed ecologist/consultant
Cane toads	Exclusion buffer plantings correctly installed with 90% survival rate achieved.	Appointed contractor for implementation of the VMP

4.6 Erosion and Sediment Management

Soil disturbance is expected from vegetation grubbing/clearing, establishment of access track, installation of temporary crossings, vehicle movements, bulk earth works and drain realignment work. Civil Tech Consulting Engineers have prepared an erosion and sediment control plan for Early Stage 2 Bulk Earthworks (refer Appendix D). An appropriate staged soil and erosion control plan (SECP) must be completed to the satisfaction of council the project manager prior to the works commencing.

The project manager must ensure that the approved SECP is implemented and maintained for the duration of the works. All construction works at the site will require appropriate sediment and erosion controls are in place.

The SECPs will include details of controls and maintenance, corrective and preventative actions in Section 4.6.1 below.

4.6.1 Erosion and Sediment Controls

- **Soil Cover/Protection:** All areas of work will be stabilised as soon as possible after earthworks are complete using mulch, vegetation (grass), soil binding polymers or other types
- **Staged Construction**: Where practical construction will be done in sections with complete stabilisation undertaken prior to moving to the next stage
    - Alternatively, separate work crews can follow construction works to ensure soils are left exposed for a minimum amount of time
- **Seasonal works:** Undertaking works in seasons of low predicted rainfall intensity (where practical)
- **Limit areas of disturbance:** Clearly delineate proposed access points, pathways and works areas, use para webbing or fencing if required
- **Construction access**: Access sites should be signed appropriately
    - All site access points will have stabilised construction exit points with vibration grids/shake down racks
- **Stockpile Management**: Stockpiles to be adequately protected (sediment fencing or hay bales downslope, diversion drain upslope)
    - Long term stockpiles should be temporarily stabilised using hydroseeding, jute mesh and/or geofabric if works in that area are to be suspended for a period of 10 days (January – June) or 20 days (July – December)

- Excavated material should be placed at the closest stockpile to reduce vehicle movements
- Stockpiles should only be positioned in approved designated location as seen on the General Arrangement and Site Access Plan (*Figure 4-6*). No stockpiles should be placed with any environmental management zones

4.6.2 Monitoring

The sediment and erosion control measures are to be inspected systematically to ensure no failure of control measures a reduce the risk of prolonged erosion occurring. Inspections should occur at least daily during the construction phase continuing into the establishment phase weekly, prior to impending rainfall events where >10mm of rainfall is predicted and following rainfall events. Weather (rainfall) forecasts are to be monitored by the contractor and in the event of impending rainfall the site is to be stabilised as much as possible and sediment and erosion control measures checked to ensure satisfactory. Inspections are to be undertaken by the Environmental Officer and outcomes recorded in the *Sediment and Erosion Control Checklist* (refer Appendix E) and any problems detected resolved using appropriate sediment and erosion control measures. Where significant erosion, scour or excessive deposition of silt are identified, consultation with an appropriate professional should be followed up.

BENCH MARK
SSM195050
4.705mRL

BENCH MARK
SSM8903
3.895mRL

EP1

EP2

MZ-1

MZ-2

MZ-3

MZ-4

CREEK

SIMPSONS

REMOVE DUMPED RUBBISH AND EXOTIC VEGETATION THAT HAS ESTABLISHED FROM GREEN WASTE DISPOSAL INTO MZ - 4 AREA 1300m2
CONDUCT BUSH REGENERATION TECHNIQUES REFER EARLY WORKS REPORT FOR METHODOLOGY

INFILL PLANTING 1/m2
AREA 300m2

TEMPORARY CROSSING OVER DRAIN MIN DIAMETER PIPE Ø0.6m

EARTHWORK VOLUME
APPROX = 1,300m³

SEDIMENT FENCE 2-4/08

NORTHWEST CONSTRUCTED WF PONDS
REFER SHEET 03

SOUTHWEST CONSTRUCTED WF PONDS
REFER SHEET 05

EASTERN CONSTRUCTED WF PONDS - REFER SHEET 07

ASS AMELIORATION LOCATION

BUNTING FENCE TO BE LOCATED ON MZ-4 EXTENT FOR CLEAR DELINEATION OF NO GO ZONE 01/08

LEGEND

- PROPERTY BOUNDARY
- COMPOUND - SITE OFFICE - INDICATIVE
- STOCKPILE CUT FOR FUTURE USE
- ASS AMELIORATION LOCATION (IF REQUIRED)
- EXTENT OF CUT - VOLUME = 1,300m³
- EP1 ENTRY POINT - CONSTRUCTION FENCE GATE WITH PADLOCK
- RUMBLE STRIPS AT SITE EXIT POINT
- TEMP DRAIN CROSSING
- TEMPORARY ACCESS TRACK
- TEMP CONSTRUCTION FENCING
- NO GO ZONE FENCE - BUNTING + SIGNAGE
- SEDIMENT FENCE - REFER SHEET 08
- RETAINED WF HABITAT
- WF BREEDING PONDS
- EARTH BUND
- IMPACTED SEDGE VEGETATION REF SHEET 09 TRANSLOCATE INTO WF BREEDING PONDS
- RUBBISH REMOVAL / WEED CONTROL
- WEED CONTROL / INFILL PLANTING

AWC
Australian Wetlands Consulting Pty Ltd
25 LESLIE ST, BANGALOW NSW 2479
P (02) 6687 1550 | 1300 998 514
www.awconsult.com.au

CLIENT: CLARENCE PROPERTY

PARTNER CivilTech Consulting Engineers

Figure:4.6

GENERAL ARRANGEMENT AND SITE ACCESS PLAN

PROJECT: WALLUM ESTATE

EARLY ECO WORKS PACKAGE

REV.	ISSUE / AMENDMENTS	DATE
A	FOR DISCUSSION	16.02.22
B	FOR REVIEW	12.04.22
C	FOR APPROVAL	20.06.23
D	FOR APPROVAL	16.08.23

ENG CERT
Wade Fletcher
CiviTech Consulting Engineers
Chartered Professional Engineer
EA ID: 2954545

ADDRESS
LOT 13
DP 1251383,
TORAKINA DR
BRUNSWICK HEADS

SCALE 1:2500 @ A3
0 50 100m

REV. D

DESIGNED IC/SS
DRAWN SS/TC
CHECKED DMC

CAD FILE No. 1-211400_EW.DWG
DWG No. 1-211400_EW_01

4.7 Stormwater Management Plan

CivilTech Consulting Engineers has prepared the Stormwater Drainage Plan for Stage 1 (refer Appendix F).

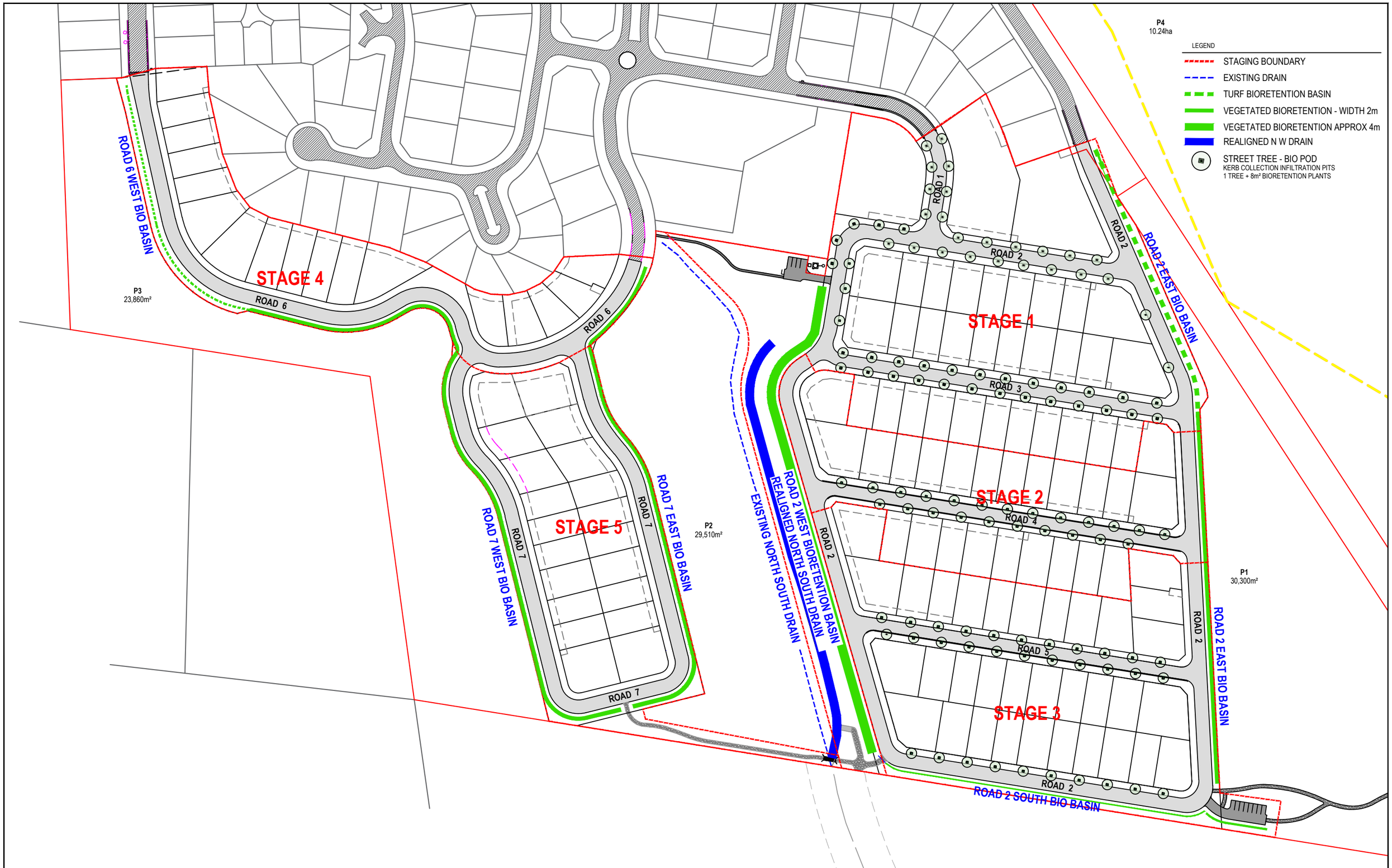
A Construction, Establishment, Operation and Maintenance Plan (CEOMP) has been prepared for the new North South Drain and bioretention assets to be construction at Wallum Estate (CEOMP, AWC 2023). The CEOMP provides step by step guidance for the new assets through the following stages:

- Construction Phase
- Building and Establishment Phase
- Operation and Maintenance

A summary of the of the construction, establishment and maintenance requirements is provided in the section below. The development includes numerous integrated stormwater treatment devices with an Assets Register provided in *Table 4-14* and *Figure 4-7*.

Table 4-14 Wallum Estate Stage 1-3 Stormwater and Bioretention Assets

Asset	Specification	Description	Major Components
North South Drain (existing)	Existing 340m x 5m wide vegetated channel	The channel is servicing the existing development (<1ha) draining to the headwall at Kingsford Drive	Maintenance only - no construction. Some sediment has accumulated during uncontrolled earthworks for temporary accommodation for flood victims). Refer to VMP (AWC, 2023)
North South Drain (new)	250m of 15m wide vegetated channel	The new north south drain is parallel to the existing drain and collects treated flow from new bioretention on Road 2 west and internal roads.	- new 15m wide drain and landscape - concrete dish drain in channel - causeway with outlets - connecting outlets from subsurface drain from Road 2 bioretention basin. - 4000 m² vegetation – refer to VMP (AWC, 2023)
Road 2 West Bio-retention	Lined 270m long x 4.85m wide x 0.4m deep media bioretention	Vegetated bioretention cells with subsurface drainage connected to new North South Drain.	- inlet zones - basin vault - batter surfaces - soil/ media / mulch - vegetation - overflow pits and grates - underflow slotted pipe - scour protection
Road 2 South (and carpark) Bio-retention	2.4m wide turf and vegetation planting bio-retention	Vegetated biofiltration cells and turf cells drain to Road 2 West bioretention stormwater pit then onto new North South Drain.	
Road 2 East Bio-retention	2.4m wide turf and vegetation planting for bioretention	Vegetated bioretention cells exfiltrate into the existing sandy soils.	
Roads 2,3,4,5,6 & 7 Bio-pods	1m x 1m x 0.6m deep bioretention street tree	Street trees with bioretention and connected with subsurface underdrain.	



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CLIENT:
CLARENCE PROPERTY

DRAWING:
LOCATION OF STROMWATER TREATMENT DEVICES - FIGURE 4.7

PROJECT:
WALLUM ESTATE CEMP

REV.	ISSUE / AMENDMENTS	DATE
A	*FOR DISCUSSION*	*19.09.23*

SCALE 1:2000 @ A3
0 0 100m
REV. **A**

DESIGNED	DM/SS	CAD FILE No. **1-211400_CEMP**
DRAWN	SS	DWG No. **1-211400_CEMP_**
CHECKED	AL	

4.7.1 New North South Drain

Construction of the new north south drain will occur as part of Stage 2 Bulk Earthworks. It will include a 1m wide concrete invert and will be vegetated in accordance with the landscaping plans. The primary function of the drain is the conveyance of flows from the Road 2 west bioretention basin to the southern boundary and the provision of the required stormwater detention volumes. The drain will include a causeway with 3xØ600mm diameter mid flow pipes. The causeway will not be constructed until Civil Stage 1.

Table 4-15 provides a step-by-step guide for construction of the New North South Drain. The guide draws from principals provided in Water by Design Construction & Establishment Guidelines v1.1 April 2010 (Water by Design, 2010).

Table 4-15 Step by Step Guide for North South Drain

Step	Construction Phase - Early Stage 2 Bulk Earthworks and Landscaping	Responsibility and Controls
Step 1: Bulk Earthworks / Landscaping Pre-start meeting	Organise meeting with superintendent, civil and landscape contractors to discuss construction methodology, function and risks associated with channel construction. Discuss flow management plan, protection, staging works, establishment and ESC plans. Confirm specification, tolerances, controls, hold points and sign- off requirements. Confirm design, planting requirements, set out and staging of planting for all construction phases.	Civil Contractor Byron Shire Council Landscape Design Superintendent ESCP CEMP Landscape Contractor
Step 2: Preparation	Plan resources, plant, materials, equipment and management plan for rainfall.	Civil Contractor
Step 3: Prepare for Landscape	Prepare for landscaping at least 6 months prior including ordering and inspecting plants, organic mulch, matting and irrigation supply.	Landscape contractor
Step 4: Erosion & Sediment Control & bunds	Erosion and sediment control to be installed prior to commencement of works in accordance with Early Stage 2 Bulk Earthworks Plans and Stage 1 Civil Plans. ***ESC to be staged and adjusted throughout the following stages to suit the work schedule.*** *The development has highly permeable soils and minimal grade. Earthworks have been minimized and erosion sediment controls tailored to these conditions. Large sediment loads typical of urban development requiring large cut / fill and modification are not anticipated for the development.*	Civil Contractor Landscape contractor
Step 5: Bulk earthworks	Undertake bulk earthwork to achieve 250mm below final surface level for drain. Bulk earthworks to commence with construction of new north south drain followed by filling of perimeter basins, roads and lots. ***Note: Steps 5, 6, 10, 11 & 12 to be commenced as soon as work schedule allows and to run concurrently.***	Civil Contractor

Step	Construction Phase - Early Stage 2 Bulk Earthworks and Landscaping	Responsibility and Controls
Step 6: Trimming and profiling	Undertake detailed excavation, trimming and profiling of drain, bunds, batters, and base. Ensure drain is free of debris. The Drain requires minimum of 150mm of topsoil after profiling and 100mm set down from any flush kerb edge.	Civil Contractor
Step 7: Install Topsoil	Ensure topsoil meets AS4419 – Soils for landscaping and gardening. Install topsoil to the design surface level and compact lightly. Surface must be +50mm from the design surface and free from local depressions.	Civil Contractor
Step 8: Drain invert construction	Excavate form and pour concrete invert. Undertake as constructed survey to confirm compliance with level tolerances.	Civil Contractor Surveyor.
Step 9: HOLD POINT –	Hold point inspection with contractor, superintendent & BSC .	Civil Contractor Byron Shire Council Superintendent
Step 10 – New Drain Landscape	North South Drain western batter to be planted out once earthworks are complete. Plant invert once concrete invert is constructed. Plant eastern invert once bioretention underdrainage is installed. (Note: Perimeter detention basins to be planted as per steps 10 & 11 as bulk earthworks construction allows. Batter closest to road to be planted until kerb & bollards are installed in future civil stages)	Landscape Contractor
Step 11: Soil Preparation	Dig planting holes by hand and where required place specified amount of slow-release fertiliser in the hole. Also use pre-soaked wetting agent if required.	Landscape contractor
Step 12: Planting	Plants to be supplied in accordance with planting plans. Plant the tube stock ensuring the root ball is covered with soil and stems are above the finished surface. Clear mulch away to 50mm from stem.	Landscape contractor
Step 13: As constructed survey	Undertake as constructed survey minimum every 50m of drain (4 spots across drain)	Surveyor
Step 14: HOLD POINT - Inspection & Signoff	At completion of Early Stage 2 bulk earthworks, Site superintendent and designers inspect drain and review as- constructed plans against SWC plans. Signoff if excavation tolerance is achieved otherwise issue non-conformance for rectification.	Superintendent Designer Byron Shire Council Civil Contractor

Step	Construction Phase - Early Stage 2 Bulk Earthworks and Landscaping	Responsibility and Controls
Step 15: Practical completion inspection.	At completion of Civil Stage 1, superintendent, BSC & Civil Contractor to review and inspect constructed plans against SWC plans.	Superintendent Byron Shire Council Civil Contractor
Step 16: Off maintenance inspection	At completion of Civil Stage 1 maintenance period, superintendent, BSC & Contractor to attend off maintenance inspection. F to be reviewed to confirm ongoing compliance.	Superintendent Byron Shire Council Civil Contractor

Maintenance will be required to protect the drainage channel and vegetation. The new vegetated channel increases the capacity of the existing drain, adds biodiversity, and provides water quality benefits. Key maintenance activities to protect the new drain include:

- Plant protection
- Weed control
- Rubbish and debris removal
- Monitoring of plant establishment and growth
- Watering
- Replanting
- Restriction of construction and public access

A summary of the actions provided in Table 4-16 and monitoring, inspections, and maintenance checklists are provided in Appendix G. Table 4-17 outlines a monthly schedule for inspections and maintenance of the new North South Drain. Activities during the plant establishment period (first two years) are more frequent when more regular weed removal and replanting is required. Once the landscape is fully established and sustainable the regime can be updated to quarterly.

Table 4-16 New North South Drain Routine Inspection and Maintenance

New Drain Routine Inspection and Maintenance		
	Inspection	Maintenance
1	Weeding and litter removal	
	Routine inspection should be carried out monthly. Check for weed invasion, litter accumulation, vegetation health and any damage/vandalism. The drain (including inflow points, overflow weirs, batters, and vegetation) should be checked for litter accumulation.	Routine maintenance includes weed control and the collection of any litter and minor remedial works as required. If weeds have been observed within the drain they should be removed by hand. Aim to remove the weed immediately including the roots. If herbicides are to be used, ensure a qualified and experienced applicator. Remove weeds off site.
2	Replanting	
	Identified loss of plant cover/ density	Replant plant species as necessary in areas that have been weed infested or in areas lacking appropriate vegetation cover during the inspections. (planted species should not be harvested)
3	Sediment, Scour, Loss of topsoil	
	Identify areas of obvious sediment deposition (i.e. around the inlet area) or damage. Identify areas of erosion, including scouring from storm flows and rill erosion of the batters from lateral inflows. Assess any damage to bund walls.	Remove sediment where it is smothering of vegetation, particularly at the inlet areas. Remove accumulated sediment by surface scraping (if it does not damage the vegetation). Reinstate soil to areas which have been lost.
	Any structures such as maintenance access, weirs, pits, piping, and access restrictions (eg. lock-rails, fencing) should be inspected for damage and/or vandalism.	Provide rectification options to asset owner for approval and carry out works
4	Remedial Works.	
	Routine inspection may identify damage to the drain after storms that should be repaired. This may include erosion of the channel system or scouring at the inlet and/or outlet	Damage should be repaired as part of the routine maintenance. Measures to reduce future damage (e.g. erosion) from occurring should also be investigated and implemented.
5	Restrict Access	
	Inspect for where damage may be occurring due to uncontrolled access (especially construction vehicles) and pedestrians.	ESC measures and fencing may be needed beyond the establishment phase if areas are being damaged. Install, secure and monitor protection measures until the drain has recovered.

Table 4-17 North South Drain Maintenance Calendar

Purpose of visit	Frequency	J	F	M	A	M	J	J	A	S	O	N	D
Inspection, check plant health, weeding, cleaning, minor maintenance (first 2 years)	Monthly	√	√	√	√	√	√	√	√	√	√	√	√
Inspection, check plant health, weeding, cleaning, minor maintenance (fully established)	Quarterly		√			√			√			√	
Sediment cleaning in concrete invert	6 monthly						√						√
Replanting (as required)	As required												

4.7.2 Bioretention Basin

Wallum Estate Road 2 is the perimeter road for Stage 1-3 and has three bioretention systems (refer *Figure 4-7*). The construction of the drain, basins and importation of bulk earthworks will be in Early Stage 2. Step-by step guidance had been drawn from *Healthy Waterways - Water by Design Construction & Establishment Guidelines* (Water by Design, 2010, *v1.1 April 2010)* and provided in *Table 4-18*.

Table 4-18 Step-by Step Guide for Construction of Bioretention Basin

Step	Stage 1 Civil Construction	Responsibility & Controls
Step 1: Pre-start meeting	Organise the pre-start meeting with superintendent, civil and landscape contractors and when required Councils compliance officer. Discuss construction methodology, functionality, design intent and risks associated with bioretention construction. Discuss preferred staging, flow management plan, protection, establishment, and ESC plans. Confirm specification, tolerances, controls, hold points and sign- off requirements. Confirm media specification, supply source and compliance certificates	Civil Contractor Engineering Landscape Design Superintendent ESCP CEMP Media Supplier
Step 2: Preparation	Plan resources, plants, materials, media, equipment, tolerances and plan for rainfall.	Civil Contractor
Step 3: Install stormwater structures	Install stormwater pits, pipes, headwalls, structures and overflows. Precast pits should have penetrations for sub-surface pipes cast to make connection. If not these should be core drilled on site in the correct location prior to installation. Design levels and tolerance must be achieved.	Civil Contractor
Step 4: Bulk earthworks	Undertake bulk earthwork including provision of bunds to protect the main system. If earth bunds and batters are used they should have 200mm of topsoil applied following earthworks. The sediment basin (road cut) should be constructed and operational prior to bulking out Road 2 West bioretention basin.	Civil Contractor ESCP

Step	Stage 1 Civil Construction	Responsibility & Controls
Step 5: Trimming and profiling	Undertake detailed excavation, trimming and profiling bunds, embankments, batters, sides and base. Ensure the base has 0.5% grade to the stormwater pit unless design specifies a flat base. Ensure the system is free of debris and meets the design tolerances. (Install the geo-synthetic liner for Road 2 West bioretention only)	Civil Contractor
Step 6: Construct overflow weir (if required)	Construct the overflow weir and key into the bunds to avoid scour. Design tolerances must be achieved (+25mm)	Civil Contractor
Step 7: As constructed survey	Undertake as constructed survey including stormwater structures, pits, pipes, weirs, invert, base and surface levels.	Surveyor
Step 8: HOLD POINT Inspection & Signoff	Site superintendent and designers inspect the system with contractor and review as- constructed plans against SWC plans. Signoff if excavation tolerance is achieved otherwise issue non-conformance for rectification.	Superintendent Designer Contractor
Step 9: Install Filter cloth Lining	NA. (Note - clay liners are used for Road 2 West at Road 2 South bioretention)	Contractor
Step 10: Install under-drainage	Install slotted rigid underdrain pipes, aggregate pipes and rigid collector pipes in the specified layout. Ensure all pipes are laid at a minimum 0.5% slope with no localised depressions. Verify using levels or string lines. Install non-return device on subsurface drainage discharge points Ensure levels are achieved (+25mm). Seal junctions and connections using sealant to prevent sand, gravel or soil passing in the drainage network. Use the drainage material adjust the pipes to achieve the design grades of 0.5%.	Contractor
Step 11: Install cleanout riser	Connect cleanout point riser to subsurface drainage and extend 100-150mm above basin surface. Ensure caps are secured (screwed) in place to protect the pipes and prevent damage.	Contractor
Stpe12: HOLD POINT Sign-off	Inspection with contractor and signoff required for liner and subsurface drainage by superintendent and designer. Photo record and Sign-off system meets design and construction requirements.	Superintendent Designer Contractor Form B
Step 13: Source drainage layer, transition layer and media	Testing and sourcing the drainage layer, transition layer and filter media should have commenced as part of Step 2& 3. The material can now be delivered to site and stockpiled ready for installation. Bioretention media hydraulic conductivity shall be in accordance with the Facility for Advancing Biofiltration 'Practice Note 1: In Situ Measurement of Hydraulic Conductivity". The number of samples to be tested shall be in accordance with the "Water Sensitive Urban Design Construction and Establishment Guidelines - Swales, Bioretention Systems and Wetlands (Water by Design).	Superintendent Contractor
Step 14: Install drainage layer	Install 200-250mm deep drainage layer to cover the slotted underdrainage pipe network. Spread and level the drainage layer to cover the pipe uniformly.	Contractor
Stpe15: HOLD POINT – Inspect the drainage layer	Inspect the drainage layer to ensure cover and depth and tolerance (+25mm) have been provided and a level surface achieved to receive the transition layer	Superintendent Form C

Step	Stage 1 Civil Construction	Responsibility & Controls
Stpe16: Install transition layer	Install 100mm deep coarse sand for the transition layer on top of the drainage layer using the same approach as Step 14 to achieve tolerances and ensure the surface is level.	Contractor
Step 17: Inspect transition layer	Inspect the transition layer to ensure cover and depth and tolerance (+25mm) have been provided and a level surface achieved to receive the filter media layer	Contractor
Step 18: Install filter media	Place the bioretention filter media over the transition layer in two separate lifts and lightly compact (hand roller) and use spreader bar to level surface of filter media. The filter surface should achieve the design level (+25mm) and be free from local depressions.	Contractor
Step 19: Install sediment fences	Install sediment fences (or bunds) around the filter media at the top of the batters or low points to prevent any sediment from entering the system. Keep vehicles off the basins.	Contractor ESCP
Step 20: Lay protective filter cloth or turf	NA. The site is not silty and velocities are low hence there is low risk of damage to the filter media. Design has specified loose weave jute to minimise this risk. Install measures in areas where required.	Contractor ESCP
Step 21: As constructed survey	Undertake an as constructed survey of the system, structures and surrounding bunds. Pick at least 4 spot levels as a cross section on the surface every 20m of the system.	Surveyor
Step 22: HOLD POINT – inspection and signoff	Site superintendent and designers inspect the system with contractor and review as- constructed plans against CC plans. If construction meets the tolerances and conforms to the design signoff	Superintendent Designer Contractor
Steps 23 -28 : Monitor and adjust ESC measures to protect system	Building Phase - Implement bunding, bypass, protection, and ESC measures. Monitor, adjust and maintain measures throughout the building and establishment phase to protect the basins from sediment, scour and damage	Superintendent Contractor

4.7.3 Bio-Pod Street Trees

Bio-pod (bioretention) street trees are also located on Road 2 and internal Roads 3,4,5,6 and 7 (refer *Figure 4-7*). The bio-pods are to be constructed in the civil stage at the same time as road pavement and services are constructed. The bio-pod street tree bioretention system follows a similar construction sequence to traditional bioretention systems however the tree species, size and variety is provided in the Streetscape Planting Plan. The underdrains connect the bio-pods along the road reserve and drain treated flows to Road 2 West stormwater discharge pits or infiltrate to groundwater. The construction and establishment guide are provided for a single system which is applicable to all bio-pods is provided in Table 4-19 while Table 4-20 provides the steps for establishment phase. Ideally a row of bio-pods is constructed, and subsurface drainage connected for a street. The guide can then be used efficiently for inspection and signoff rather than individual trees. Each bio-pod will need to be protected and maintained as they are constructed and established.

Table 4-19 Guide for Construction of Bio-pod Street Trees

Step	Stage 1 - Civil Construction Bio-pod Street Trees	Responsibility and Controls
Step 1: Pre-start meeting	Organise the pre-start meeting with superintendent, civil and landscape contractors and when required Councils compliance officer. Discuss construction methodology, functionality, design intent and risks associated with bioretention construction. Discuss preferred staging, flow management plan, protection, establishment, and ESC plans. Confirm specification, tolerances, controls, hold points and sign- off requirements. Confirm media specification, supply source and compliance certificates	Civil Contractor Engineering Landscape Design Superintendent ESCP CEMP Media Supplier
Step 2: Preparation	Plan resources, plants, materials, media, equipment, tolerances, and plan for rainfall.	Civil Contractor
Step 3: Install stormwater structures	NA	
Step 4: Bulk earthworks	The bulk earthworks will be undertaken well before the civil stage and installation of the bio-pods. The excavation for the tree's root ball and installation will occur later in the civil stage.	Civil Contractor ESCP
Step 5: Trimming and profiling	Undertake detailed excavation, trimming and profiling sides and base. Ensure the base has 0.5% grade for the main subsurface drain. Ensure the system is free of debris and meets the design tolerances.	Civil Contractor
Step 6: NA	NA	Civil Contractor
Step 7: As constructed survey	Undertake as constructed survey including invert, base, and surface levels.	Surveyor
Step 8: HOLD POINT Inspection & Signoff	Site superintendent and designers inspect the system with contractor and review as- constructed plans against CC plans. Signoff if excavation tolerance is achieved otherwise issue non-conformance for rectification.	Superintendent Designer Contractor
Step 9: Install root barrier	Install root barrier behind the kerb to protect pavement	Contractor
Step 10: Install under-drainage & root guard on pavement face	Install slotted rigid underdrain pipes, aggregate pipes and rigid collector pipes in the specified layout. Ensure all pipes are laid at a minimum 0.5% slope with no localised depressions. Verify using levels or string lines. Install non-return device on subsurface drainage discharge points. Lay root guard against pavement face and wrap 300mm under v drain and secure. Ensure levels are achieved (+ 25mm). Seal junctions and connections using sealant to prevent sand, gravel or soil passing in the drainage network. Use the drainage material adjust the pipes to achieve the design grades of 0.5%.	Contractor
Step 11: Install cleanout riser	Connect cleanout point riser to subsurface drainage and extend 100 mm above basin surface. Ensure caps are secured (screwed) in place to protect the pipes and prevent damage.	Contractor
Stpe12: HOLD POINT Sign-off	Inspection with contractor and signoff required for liner and subsurface drainage by superintendent and designer. Photo record and Sign-off system meets design and construction requirements.	Superintendent Designer Contractor Form B
Step 13: Source filter media	Testing filter media should have commenced as part of Step 2 & 3. The material can now be delivered to site and stockpiled ready for installation. (Bioretention media hydraulic conductivity shall be in accordance with the Facility for Advancing Biofiltration 'Practice Note 1: In Situ Measurement of Hydraulic Conductivity". The number of samples to be tested shall be in accordance with the "Water Sensitive Urban Design Construction and Establishment Guidelines - Swales, Bioretention Systems and Wetlands (Water by Design)).	Superintendent Contractor

Step	Stage 1 - Civil Construction Bio-pod Street Trees	Responsibility and Controls
Step 14- 17: Install drainage layers	NA. Only filter media will be used to backfill the bio-pod	NA
Step 18: Install filter media	Place the bioretention filter media and use spreader bar to level surface of filter media. The filter surface should achieve the design level (+25mm) and be free from local depressions.	Contractor
Step 19: Install sediment fences (or other measure)	Implement measures to protect the bipods and divert flows as needed until chip seal is placed. Keep vehicles off the bio-pod area.	Contractor ESCP
Step 20: Lay protective filter cloth or turf	Temporary protection using filter cloth or turf should be provided where required to protect against sediment laden runoff.	Contractor ESCP
Step 21: As constructed survey	Undertake an as constructed survey of the system, structures, and surrounding bunds.	Surveyor
Step 22: HOLD POINT – inspection and signoff	Site superintendent and designers inspect the system with contractor and review as- constructed plans against CC plans.	Superintendent Designer Contractor
Steps 23 -28: Monitor and adjust ESC measures to protect system	Building Phase - Implement sand bunding, bypass, protection, and ESC measures where needed. Monitor, adjust and maintain measures throughout the building and establishment phase to protect the bio-pods from sediment, scour and damage.	Superintendent Contractor

Table 4-20 Guide for Landscape and Establishment of Bio-pod Street Trees

Step	Stage 2 Landscape Establishment	Responsibility & Controls
Step 29: Pre-start and plant set out meeting	Before tree planting commences hold a prestart meeting with designers, ecologist, superintendent, landscape contractor. Confirm design, planting requirements, set out and planting plan.	Superintendent Designer Landscape Contractor
Step 30: Preparation	Prepare for landscaping at least 6 months prior including ordering and inspecting trees and river stone mulch (75mm)	Landscape contractor
Step 31: Removal of building phase protection & flush underdrains	Remove the building phase protection (turf), cloth, sediment. Flush out underdrains with potable water to remove sediment.	Landscape contractor
Step 32: Level surfaces	After protective layers are removed level off basin surface using spreader bars (or level). Top-up filter media where needed. Do not over compact media.	Landscape contractor
Step 33: Soil Preparation	Dig holes by hand and where required place specified amount of slow release fertiliser in the hole. Use pre-soaked wetting agent if required.	Landscape contractor
Step 34: Plant Tree	Plant the tree and secure to stakes and tube stock ensuring the root ball is covered with media and stems are above the filter media. Clear mulch away to 50mm from trunk.	Landscape contractor
Step 35: River stone mulching	Mulch the basin areas to specification provided.	Landscape contractor
Step 36: PRACTICAL COMPLETION – Inspection & Sign-Off	After installation of the river stone mulch and tree superintendent and designers to inspect the drain with contractor and Sign-Off Include photos.	Superintendent Designer
Step 37: Watering	Week 1-6 5x watering / week Week 6-10 3x watering/ week Week 11-15 2x watering / week (if there is no rainfall, each tree should receive 2.5-5.0 litres / week during the establishment in the first 6 weeks (40mm/week)	Landscape contractor

Step	Stage 2 Landscape Establishment	Responsibility & Controls
Step 38: Weeding	Inspect the bio-pod and tree fortnightly during establishment, removing weeds by hand.	Landscape contractor
Step 39: On-going inspections & final landscape establishment	Monitor the establishment of tree until they are robust and self-sustaining. Growth, health and maturity should be recorded 3 monthly with photos of the street tree bio-pod provided.	Landscape contractor
Step 40: Inspection and Signoff	After plants are established, the site superintendent and bioretention designer will inspect the system and complete.	Superintendent

Operation and maintenance follows immediately on from the establishment phase to ensure the bioretention systems are robust self and self-sustaining. Key requirements of bioretention maintenance include:

- Monitoring plant establishment and issues
- Plant replacement
- Weed management
- Management of inlet and outlet zone
- Rubbish and debris removal
- Scour protection and restoration
- Top-up soil/ media lost
- Subsurface drainage cleaning
- Management of extreme events

Table 4-21 outlines a monthly schedule for inspections and maintenance of the bioretention basins and bio-pods. Inspection and maintenance activities during the plant establishment period (first two years) are more frequent when more regular weed removal and replanting are required. Once the bioretention and bio-pods are well established and sustainable the regime can be updated too quarterly.

Reporting on the performance of the bioretention basin, bio pods by the project engineer or other professional with sufficient experience and capabilities construction, and establishment of bioretention basins and stormwater detention systems for Council's acceptance demonstrating compliance with the approved design.

Table 4-21 Schedule of bioretention inspection & maintenance

Purpose of Visit	Frequency	J	F	M	A	M	J	J	A	S	O	N	D
Routine Inspection and maintenance as required (first 2 years)	Monthly	√	√	√	√	√	√	√	√	√	√	√	√
Once systems are fully established and sustainable	Quarterly		√			√			√			√	

4.7.4 Stormwater Treatment Device Management and Performance Reporting

Reporting on the performance of the stormwater treatment devices and north south drain by the project engineer or other environmental professional with sufficient experience and capabilities in the construction, and establishment of bioretention basins and stormwater detention systems for Council's acceptance demonstrating compliance with the approved design.

In the event the monitoring report identifies failures, the report shall provide an alternative design that will prevent future and ongoing failures for the particular device.

4.7.4.1 Newly Constructed North South Drain

The new North South Drain is contained within Management Zone 3a. Drain construction will require disturbance of all existing vegetation in this zone, therefore post construction planting may only occur when works are complete and signed off by the project engineer and stormwater consultant. Management actions for MZ 3a are limited to landscape plantings to establish wallum sand heath and a treatment swale, as specified in the landscape plan at Appendix C. Monitoring of the plantings will be required following installation.

Notes:

- For the long term habitat maintenance of wet heath, incursions of woody vegetation (eg. eucalypts, wattles etc which may form a closed canopy) must be removed to maintain biodiversity values associated with adjacent existing high quality habitat.

Management actions for MZ 3a therefore are limited to:

- Landscape plantings to establish wallum sand heath and a treatment swale, as specified in the Landscape Plan and Habitat Creation Revision at Appendix C. The landscape plan will specifically include a dense planting of sedges and grasses to widths of up to 5m (space permitting) along mapped watercourses to restrict cane toad incursions (refer Appendix C).

4.7.4.2 Inlet and Outlet Points

Inflow aprons and overflow pits/outlets require monitoring as they are prone to scour and litter build up. Debris can block inlets and outlets, becoming unsightly and compromising the biofiltration processes. Stormwater inlets to the basin should be inspected as part of the routine inspection and cleaned of sediment and rubbish.

The outlet pit should be inspected for damage, accumulated debris and working order at the routine inspection. The emergency overflow weir may also have rubbish, debris, weed growth and sediment removed to allow free flow of water should be carried out as required. Any deflection can cause scour to the downstream banks and/or infrastructure.

4.7.4.3 Litter and Debris Removal

This is a particularly an issue through the building phase of estate development. Litter and debris washed into the bioretention basin can be unsightly and dangerous for wildlife. Plastic containers, polystyrene, construction wrapping and other accumulated rubbish causes damage and provides breeding habitat for vermin and mosquitoes. Rubbish should be removed after storm events and/or during routine maintenance.

Rubbish should be recycled where possible. The quantity and type of rubbish should be recorded to help understand where it may originate from and help implement control measures.

4.7.4.4 Scour Protection

The filter media is specifically designed to support plant growth and allow filtration (hydraulic conductivity). Media can be lost through high flow conditions, scour, animals and development activity. Where media is lost it should be reinstated and scour protection provided to protect the basin surface and media.

Scour is most common at the inlet to bioretention systems. It is important to restore soils and provide added protection to areas where scour is occurring. Seek professional advice if this is an ongoing issue for design and mitigation.

4.7.4.5 Subsurface Drainage

Treated stormwater is drained into slotted UPVC pipe at the base of the filter media and discharged. Access to the subsurface pipe is provided through plumbing access covers on the surface. Low pressure water should used to flush the pipes every 2-3 years to ensure drainage capacity is provided for the raingarden. Ensure risers have caps and they are screwed on securely.

4.7.4.6 Management in Drought

In the event of an extended period of drought, established plants may die or retreat below ground ('senescence') but will re-grow when water is supplied. Mature plants should survive extended periods of drought with no standing water by penetrating their roots deep into the soil profile. In prolonged periods of drought, management should:

- Monitor plant health
- Prevent soil desiccation by using sprinkler irrigation, particularly in areas containing unhealthy looking plants
- Consider flood irrigation

The basin outlets could be modified (blocked) to retain water in extreme circumstances.

The impact of drought can be reduced through:

- Selection of drought tolerant species
- Mulching of terrestrial areas
- Deep watering that encourages deep-rooted plants.

4.7.4.7 Management in Flood

Following a flood or significant storm event, the bioretention basin should be assessed for scouring, plant loss and general damage. If necessary, repair or replant to emulate pre-flood conditions and prevent further damage. Extreme flood events may also introduce noxious weed species. Post-flood management should therefore place high priority on monitoring for, and vigilantly removing, noxious weed and undesirable species. After floods there is commonly an accumulation of rubbish and debris. Resources will need to be allocated for the collection of this rubbish.

4.8 Acid Sulfate Soils

The *Wallum Estate, Acid Sulfate Soil Management Plan, Revision D (AWC 2023)* highlights assessments of the site by Border Tec, Geotech and AWC which involved soil sampling and laboratory analysis in accordance with relevant guidelines. None of the assessments detected any Actual (ASS) or Potential Acid Sulfate Soil (PASS) on site. Nonetheless, there is the potential to expose undetected ASS, or impact PASS through excavations works associated with construction of WF pond, deep sewer and other services, and the new North South

Drain. As such, routine monitoring of a range of indicators, including visual, ground and surface water quality monitoring and amelioration steps as recommended within the *Wallum Estate, Acid Sulfate Soil Management Plan, Revision D (AWC 2023)* must be adhered to. Monitoring must be carried out by a person that holds a degree in Environmental Science and is trained in Acid Sulfate Management in NWS.

4.8.1 Acid Sulfate Soils Monitoring

Indicators of ASS disturbance and acid production, and their monitoring requirements are discussed below. Groundwater and surface water quality and groundwater levels will be routinely monitored (monthly) as a component of general construction phase environmental monitoring (further detail in Section 4.10 & 4.11). Work-based monitoring shall also be undertaken to assess for visual indicators of ASS.

4.8.1.1 Groundwater Level

Decrease in groundwater levels caused by construction activities may instigate oxidation of Potential Acid Sulfate Soils (PASS) and subsequent acid production. Levels are to be monitored and data provisions provided to the Environmental Manager. If substantial, unexpected reductions in groundwater level are evident, further assessment of surface and groundwater quality will be required to confirm ASS indicators are not present. Groundwater level monitoring locations are shown on *Figure 4-8*.

4.8.1.2 Water Quality Monitoring

Groundwater (monitoring wells) and surface water will be monitored in accordance with the schedule in

Table 4-22. Surface waters will also be monitored for visual indicators. Surface water will be collected from three internal sites, located in the primary drainage channel and tributaries (SW1, SW2 and SW3). Samples will be collected from four groundwater monitoring wells, adjacent the primary drain works (MW102, MW120, MW112 and MW113) (refer Figure 4-8).

Indicators of ASS disturbance and impact to the water on the site are shown in

Table *4-23*, with trigger values provided. As the site can have naturally occurring low pH in water and soils, pH values alone are not sufficient to detect ASS impact. Previous data collected at the site provides an indication of the existing baseline pH levels allowing a trigger level to be determined (refer

Table *4-23*).

Table 4-22 Water quality monitoring schedule (ASS parameters)

Monitoring	Monitoring frequency	
	Routine #	Works based *
Routine visual and field parameters (soil and water)	Weekly	Daily
Routine surface water sample collection and laboratory analysis	Monthly	Weekly
Routine groundwater sample collection and laboratory analysis	Monthly	Weekly *
Note: this schedule is in relation to the ASS Management Plan only, other water quality monitoring may be required for other environmental management. Frequency can be modified to align with other monitoring schedules to the satisfaction of the Site Superintendent, Environmental Manager and Byron Shire Council # Routine monitoring to continue through the construction stage * E.g. excavation >1 m depth (construction of frog ponds), or other works to the satisfaction of the Environment Manager		

Table 4-23 Water indicators of ASS/PASS

Indicator Type	Parameter	Indicator	Comment	Trigger value
Field/visual indicators#	Actual ASS	• Water of pH <5.5 in adjacent streams, drains, groundwater or ponding on the surface • Unusually clear or milky blue-green drain water flowing from or within the area (aluminium released by the ASS acts as a flocculant) • Red iron colouring sediments deposited on aquatic plants and channels	Refer below for pH triggers Detection of unusually clear or milky blue-green water in drains is a key indicator; the naturally occurring waters on site are generally tannin stained Iron floc staining on the banks and aquatic plants of water courses	Detection of clear and/or milky blue-green water in surface waters and/or groundwater and/or Detection of iron floc staining
	Potential ASS	• Water pH neutral but may be acid		

Indicator Type		Parameter	Indicator	Comment	Trigger value
Water Quality tests##	Field parameters (handheld sensor)	pH	Change +/- 0.5 pH units from natural range (range varies depending on site location)	Baseline data for surface water (SW1-SW3) shows pH range 4.05-5.86	pH <4.0 and/or >6.0 water in surface waters and/or groundwater
		TDS EC	TDS >1500 mg/L	Baseline data shows EC range 70-153 µS/m though close to an estuarine system,	EC values >500 µS/m
	Laboratory analysis	Calculation of $Cl:SO_4$ ratio	0.5 = indicator value	Existing range 1.8-15.96	>16
		Fe (total)	>500 µg/L	Existing range 233-3467 µg/L	>3500 µg/L
		Al (total)	5 µg/L for pH <6.5 100 µg/L for pH >6.5	Existing range 454-1370 µg/L	>1370 µg/L
# Based on Table 2.3 of the ASSMAC Guidelines (1998) ## ANZECC guidelines as part of commentary in ASSMAC (1998) TDS = Total Dissolved Solids; EC = Electrical Conductivity					

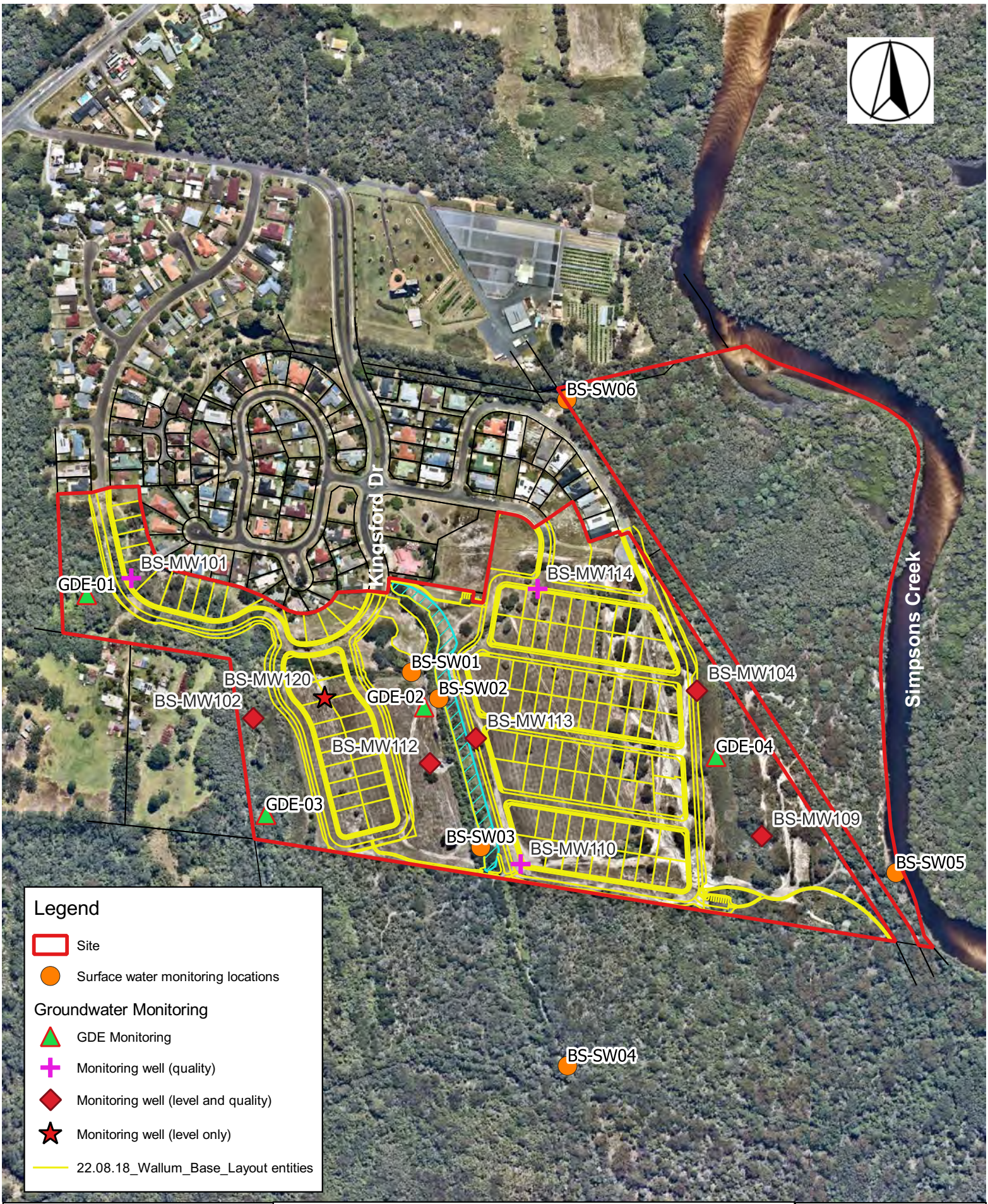
4.8.1.3 Soils

During excavation works for WF pond construction and deep sewer construction, ASS may be uncovered and exposed. Visual identification of ASS may be difficult however Table 4-24 provides some potential indicators of ASS.

Table 4-24 Visual indicators of Acid Sulfate Soil

ASS visual indicator (potential)
Sulfur odour (rotten egg gas)
Different soil types, particularly clays on this site
Yellow mottles in the soil (jarosite)

All excavations >1 m depth during construction is to be visually inspected by the Environment Manager that is trained in ASS management in NSW to ensure ASS is not intersected. If any of the above are detected, excavations should cease and water testing immediately surrounding the works should be undertaken. Additionally, soil pH can be tested in the field to provide an indication of ASS. If indicators are detected, refer to the amelioration processes in section 5.2.



AWC

0 100 200 300 m

Figure 4-8 Groundwater monitoring wells (quality and level), surface water monitoring and GDE monitoring locations

Data source:
Aerial - Nearmaps
Layout - Cilviltech

Date:14-09-22
Job No:211400
Drawn: ED/JM
Checked: JM

A4 Scale 1:5,000
Coordinate System: MGA 56 Projection: Transverse Mercator

4.9 Dewatering

Excavation works for constructing the gravity sewer and North-South drain re-alignment are expected to intercept the groundwater table. A Dewatering Management Plan (DMP) has been prepared (ENV Solutions, 2023) which describes dewatering methodologies, outlines groundwater treatment requirements/methodologies and describe monitoring and reporting requirements to be implemented during dewatering works associated with these works. The DMP (ENV, 2023) must be referred to for dewatering requirements.

Environmental mitigation and management measures relating to dewatering are summarised in the Sections below. Dewatering monitoring and reporting requirements are summarised in Section 4.9.6.

4.9.1 North – South Drain Construction

Environmental mitigation measures and management process:

- No dewatering of the underlying groundwater aquifer to occur as a part of the proposed construction methodology
- Erosion and Sediment Control plan measures to be adhered to (refer Section 4.6)
- Monitoring as per the surface water groundwater management plan

4.9.2 Groundwater Extraction Methodology

Groundwater extraction methods:

- Staged deep well or well point spear groundwater extraction methodology is recommended (refer to DMP for description of these methodologies)
- Extracted groundwater will be directed to infiltration basins located on site (refer DMP (ENV, 2023) or re-used on site as supplementary water supply to vegetation rehabilitation areas through the use of a sprinkler system, or in the form of dust suppression.
- The construction methodology aims to complete and finalise the gravity sewer in 20m sections, with each 20m section to be completed in a one (1) day construction period.
- Gravity sewer dewatering is to be completed within twenty -eight (28) days
- Excavations are to be benched where required, with trench boxes used to support excavations in areas of lower depth/deeper groundwater

4.9.3 Groundwater Extraction

Environmental management process:

- The target Surface Water Level (SWL) is 2.40mAHD and therefore, the SWL will need to be lowered (drawn down) to 1.70mAHD and maintained (steady state) at 2.40mAHD.
- Initial drawdown estimates are expected to be approximately 10 m^3 (0.01ML)
- Extraction flow rate is expected to range between 0.1 and 0.9L/s (8.5m^3 to 77m^3 per day)
- The zone of influence is expected to range between 5 to 51m
- Total estimate extraction volume is expected to range between 0.1ML – 2.1ML
- Dewatering methodologies will be managed to mitigate total volume, targeting lower end estimates.

Environmental mitigation measures:

- Undertaking works in extended periods of dry weather
- Limiting the use of dewatering equipment where possible (i.e., for construction occurring at the surface water/groundwater interface)

4.9.4 Groundwater Disposal

Environmental mitigation measures and management process:

- Extraction of groundwater from dewatering activities is to be managed in the following hierarchy;
  - Artificial recharge water into the groundwater table through the use of infiltration basins/trenches, where it reinfiltrates into the underlying aquifer
    - Extract water is to be delivered to the infiltration basin located at the adjacent stage to ensure extract water is not re-infiltrated into the aquifer adjacent to active excavations
    - During Stage 5 works (final stage), extracted water will be directed into the artificial infiltration system located centrally within the allotment area
    - Any sediment "clogging" the basins/trenches to be regularly removed to enable continued recharge to the aquifer
    - The size of each basin/trench will be dependent on available space and depth to the water table at the time of construction
    - Infiltration is to be undertaken until each basin/trench reach two thirds (2/3) of its total capacity (or else move to level 2 of the hierarchy of disposal)
  - Onsite re-use of extract water in the form of vegetation establishment/rehabilitation, dust suppression, earthworks compaction and/or plant/vehicle wash down (triggered when infiltration basins/trenches exceed two-thirds of their total capacity)
    - On- site reuse should not cause the ponding or runoff of water, which may then cause concentrated runoff and unauthorised discharge
    - Should ponding be observed, and artificial recharge systems exceed two-thirds of total capacity, then a Water Treatment Plant is to be instated and level 3 of this hierarchy triggered.
  - Discharge extract water off site (to receiving waters via North-South drain).
    - Triggered when level 1 and 2 of this hierarchy are not viable due to variables such as aquifer recharge, climatic conditions (i.e., saturated ground) or slow infiltration rates onsite
    - Water treatment plant to be installed and extracted water treated to meet the WQOs outlined in *Table 4-28*.
    - Further details on the water treatment process provided in Section 4.9.5 below

4.9.5 Groundwater Treatment

Environmental mitigation measures and management process:

- Water Treatment Plant (WTP) will need to be established onsite & commissioned by a suitably qualified engineer or scientist, including (as a minimum):
  - pH correction
  - Metals precipitation/aeration capability
  - Solids removal capability

4.9.6 Dewatering Monitoring

Section 6 of the *Wallum Subdivision, Dewatering Management Plan* (ENV,2023) describes the required validation and monitoring process to provide a framework for dewatering contractors to collect, interpret, act and report on the performance of the dewatering process. The monitoring requirements during dewatering are provided in Section 4.9.6.1 and Section 4.9.6.2 below.

4.9.6.1 Discharge to Land

Monitoring requirements for discharge to land are provided in Table 4-25. The water quality objectives (WQOs) are provided in Table 4-26. Further details can be found in the Dewatering Management Plan (ENV,2023).

Table 4-25 Dewatering - discharge to land, monitoring requirements

Requirement	Monitoring	Monitoring location	Frequency	Triggers
Daily field monitoring	Visual inspection	Discharge to land footprint and receiving environment (Everitts Creek)	Daily	Refer WQO's in Table 4-26
	pH	Extracted water and receiving environment	Daily	
	Electrical conductivity	Extracted water and receiving environment	Daily	
	Flow rate	Dewatering water treatment plant	Continuous flow rate measurements and totalised daily volumes	

Table 4-26 Water Quality Objectives (WQOs) Discharge to Land (ENVSolutions, 2023)

Parameter	Water Quality Objective (WQO)
Physicochemical	
pH	4.0 – 6.5[1]
Electrical Conductivity (EC) (µs/cm^{-1})	100 – 140[1]
Oil & Grease (Visual)	No visual observations [2]

Table Notes:
1. Derived from receiving environment baseline water quality range values collated by AWC (Attachment 4).
2. Derived from Transport for New South Wales (TfNSW) (formerly RTA) Technical Guideline EMS-TG-011, Environmental Management of Construction Site Dewatering (RTA, 2011)

4.9.6.2 Discharge to waters

Monitoring requirements for discharge to waters are provided in Table 4-27. The water quality objectives (WQOs) are provided in Table 4-28. Further details can be found in the *Dewatering Management Plan* (ENV,2023).

Table 4-27 Dewatering - discharge to waters, monitoring requirements

	Monitoring	Monitoring location	Frequency	Limits/ triggers
Analytical field sampling	Water sample tested by NATA certified laboratory (pH, TSS, Turbidity, EC, Aluminium, Iron)	Outlet of water treatment plant (WTP)	Prior to discharge Every 7 days (or as required under the guidance of a suitably qualified person)	Refer WQOs in Table 4-28
Daily field monitoring	Visual inspection	Treatment process and receiving environment (Everitt's Creek)	Daily	N/A
	pH	WTP	Continuous measurement	Refer WQOs in Table 4-28
	Turbidity			
	Electrical Conductivity			
	Flow	WTP	Continuous flow rate measurements and totalised daily volumes	

Table 4-28 Water Quality Objectives (WQOs) Discharge to Waters (ENVSolutions, 2023)

Parameter	Water Quality Objective (WQO)
Physicochemical	
pH	6.5 – 8.0 [1]
Total Suspended Solids (TSS)	< 50[2]
Turbidity (NTU)	< 50[2]
Electrical Conductivity (EC) (µs/cm^{-1})	125 - 2200
Metals	
Aluminium (µg/L)	< 900[3]
Iron (µg/L)	< 4000[3]

Table notes:
1. Derived from ANZECC/ ARMCANZ (2000) – (Table 3.3.2).
2. Derived from ANZECC/ ARMCANZ (2000) – (Table 3.3.3).
3. Derived from AWC (2022a) baseline receiving environment water quality data set.

4.9.7 Dewatering Reporting

During the dewatering process, daily observations will be recorded and stored onsite and a daily report summarising monitoring results and observations will be provided and presented to the Principal Contractor outlining physiochemical changes across the process, high level plant function/ performance summary and flow (rate & totalised volume). If totalised project flow volumes exceed 2.1ML (refer to section 4.3.3 of the Dewatering Management Plan (ENV,2023)), then exceedances are to be reported to Byron Shire Council.

A dewatering report summarising the results of monitoring will be supplied within two weeks of cessation of discharges. Any complaints shall be noted in the site logbook and corrective action taken (where appropriate and practicable) to prevent recurrence.

4.10 Surface Water

To ensure surface water quality is not being adversely impacted by the works, monthly monitoring should continue as stated within the *Wallum Estate, Surface and Groundwater Management Pan, Revision E (AWC 2023)*.

4.10.1 Surface Water Monitoring

Monitoring locations for surface water is shown on Figure 4-8. All existing surface water monitoring locations will be monitored routinely (monthly) for quality during the entire construction and occupation phases (refer Table 4-29 and Table 4-30). Table 4-31 below detail the required testing analytes while Table 4-32 highlights set action criteria for each monitoring location. for surface water quality. Exceeding these values triggers the Action Response Plan (refer section 5.1).

Surface water monitoring for physical and chemical analytes should also be undertaken at up and down stream sites (SW1 and SW3) within the drain daily during construction of the newly aligned North South drain to determine if there is a reduction in surface water quality resulting from the works.

4.10.2 Surface Water Reporting

At least six (6) monthly reporting is required during subdivision construction phase for at least five (5) years or until two years following the issue of a subdivision certificate for Stage 5, whichever is. the later

4.10.2.1 Construction Phase Surface Water Reporting

The 'construction phase' includes the time period from commencement of subdivision construction works for Early Works and continues until the subdivision certificate is issued for Civil Stage 5. Six monthly monitoring reports to be provided to Council presenting the findings. A report will also be prepared at the end of each construction stage which will be issued to Council prior to the subdivision works certificate being released. Findings will be compared to trigger values shown in Table 4-32 below.

While active excavations are being undertaken to construct the new North South Drain a daily test of field parameters (EC, pH, temperature, redox potential) will be taken at surface water sites SW02 and SW03. This is in addition to the monthly routine monitoring during the construction phase detailed below. Daily monitoring will be done by the lead civil contractor's Environmental Manager with data provided weekly to the developments Environmental Representative.

4.10.2.2 Occupational Phase Surface Water Reporting

From the issue of the final subdivision certificate from Council, monthly sample collection will continue for a further 12 months. An Annual report will be prepared detailing results and comparisons to the action criteria stipulated, or as amended in the interim until the final maintenance bond is returned.

Table 4-29 Construction phase surface water monitoring

Surface water attribute	Monitoring program	Schedule/Timing	Reporting
Surface water quality including ASS	Collection of groundwater samples and analysis from the six existing locations (refer Figure 4-8) and existing analytes (refer Table 4-31)	Monthly – between commencement of subdivision construction works and completion of construction for each stage. See Note ** below	* At the end of each subdivision works stage (required prior to council issuing subdivision stage certificate) # Six monthly monitoring report to be provided to council (unless annual monitoring)
* Provide all monitoring data to the Project Environmental Manager for dispersal to relevant people ** During excavation and construction of the new North South Drain, daily field parameters (pH, EC, NTU, temperature and redox potential) at surface water sites SW02 and SW03 # Reporting is to comply with Condition 9 of the consent conditions Analysis of all monitoring and sampling data against baseline data and approved thresholds • At least six (6) monthly reporting during subdivision construction works for at least five (5) years or until the issue of a subdivision certificate for Stage 5, whichever is the later			

Table 4-30 Occupation phase surface water monitoring

Surface water attribute	Monitoring program	Schedule/Timing	Reporting*
Surface water quality including ASS	Collection of surface water samples and analysis from the six existing locations refer Figure 4-8) and existing analytes (refer Table 4-31.)	Monthly – between issue of a subdivision works certificate for a period of 12 months	* Annual # Annual monitoring report to be provided to council
* Provide all monitoring data to the Project Environmental Manager for dispersal to relevant people (e.g. groundwater quality data for Acid Frog management purposes) # Reporting is to comply with Condition 9 of the consent conditions Monitoring results of groundwater levels and quality from the commencement of Early Stage 1 works until the issue of a subdivision certificate for Stage 5 with submission of an updated report to Council prior to the issue of the subdivision works certificate for each stage of works • Analysis of all monitoring and sampling data against baseline data and approved thresholds , limits and triggers			

Table 4-31 Surface water monitoring analytes

Surface Water Quality Sampling – Water Quality Analytes				
Phys/chem pH Conductivity * Total Dissolved Salts (TDS) Total Suspended Solids (TSS)	**Nutrients** Total Phosphorus (TP) Phosphate Total Nitrogen (TN) Nitrite Total Kjeldahl Nitrogen Nitrate Ammonia	**Salts** Calcium Magnesium Potassium Sodium Chloride Sulfur	**ASS** Fe (total) Al (total Cl:SO_4 ratio **Biological** Chlorophyll '*a*' Algal biomass	**Hydrocarbons** Total Recoverable Hydrocarbons (TRH - speciated) **Metals** Lead Arsenic Mercury

Table 4-32 Action criteria- Surface water

Parameter	SW01	SW02	SW03	SW04	SW05	SW06
pH #	<4.05 or >4.58	<4.17 or >5.21	<4.17 or >5.86	<4.17 or >6.07	<5.69 or >8.03	<5.46 or >6.85
EC (dS/cm)	0.14	0.13	0.11	<0.09 or >0.15	<0.06 or >43.80	1.56
TSS (mg/L)	28.50	35.60	87.20	17.27	9.67	5.00
TP (mg/L)	0.51	0.29	0.28	0.22	0.28	1.16
TN (mg/L)	2.36	1.97	2.10	1.38	0.94	1.69
Ammonia	0.16	0.14	0.15	0.13	0.12	0.31
ASS indicators						
Al (mg/L)- dissolved	0.73	0.99	0.87	0.67	0.42	0.46
Fe (mg/L) dissolved	0.48	0.73	0.55	2.17	1.52	0.80
Sulfate/Chloride ratio	0.33	0.39	0.38	0.32	0.19	0.71
Al/Ca ratio	0.88	0.51	1.00	0.44	0.08	0.08
SO4/alkalinity ratio	ND	1.68	2.72	5.58	21.47	3.44
# pH action criteria based on the range between the minimum and maximum values detected in the baseline data Note: when action criteria are exceeded, the Groundwater Action Response Plan will be enacted (refer 5.1)						

4.11 Groundwater Quality

To ensure groundwater quality is not being adversely impacted by the works, monthly monitoring should continue as stated within the *Wallum Estate, Surface and Groundwater Management Pan, Revision E (AWC 2023)*. Monitoring locations for groundwater bores is shown on *Figure 4-8*.

4.11.1 Groundwater Monitoring

All existing groundwater monitoring bores will be monitored monthly for quality during the entire construction and occupation phases (refer Table 4-33 and Table 4-34). The 'construction phase' includes the time period from commencement of subdivision construction works for Early Works and continues until the subdivision certificate is issued for Civil Stage 5. Refer to *Table 4-35 Groundwater monitoring analytes*

Table 4-36 for the adopted action criteria for groundwater quality. Should the groundwater monitoring results be outside these trigger values, the Action Response Plan will be enacted (refer section 5.1 below).

4.11.2 Groundwater Reporting

Condition 9a states that at least six (6) monthly reporting is required during subdivision construction phase for at least five (5) years or until two years following the issue of a subdivision certificate for Stage 5, whichever is. the later

4.11.2.1 Construction Phase Groundwater Monitoring

The 'construction phase' includes the time period from commencement of subdivision construction works for Early Works and continues until the subdivision certificate is issued for Civil Stage 5. Six monthly monitoring reports to be provided to Council presenting the findings. A report will also be prepared at the end of each construction stage which will be issued to Council prior to the subdivision works certificate being released. Findings will be compared to trigger values shown in *Table 4-36*.

While active excavations are being undertaken to construct the new North South Drain a daily test of field parameters (EC, pH, temperature, redox potential) groundwater test bores MW110 and MW113. This is in addition to the monthly routine monitoring during the construction phase detailed below. Daily monitoring will be done by the lead civil contractor's Environmental Manager with data provided weekly to the developments Environmental Representative

4.11.2.2 Occupational Phase Groundwater Reporting

From the issue of the final subdivision certificate from Council, monthly sample collection will continue for a further 12 months. An annual report will be prepared detailing results and comparisons to the action criteria stipulated, or as amended in the interim until the final maintenance bond is returned.

Table 4-33 Construction phase groundwater monitoring

Groundwater attribute	Monitoring program	Schedule/Timing	Reporting
Groundwater quality including ASS indicators	Collection of groundwater samples and analysis from the six existing bores (refer Figure 4-8) and existing analytes (refer Table 4-35)	Monthly – between commencement of subdivision construction works and the issue of a subdivision works certificate for each stage See Note ** below	* At the end of each subdivision works stage (required prior to council issuing subdivision stage certificate) # Six monthly monitoring report to be provided to council
* Provide all monitoring data to the Project Environmental Manager for dispersal to relevant people (e.g. groundwater quality data for Acid Frog management purposes) ** During excavation and construction of the new North South Drain, daily field parameters (pH, EC, NTU, temperature and redox potential) and dip measurements of groundwater level are to be tested at monitoring bores MW110 and MW113 # Reporting is to comply with Condition 9 of the consent conditions Analysis of all monitoring and sampling data against baseline data and approved thresholds , limits and triggers • At least six (6) monthly reporting during subdivision construction works for at least five (5) years or until the issue of a subdivision certificate for Stage 5, whichever is the later			

Table 4-34 Occupation phase groundwater monitoring

Groundwater attribute	Monitoring program	Schedule/Timing	Reporting*
Groundwater quality including ASS indicators	Collection of groundwater samples and analysis from the six existing bores (referFigure 4-8) and existing analytes (refer Table 4-35)	Monthly – between issue of a subdivision works certificate for a period of 12 months	* Quarterly data provisions #Annual monitoring report to be provided to council
* Provide all monitoring data to the Project Environmental Manager for dispersal to relevant people (e.g. groundwater quality data for Acid Frog management purposes) # Reporting is to comply with Condition 9 of the consent conditions • Analysis of all monitoring and sampling data against baseline data			

Table 4-35 Groundwater monitoring analytes

Groundwater Quality Sampling – Water Quality Analytes			
Phys/chem	Nutrients	Salts	ASS Parameters:
pH * Conductivity * Total Dissolved Salts (TDS) * Total Suspended Solids (TSS)	Total Phosphorus (TP) Phosphate Total Nitrogen (TN) Nitrite Total Kjeldahl Nitrogen Nitrate Ammonia	Calcium Magnesium Potassium Sodium Chloride Sulfur	Fe (total)* Al (total* Cl:SO_4 ratio*
* = also used for ASS indicators (refer Section 4.8)			

Table 4-36 Action criteria - Groundwater quality

	MW101	MW102	MW109	MW112	MW113	MW114
pH #	<4.06 or >5.76	<4.28 or >5.24	<3.78 or >4.19	<4.3 or >5.32	<4.27 or >5.25	<4.68 or >5.25
EC (dS/cm)	0.12	0.09	0.17	0.11	0.13	0.17
TSS (mg/L)	11328	2400	580	1340	2408	121
TP (mg/L)	2.61	0.88	0.35	0.52	1.24	0.28
TN (mg/L)	15.68	2.94	3.74	4.56	18.58	3.13
Ammonia	0.44	0.17	0.24	0.26	0.19	0.2
ASS indicators						
Al (mg/L)- dissolved	5.02	0.99	0.48	1.53	9.76	2.09
Fe (mg/L) dissolved	2.2	0.46	0.59	0.41	1.34	0.72
Sulfate/Chloride ratio	0.31	0.24	0.57	0.28	0.19	0.27
Al/Ca ratio	4.02	0.74	ND	4.46	8.15	1.61
SO4/alkalinity ratio	ND	2.36	0.02	1.42	5.10	1.22

# pH action criteria based on the range between the minimum and maximum values detected in the baseline data 	
ND = not detected/below detectable limits
Note: when action criteria are exceeded, the Groundwater Action Response Plan will be enacted (refer Section 5)						

4.11.1 Existing Monitoring Wells and Relocation Schedule

Of the nine existing monitoring bores at the subject site, six need to be relocated as they are within a proposed construction zone. Table 4-37 shows the bores (refer Figure 4-8) their use and the Construction Stage in which they are located. The bores will be relocated as early as possible (early works stage) to collect an overlap in groundwater level and groundwater quality data to allow a similarity assessment and calculation of relevant action criteria.

Two bores (BS-MW110 and BS-MW113) are located in Construction Stage 3, both close to the proposed new drainage line. As the proposed new drainage line will be constructed as part of the early works, it is essential that these two existing bores are retained through that works period with new bores installed as soon as possible after construction.

Table 4-37 Existing bores to be relocated and Construction Stage

Bore	Use*	Relocation required?	#ConSt	##Install ConST
BS-MW101	GWQ	Y	4	EW
BS-MW104	GWQ, GWL	Y	2	EW
BS-MW110	GWQ	Y	3	EW/St1
BS-MW113	GWQ, GWL	Y	3	EW/St1
BS-MW114	GWQ	Y	1	EW
BS-MW120	GWL	Y	5	EW
BS-MW102	GWQ, GWL	N		
BS-MW109	GWQ, GWL	N		
BS-MW112	GWQ, GWL	N		
# ConSt = Within which delineated Construction Stage zone ## Install ConSt – Which construction stage to form the new bore; EW = Early works, St1 = Stage 1 *GWQ = groundwater quality; GWL = groundwater level				

4.11.1.1 Decommissioning of Existing Groundwater Monitoring Bores

The bores that require decommissioning will be done so in accordance with *Fact sheet Decommission a water*

bore Information for approval holders and licensed drillers (Water NSW, 2023) and *Minimum Construction Requirements for Water Bores in Australia (MCR)* (National Uniform Drillers Licensing Committee, 2020). Decommissioning of bores may require approval from WaterNSW.

All bores are for monitoring purposes only (not for water extraction) and are shallow (<4m deep) hence will be relatively easy to decommission.

4.11.1.2 Installation of Replacement Groundwater Monitoring Bores

Replacement bores are to be installed in accordance with *Minimum Construction Requirements for Water Bores in Australia (MCR)* (National Uniform Drillers Licensing Committee, 2020). If required, all new bores are to be licenced with WaterNSW.

4.12 Groundwater Level

Groundwater level monitoring and reporting during the construction and occupation phase will be undertaken as per the *Wallum Estate, Surface and Groundwater Management Pan, Revision E (AWC 2023)*. The groundwater level monitoring requirements are summarised in Table 4-38 and Table 4-39.

There will be a substantial difference in surface conditions post construction (namely an increase in impervious surfaces such as roofs and roads) and subsequent effect on infiltration which is to be ameliorated through the development design. The objective of monitoring groundwater levels across the site is to determine whether the proposed development has any discernible effect on groundwater regime in critical areas in the medium to long term.

The rolling average of the 30, 60 and 90-day period is to be compared with the adopted "action criteria" for each site (detailed in Table 4-40. If action criteria values are exceeded the project manager is to instigate further investigations as detailed in the Surface and Groundwater Action Response Plan (see section 5.1).

Table 4-38 Construction phase groundwater monitoring

Groundwater attribute	Monitoring program	Schedule/Timing	Reporting
Groundwater level	^^ In-situ water level loggers – retain the six existing water level loggers through to the occupation phase of the development	One (1) hourly data point	* At the end of each subdivision works stage (required prior to council issuing subdivision stage certificate) # Six monthly monitoring report to be provided to council
^^ Some wells (BS-MW101, BS-MW120, BS-MW114, BS-MW110 and BS-MW104) will be destroyed during the construction phase; these will be replaced in a nearby location where construction will not impact. A time overlap between installation of the new well and the removal of the existing well is required to compare data and perform similarity testing between data.			

Table 4-39 Occupation phase groundwater monitoring

Groundwater attribute	Monitoring program	Schedule/Timing	Reporting
Groundwater level	^^ In-situ water level loggers – retain the six existing water level loggers through the first 12 months of the occupation phase of the development	One (1) hourly data point	* Quarterly data provisions # Six monthly monitoring report to be provided to council
^^ Some wells (BS-MW101, BS-MW120, BS-MW114, BS-MW110 and BS-MW104) will be destroyed during the construction phase; these will be replaced in a nearby location where construction will not impact. A time overlap between installation of the new well and the removal of the existing well is required to compare data and perform similarity testing between data.			

Table 4-40 Action criteria for groundwater level

	MW-113	MW-102	MW-104	MW-109	MW-112	MW-120
Min. (mAHD)	3.36	3.61	3.12	2.80	3.63	3.76
Max. (mAHD)	4.14	4.49	4.07	4.09	4.76	4.79
Range (m)	0.78	0.88	0.95	1.28	1.13	1.02
Lower action criteria	**3.16***	**3.57**	**2.92***	**2.02**	**3.61**	**3.56***
function	-0.2m	-5%	-0.2m	-5%	-5%	-0.2m
Upper action criteria	**4.18**	**4.53**	**4.12**	**4.15**	**4.90**	**4.84**
function	+5%	+5%	+5%	+5%	+5%	+5%
Note: Action criteria will be compared with the 30, 60 and 90 day rolling average values from the collected monitoring data * Upper action criteria based on predicted 0.2m decrease in groundwater levels (Martens, 2021)						

4.13 Dust and Air Quality

Compliance with the objectives of the *Protection of the Environment Operations (Clean Air) Regulation 2021* is required. The proposed activity will result in minor emissions from vegetation clearing and the machinery movements resulting in minor air pollution. Dust from earth works and machinery (trucks, excavators, utilities etc) movement on unsealed access paths will be the main source of air pollution. Precautions to minimise dust generation shall be undertaken as follows:

Precautions to minimise dust generation shall be undertaken as follows:

- All activities where dust may be produced shall not be undertaken in particularly dry and windy conditions except with adequate precautions to limit impact to receptors
- Areas where dust is being generated shall be watered down for dust suppression
    - Alternatively, dust suppression using spray on binders (multiple manufacturers and products available) may be utilised
- During haulage of soil materials, the trucks are to be adequately covered to minimise dust generation and deposition through residential areas
- Minimise dust and dirt residues being deposited on roadways by haulage vehicles

Additionally;

- Where possible, exhaust from machinery is not to be directed toward receptors (e.g., urban area and child day care), limit the concentrations and exposure time to avoid causing harm and/or nuisance
- No materials are to be burnt on site

The contractor must be mindful of dust and air pollution coming from all activities and should mitigate such pollutants as appropriate.

4.14 Noise and Vibrations

ENV Solutions has prepared at *Noise and Vibration Management Plan* (NVMP) for on-site construction works associated with the construction and development of the staged subdivision. The NVMP (ENVSoulution, 2023) should be read in conjunction with this CEMP to ensure that the Principal Contractor mitigates the environmental risk and manage the impacts associated with the development activity.

As the project site is in close proximity to sensitive receptors (residential area and Child Day Care) contractor shall keep construction noise to a minimum. Primary noise and vibrations from the proposed remediation will be associated with construction works including:

- Truck and vehicle movement
- Machinery for excavation
- Rollers and Compactors

4.14.1 Adopted Noise Criteria

ENV Solutions highlights that the EPA recommends management levels and goals when assessing construction noise and vibration. These are outlined in:

- The Interim Construction Noise Guideline (ICNG),
- Assessing Vibration: a technical guideline.

Additionally, Condition 77 of the Development Application DA 10.2021.575.1 issued by Byron Shire Council

sets noise levels for the Project, whereby construction noise is to be limited as follows:

- For construction periods of four (4) weeks and under, the L10 noise level measured over a period of not less than fifteen (15) minutes when the construction site is in operation must not exceed the background level by more than 20 dB(A).
- For construction periods greater than four (4) weeks and not exceeding twenty-six (26) weeks, the L10 noise level measured over a period of not less than fifteen (15) minutes when the construction site is in operation must not exceed the background level by more than 10 dB(A).
- Considering the Project is scheduled to exceed twenty-six (26) weeks, the noise criteria specified within the Interim Construction Noise Guideline shall be adopted for construction phase of the Wallum Estate.
- The ICNG provides the standards used to establish Noise Management Levels (NML) and their application for both residential and commercial sensitive receivers, as detailed in *Table 4-41*. The NMLs chosen during standard construction times for residential locations are determined by identifying the Rating Background Noise Level (RBL) using methods outlined in AS1055(2018) Description and Measurement of Environmental Noise, then adding 10dB. At this level, the noise has a minimal effect on the surrounding residential areas' noise comfort.
- Thus, according to the evaluation standards, all residential areas have an established NML value of 55dB(A), while commercial areas have an NML of 70dB(A) during construction times, which are from 7am – 6pm from Monday to Friday and 8am – 1pm on Saturdays, as shown in Table 4-42.

Table 4-41 Noise Management Levels for Residential Receptors (Sourced ENVSolutions, 2023)

Time of Day	Management Level LAeq(15 minutes)	How to Apply
Recommended Standard Hours 7am – 6pm (Monday to Friday) 8am – 1pm (Saturday) No works on Sundays or Public Holidays	Noise affected RBL + 10dB	The noise affected level represents the point above which there may be some community reaction to noise. ▪ Where the predicted or measured LAeq(15 minutes) is greater than the noise affected level, the proponent should apply all feasible and reasonable work practices to meet the noise affected level. ▪ The proponent should also inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels and duration, as well as contact details
	Highly Noise Affected 75 dB (A)	The highly noise affected level represents the point above which there may be strong community reaction to noise. ▪ Where noise is above this level, the relevant authority (consent, determining or regulatory) may require respite periods by restricting the hours that the very noisy activities can occur, taking into account: 1. Times identified by the community when they are less sensitive to noise (such as before and after school for works near schools, or mid-morning or mid-afternoon for works near residences; and 2. If the community is prepared to accept a longer period of construction in exchange for restrictions on construction times.
Outside Recommended Standard Hours	Noise affected RBL + 5dB	A strong justification would typically be required for works outside the recommended standard hours. ▪ The proponent should apply all feasible and reasonable work practices to meet the noise affected level. ▪ Where all feasible and reasonable practices have been applied and noise is more than 5 dB(A) above the noise affected level, the proponent should negotiate with the community.

Table 4-42 Adopted noise levels (sourced ENVSolution, 2023)

Time Period	Day 7am – 6pm Mon - Fri 8am – 1pm Saturday	Evening 6pm – 10pm Mon – Sun 1pm – 10pm Saturday	Night 10pm – 7am Mon – Sat 10pm – 8am Sunday Public Holidays
RBL (dBA)	**45**	40	35
Noise Management Level			
Residential	**55**	50	40
Place of Worship (when in use)	**55**	45	-
Schools/Education Institutions	**55**	-	-
Commercial	**70**	70	70
Industrial	**75**	75	75

4.14.2 Predicted Noise Levels

The predicted 'worst case' noise levels (refer Table 4-43), are representative of the machinery and activities associated with the construction scenarios; site establishment, clearing, bulk earthworks and asphalting.

Assuming no controls measures are in place, predicted 'worst case' noise levels derived from construction activities associated with bulk earthworks (Appendix B of the NVMP (ENV, 2023)) indicate that sensitive receivers with direct line of sight of the works up to a distance of 425m shall be exposed to noise levels that exceed the sites construction noise management level Table 4-43). Modelling also suggests that during bulk earth works , all sensitive receivers within 70m whom have line of sight with the operations shall be exposed to highly intrusive noise levels (>75dB).

Table 4-43 Predicted Worst Case Sound Pressure Level (SPL) at Sensitive Receivers - Bulk Earthworks

Impacted Receptor	Distance to Works	Predicted SPL dB(A)	NML dB(A)	Predicted Noise Impact
R1 (direct line of sight)	0 - 150 m	62 - 91	55	Moderately Intrusive to Highly Intrusive
R2 (behind solid barrier)	35 - 365m	42 - 65	55	Noticeable to Moderately Intrusive
R3 (direct line of sight)	23 m	79	55	Highly Intrusive
R4 (direct line of sight)	6 m	87	55	Highly Intrusive
R5 (direct line of sight)	45 m	73	75	Highly Intrusive
R6 (behind solid barrier)	150 m	57	55	Clearly Audible
R7 (direct line of sight)	0 m	91	55	Highly Intrusive

All sensitive receivers set back from the operations (i.e. R2 and R6) where there is no line of sight with the development are predicted to be exposed to clearly audible (<10dB above NML) to moderately intrusive (10 - 20dB above NML) noise levels.

Based on this assessment, the Principal Contractor shall be required to implement a number of mitigation measures to alleviate noise impacts to the surrounding community including the installation of temporary noise attenuation adjacent to the childcare facility (R4) and the flood relief temporary housing facility (R7) to mitigate construction noise levels emitted from the site (refer Figure 4-9). The temporary noise reduction fencing should be at minimum of 3m high and have a minimum Sound Reduction Index (R_W) of 15 – 20dB. EchoBarrier R8 or 17mm plywood hoarding may be used. The installation of fencing requires there to be no gaps between or beneath panels to adequately reduce noise from construction activity.

Furthermore, during Stage 1, if construction is within 20m of the nearest sensitive receiver and within 75m during Stage 4, the Principal Contractor must respite periods or limit construction activities. To adhere to this, the Principal Contractor should either reduce the machinery working actively within these zones or restrict the operation of loud equipment like earthmoving machines near sensitive areas to between 9:00am – 12:00pm and 1:30pm – 4:30pm (Monday to Friday), in accordance with DECCW guidelines. Such preventive steps are mandatory during Stages 1 & 4, especially when anticipated disruptive tasks such as setting up the site, land clearing, extensive earthworks, and road setting are in progress within the zones shown in Figure 4-9.

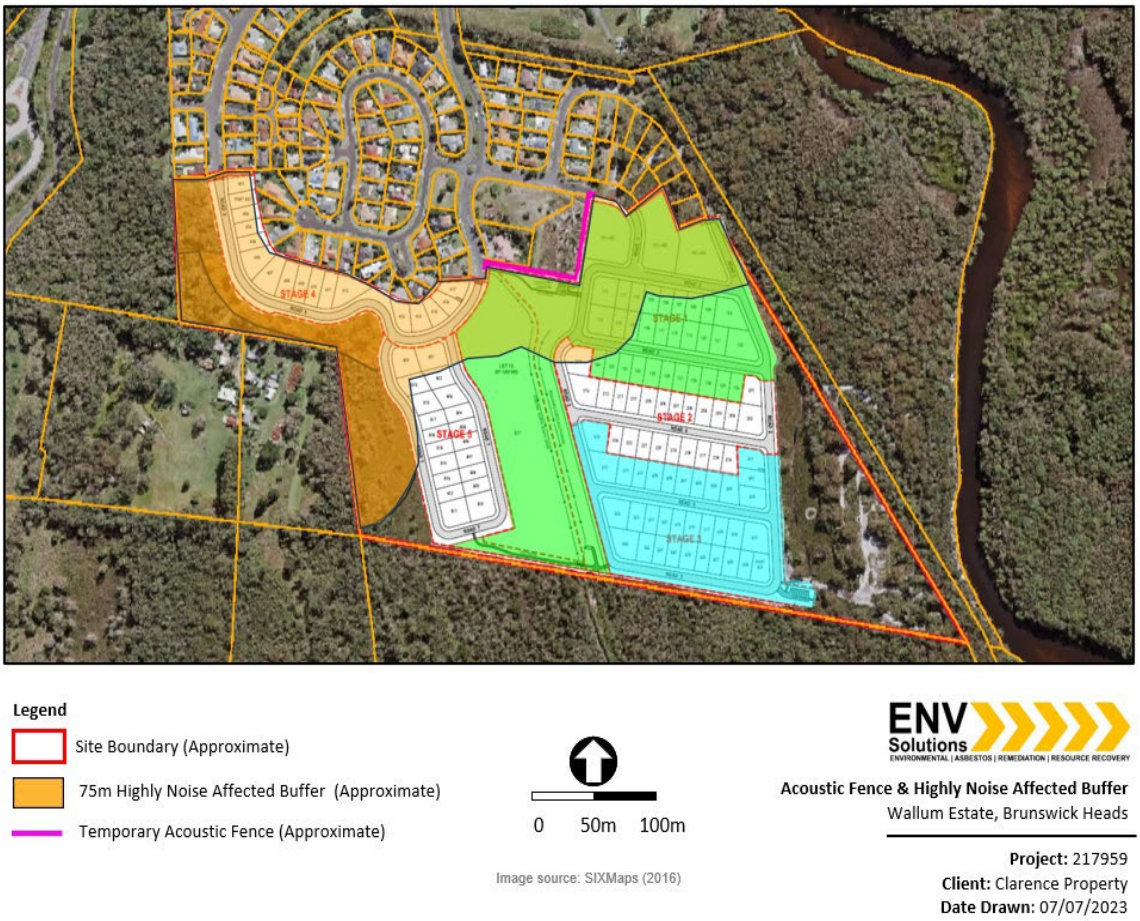


Figure 4-9 Noise Mitigation: Reduces Work Noise Buffer and Acoustic Fence (Sourced ENVSolutions, 2023).

The lead contractor will inform the wider community through a letterbox drop during the development phases. Another notice will be given at least seven days before work begins, following the standards in the Interim Construction Noise Guideline (2009). If noise levels are expected to surpass the "highly noise affected" limit of 75 dB(A) at sensitive receivers within 20m of the project, those specific areas will receive a dedicated letterbox notification. This specific notice will be sent out at least 5 business days before construction activities that are likely to exceed the noise objective (>75dB(A)) start.

Additional consultation between the Principal Contractor and the Lilly Pilly Pre-school (R4) will be required to discuss anticipated noisy works and the timings of respite periods to coincide with children's sleeping and quiet times schedule.

4.14.3 Construction Vibration Guidelines

Vibration effects from construction activities can be categorized into three categories:

1. Effects on building occupants (human comfort). Construction-induced vibrations can sometimes be felt by people in nearby buildings. Although these vibrations are typically intermittent, criteria for them, based on the Vibration Dose Value (VDV), are provided in the EPA's *Assessing Vibration: a technical guideline* (2006) and are detailed in Table 4-44. While it's not anticipated that the proposed construction will cause continuous or sudden vibration impacts, guidelines are provided in Table 4-45 and Table 4-44.

2. Effects on building contents. Humans can detect vibration levels much lower than those that might damage building contents. In most cases, the criteria centered on human comfort are the strictest.

Hence, there's usually no need to set distinct standards for potential vibration impacts on common building contents. However, exceptions exist, especially when buildings house vibration-sensitive devices like electron microscopes or medical imaging tools. There have been no reports of such equipment in the surveyed area.

3. Effects on the building's structural and cosmetic integrity. Intense construction vibrations can potentially result in cosmetic damage to parts of the affected structures. Industry-defined cosmetic damage vibration limits can be found in British Standard BS 7385 and German Standard DIN 4150.

Table 4-44 Vibration dose values for intermittent vibration (sourced ENVSolutions, 2023)

Building Type	Assessment Period	Vibration Dose Value[1] ($mm/s^{1.75}$)	
		Preferred	Maximum
Critical Areas	Day or night	100	200
Residential	Day	200	400
	Night	130	260
Offices, schools, educational institutions, and places of worship	Day or night	400	800
Workshops	Day or night	800	1600

Table 4-45 Preferred Weighted RMS Acceleration Values for Continuous and Impulsive Vibration (sourced ENVSolutions, 2023)

Type	Location	Assessment Period	Preferred values mm/s^2		Maximum values mm/s^2	
			z-axis	x & y axes	z-axis	x & y axes
Continuous Vibration	Critical areas	Day or night	5	3.6	10	7.2
	Residences	Day	10	7.1	20	14
		Night	7	5	14	10
	Offices, schools, educational institutions, and places of worship	Day or night	20	14	40	29
	Workshops	Day or night	40	29	80	58
Impulsive Vibration	Critical areas	Day or night	5	3.6	10	7.2
	Residences	Day	300	210	600	420
		Night	100	71	200	140
	Offices, schools, educational institutions and places of worship	Day or night	640	460	1280	920
	Workshops	Day or night	640	460	1280	920

Minimum working distances for typical vibration intensive construction equipment are provided in the CNVG and are shown in Table 4-46 below. These distances are based on standards from BS 7385, DIN 4150, and the NSW EPA Vibration Guideline. They highlight the least distance required to prevent cosmetic damage to structures and to ensure the comfort of inhabitants.

Table 4-46 Recommended Minimum Working Distances from Vibration Intensive Equipment (sourced ENVSolutions, 2023).

Plant Item	Rating/Description	Minimum Distance[1]	
		Cosmetic Damage	Human

		Residential (BS 7385)	Heritage Items (DIN 4150, Group 3)	Response (NSW EPA Guideline)
Vibratory Roller	<50kN (1–2 tonne)	5m	11m	15–20m
	<100kN (2–4 tonne)	6m	13m	20m
	<200kN (4–6 tonne)	12m	15m	40m
	<300kN (7–13 tonne)	15m	31m	100m
	>300kN (13–18 tonne)	20m	40m	100m
	>300kN (>18 tonne)	25m	50m	100m
Hydraulic Hammer	300kg (5–12 t excavator)	2m	5m	7m
	900kg (12–18t excavator)	7m	15m	23m
	1,600kg (18–34t excavator)	22m	44m	73m
Jackhammer	Handheld	1m (nominal)	3m	2m
Vibratory Pile Driver	Sheet Piles	7m	15m	20m

4.14.4 Noise and Vibration Monitoring

Campaign noise monitoring (1 week) shall be conducted at the commencement of each construction scenario to verify ambient noise levels against predicted noise levels and will be carried out based on complaints. A noise assessment lasting for a week will be conducted at affected residential areas to check adherence to the set Noise Management Levels (NMLs). If these levels are surpassed, the Principal Contractor is responsible implementing additional mitigation measures against noise disturbances.

For the project's duration, vibration monitoring will be in place whenever equipment that produces strong vibrations is operated within a 25m radius of sensitive locations. Vibration monitoring devices will have a live alert system to notify the workforce of potential harmful vibration levels. Should there be a detection of notable vibration, it may be necessary to place permanent vibration monitors as close as feasible to neighbouring structures to ensure the entire project remains compliant. Reports shall be provided to Council within 1 week of completing the monitoring event.

4.14.5 Noise and Vibration Reporting

A report on noise monitoring will be completed following the monitoring event detailing the observations, comparing the findings with the predicted noise levels, and provide additional noise management or subsequent monitoring is necessary post-control implementation. Reports shall be provided to Council within 1 week of completing the monitoring event.

Vibration monitoring reports will be prepared every month following, evaluating the vibration readings against the adopted criteria, and provide recommendations on additional mitigation measures or further surveillance. All documentation should be kept on the premises for potential review by authoritative entities when demanded. Reports shall be provided to Council within 1 week of completing the monitoring event.

4.15 Unexpected Finds Protocol (UFP)

ENV Solutions have prepared an Unexpected Finds Plan (UFP) (ENV, 2023) for the proposed development. The UFP has been prepared to provide Principal Contractor with a clear and concise methodology for managing unexpected finds during development works. Contamination Unexpected Finds (Contamination) include but are not limited to:

- Building materials, particularly painted timber (lead) and fibre cement sheeting (asbestos)
- Heavy Mineral Sands Residue
- ASS
- Medical Waste
- Drums and/or bottles with or without warning signs
- Patches or oily or otherwise discoloured soil

If unexpected finds, with respect to contamination, are encountered by the contractor during earthworks, the Unexpected Find Protocol shall be adopted, and details recorded using the Unexpected Find Recording Sheet provided in Appendix H. A flow diagram of the UF protocol is provided in Appendix I. If Contamination Unexpected Finds are encountered the following general approach should be adopted:

- Upon discovery of an UF, all works in the vicinity shall cease, the Site Supervisor notified of the find, and the affected area closed off (e.g., with barrier tape)
- The GPS location of the UF shall be recorded (with accuracy of < 1m)
- The Site Supervisor is to it to notify the Project Manager and Project Manager shall notify an appropriately qualified Environmental Consultant (any UF including suspected Asbestos Containing Material) (ACM)) or an Occupational Hygienist (for suspected ACM finds) to assess the site
- The Environmental Consultant will assess the area and assess the potential impact to human health and the environment of the UF with reference to National Environment Protection Council (NEPC, 1999) National Environment Protection Council (Assessment of Site Contamination) Measure (NEPC, 2013)
- The Environmental Consultant will provide advice to the Project Manager regarding recommendations for management of the UF detailed in a report which includes the extent of their assessment and methods of disposal\ remediation\ management
- The assessment results and any related documents (e.g., management plans) may be provided to Council (as required) prior to the removal or treatment the UF
- The agreed management/ remedial methods shall be implemented
- Details of the UF and any remedial actions employed in the site record system

If the UF includes suspected ACM finds, the following additional protocol will also apply:

- At the cessation of works and closure of the area, warning signs specific to asbestos hazards shall be placed at the site. Warning signs must comply with the AS 1319-1994 *Safety Signs for the Occupational Environment*
- An appropriately qualified Environment Consultant or Occupational Hygienist is to confirm the presence of asbestos and assess its extent
    - A report will be prepared which details the assessment results and required management methods
- The recommended management methods shall be implemented
- In dry/ windy conditions, all ACM shall be lightly wetted and covered with plastic sheeting until it is appropriately remediated or removed
- All work associated with asbestos in soil will be undertaken by an appropriately licensed contractor
- Monitoring for airborne asbestos fibres is to be carried out during soil excavation and remediation works involving ACM

- Disposal of ACM shall be at a landfill or waste transfer station licensed by the EPA to receive asbestos
    - Receipts of correct disposal of ACM (e.g., weighbridge dockets) must be provided to the Site Foreman and kept
- At the completion of the excavation works, a clearance inspection (including soil sampling and testing) is to be carried out by the Environmental Consultant or Occupational Hygienist which confirms that the area is safe to access and work in.

4.16 Cultural Heritage

According to the Cultural Heritage Assessment carried out by Everick Heritage Consultants Pty Ltd (2010), no items of Indigenous or European (non-Indigenous) heritage were identified on the subject site. If objects are encountered during works the unexpected find protocol shall be adopted, and details recorded using the Unexpected Find Recording Sheet provided in Appendix H

If any unexpected finds including objects or bones are uncovered during the activity, works must cease, site secured, and unexpected finds protocol implemented. In the case of suspected human remains only, notify NSW Police. In the case of Aboriginal objects, the contractor should notify the NSW Department of Planning Industry and Environment (DPIE), Tweed Byron Local Aboriginal Land Council and the Bundjalung of Byron Bay Aboriginal Corporation (Arakwal) and provide available details of the objects and their location. Works must immediately cease within the vicinity until such time as the necessary permits have been obtained from DPIE to continue the work. The developer must comply with any further request made by DPIE to cease work for the purposes of archaeological assessment and recording.

4.17 Waste Management

Waste from the construction works needs to be managed appropriately to comply with the *POEO Act* and the subordinate *Protection of the Environment Operations (Waste) Regulation 2014*, and the *Waste Avoidance and Resource Recovery Act 2001 (WARR Act).* The contractor shall prepare a waste management plan that will reduce the amount of waste being generated from works at the site and considers the following:

- Where appropriate the contractor shall reduce, reuse or recycle waste materials
- Where waste requires disposal, the contractor shall ensure that it is disposed of at an approved waste facility and receipts to be obtained and kept
- Waste is to be collected, sorted and stored appropriately on site until appropriate disposal can be made. e.g., skip bins for general waste are to be covered to ensure waste is not scattered by birds or wind
- Do not burn or bury any waste on site
- All vegetative waste can be chipped and reused on site, or otherwise taken to green waste collection centres
- Weed material cannot be chipped and re-used
- Waste materials that may be hazardous, e.g., fuels, chemicals or biohazard material, shall be contained and stored on site in accordance with appropriate guidelines and are kept separate from general waste stockpiles
- Where waste is to be transported off site, the receiving depot shall preferably be the closest available
- Putrescible waste generated during construction will be securely stored on site to limit access by scavenger animals and will be transported off site for disposal

A waste management hierarchy with waste management practices listed in the preferred order of adoption is listed below:

- Waste avoidance
- Waste re-use
- Waste recovery
- Energy recovery from waste
- Waste disposal

A Site Waste Minimisation and Management Plan (SWMMP) has been produced for Wallum- Stage 1 Civil Works and should be referred to in Appendix J.

4.18 Chemical Storage

The storage of dangerous goods is regulated by the NSW *Occupational Health and Safety Act 2000*. Should the contractor have any goods deemed to be classified as 'Dangerous Goods' under the Act (or any other guideline) stored at the site, appropriate precaution shall be taken. Material Safety Data Sheets (MSDS) are to be kept on hand and all personnel responsible for use and storage should read them.

All other fuels and chemicals shall be stored as per manufacturer recommendations and local guidelines. Spill kits and spill procedures are to be maintained and readily available on site, preferably co-located in the chemical storage area. When not in use, all chemicals shall be securely stored and locked in an appropriate location confirmed in consultation with the Project Manager.

All machinery fuel refilling will be undertaken in a specified location at least 30 meters from the upper bank of the drainage line and must not occur within any management zones. A spill kit will be on hand at all times during refilling.

4.19 Mosquito Management

AWC has been engaged by Clarence Property Pty Ltd to complete a Mosquito Risk and Management Plan (MRMP) in support of a proposed subdivision at Brunswick Heads within the Byron Shire Local Government Area (LGA). The MRMP was prepared for the development and will be implemented in accordance with guidelines from Byron Shire Council. The MRMP of this plan are to ensure that:

- The development doesn't increase the mosquito or midge problem or create additional mosquito breeding sites
- Mosquitos and midges on-site will not adversely affect the health and welfare of future residents and populations will be controlled to the satisfaction of BSC
- Mosquitos and midge management will be undertaken without adversely affecting other native flora or fauna

4.19.1 Mosquito Management

To ensure that the objectives of the MRMP are achieved, there are a number of management measures that can be implemented. To achieve the maximum effectiveness for any mosquito control program, it is essential that an integrated approach is taken to control risk to humans whilst maintaining ecological values.

Section 5 of the MEMP should be referred to for detailed management measures to reduce the risks associated with mosquitos at site. Management measures are listed below:

- **Building design**
    - Installation of insect screens
    - Roof guttering should be fitted with a leaf guard to reduce the accumulation of leaves in gutters that can act as mosquito breeding

- **Water sensitive Urban design-**To reduce the suitability for mosquito breeding water bodies such as drains should have surface movement, steep margins free of shelter. Ideally depths should be above 2m however is not practical in most instances.
    - The Central drain is to be reshaped to efficiently convey water downstream. There will be no ponds within this drain. In rain events the central drain will be fully flushed, interrupting any potential mosquito production
    - **Trunk drainage:** Due to the limited fall across site the drainage system has been designed at minimum grade. This means water will move slowly through the system but will not allow for standing water. Associated pits will also be selected to allow drainage from base, ensuring no standing water occurs
    - **Bio retention ponds** will be designed to only hold water for brief periods (less than 2 hours), not allowing sufficient time for mosquito breeding to occur. Vegetation is restricted to sedges, grasses and small shrubs. No trees will be planted in bio retention ponds, reducing shade and suitability for mosquito foraging habitat.
- **Vegetation Selection :** Vegetation planted within constructed habitat, will consist of grasses and small shrubs common to wallum heath and sedge land ecological communities. This low planting will reduce shade which is preferable for mosquito production
- **Constructed Wetlands:** Designed to only be hydrated by ground water expression and rainwater falling directly into basins (no stormwater) with regular wetting and drying periods
- **Broadscale Control;** Byron Shire Council has advised against broad scale mosquito control activities
- **Community Consultation:** Local residents should be informed of ways in which they can reduce mosquito numbers on their property, how to avoid getting bitten

4.19.2 Maintenance of Stormwater Devices

A properly designed system which is maintained in accordance with a site-specific Operation and Maintenance Manual will largely reduce this risk. Stormwater devices should be managed in accordance with the CEOMP (AWC, 2023) which is summarised in Section 4.7

4.20 Vehicle Movement

Due to the central drain, there is no connectivity for vehicle access between the eastern and western portions of the site. Vehicles must leave the site and utilise urban roads to move between eastern and western areas. Due to the urban environment (including an adjacent pre-school) vehicles must travel at no more than 30km/hr.

4.21 Monitoring Bore Protection

Several groundwater monitoring bores are installed at the site (refer Figure 4-8). To protect bores from accidental damage, each bore must be protected with star pickets and a stout wire sleeve. High visibility para-webbing must be wrapped around each sleeve and a sign stating ‘Caution, monitoring bore – do not disturb’ installed adjacent to each site. All personnel are to be made aware of bore locations and requirements as part of site induction.

4.22 Road Pavement Performance

The design of the road pavement is to meet the required design life, based on the subgrade strength, traffic loading and environmental factors determining the selection of appropriate materials for select subgrade, subbase, base and wearing surface. The Northern Rivers Local Government (2020) *Development Design Specification D2 Pavement Design and Austroad* (2023) Guide to Road Design should adhered to development of safe, economical and efficient road design. The contractor must be able to provide Council with the evidence that compliance of minimum standards set out for road design within The Northern Rivers Local

Government (2020) an Austroad (2023) have been met.

Following the practical completion of road pavement within each stage the road pavement for that specific stage can move to the On-Maintenance Stage. A finial performance evaluation by the Civil Engineer is required to ensure that the road pavement can serve traffic safely and comfortably over its lifetime. To ensure that the road pavement fulfills its requirement the Civil Engineer must complete a visual evaluation and functional evaluation 6 months following the On-maintenance period. The visual evaluation should note longitudinal and transverse cracking, patching, potholes and rutting or any other defects. The functional evaluation of the pavement should be based on ride quality (smoothness/roughness), pavement distress and skid resistance. Reporting on the performance of the road pavement should be carried out and reported to Council.

5 Adaptive Management

An adaptive management approach towards environmental management is recommended to ensure best environmental practice. Adaptive management involves continually monitoring the processes provided in this plan and evaluating their effectiveness, improving the plan where possible based on these evaluations, observations and feedback from staff. This plan, or sections of it, may be reviewed and updated as required prior to or during the construction process in response to specific site conditions, hazards or issues identified onsite, monitoring outcomes, construction methods or challenges that arise.

5.1 Surface and Groundwater Action Response Plan

Should the results of groundwater and surface water monitoring during the construction and occupation phase of the development be outside the relevant action criteria, the Groundwater and Surface Water Action Response Plan will be enacted (refer Table 5-1).

Table 5-1 Groundwater and Surface Water Action Response Plan

Performance Criteria	Action	Response
Groundwater quality		
No decrease in groundwater quality due to proposed development (construction and operational stages)	1. Check and validate data a. Retake sample to confirm concentration/value 2. Notify management (Site Superintendent, Environmental Manager) 3. Undertaken Phase 1 investigation to confirm trigger exceedance is development (construction/operation) related a. If necessary engage suitably qualified person b. Review/consider recent conditions (weather, land use activities, construction activities) c. Review/consider other relevant monitoring data d. If investigation confirms trigger exceedance is not related to construction activities, record data and cease investigation 4. If trigger level exceedance is development related confirm if the activities have caused or have the potential to cause substantial environmental harm a. Notify Environmental Manager, Site Superintendent and relevant agencies as soon as practicable (whether or not it is development related) 5. Notify Environmental Manager and other relevant agencies if performance measures are exceeded as soon as practicable 6. Complete an Investigation Report and provide to all stakeholders and other relevant agencies with 21 days of identifying the incident 7. Prepare rectification proposal, engage stakeholders and remediate	Where it has been determined that development related impacts have caused a trigger exceedance, implementation of contingency and remedial measures is required. These may include, but not limited to, the following: • Review monitoring program and Groundwater Management Plan and revise if necessary • Investigate reasonable and feasible remedial measures • Review water management infrastructure (e.g., WSUD) and repair/renew if necessary

Performance Criteria	Action	Response
Groundwater Level		
No significant decrease or increase in groundwater levels due to the proposed development	1. Check and validate data 2. Notify management (Site Superintendent, Environmental Manager) 3. Undertaken Phase 1 investigation to confirm trigger exceedance is development (construction/operation) related a. If necessary, engage suitably qualified person b. Review/consider recent conditions (weather, land use activities, construction activities) c. Review/consider other relevant monitoring data d. If investigation confirms trigger exceedance is not related to construction activities, record data and cease investigation 4. If trigger level exceedance is development related confirm if the activities have caused or have the potential to cause substantial environmental harm a. Notify Environmental Manager, Site Superintendent and relevant agencies immediately as soon as practicable (whether or not it is development related) 5. Notify Environmental Manager and other relevant agencies if performance measures are exceeded as soon as practicable 6. Complete an Investigation Report and provide to all stakeholders and other relevant agencies with 21 days of identifying the incident 7. Prepare rectification proposal, engage stakeholders and remediate	Where it has been determined that development related impacts have caused a trigger exceedance, implementation of contingency and remedial measures is required. These may include, but not limited to, the following: • Review monitoring program and Groundwater Management Plan and revise if necessary • Investigate reasonable and feasible remedial measures • Review water management infrastructure (e.g. WSUD) and repair/renew if necessary

Performance Criteria	Action	Response
Surface Water		
No significant increase in pollutant concentrations in surface water due to the proposed development	1. Check and validate data a. Retake sample and analysis to confirm exceedance 2. Notify management (Site Superintendent, Environmental Manager) 3. Undertaken Phase 1 investigation to confirm trigger exceedance is development (construction/operation) related a. If necessary engage suitably qualified person b. Review/consider recent conditions (weather, land use activities, construction activities) c. Review/consider other relevant monitoring data d. If investigation confirms trigger exceedance is not related to construction activities, record data and cease investigation 4. If trigger level exceedance is development related confirm if the activities have caused or have the potential to cause substantial environmental harm a. Notify Environmental Manager, Site Superintendent and relevant agencies immediately as soon as practicable (whether or not it is development related) 5. Notify Environmental Manager and other relevant agencies if performance measures are exceeded as soon as practicable 6. Complete an Investigation Report and provide to all stakeholders and other relevant agencies with 21 days of identifying the incident 7. Prepare rectification proposal, engage stakeholders and remediate	Where it has been determined that development related impacts have caused a trigger exceedance, implementation of contingency and remedial measures is required. These may include, but not limited to, the following: • Review monitoring program and Groundwater Management Plan and revise if necessary • Investigate reasonable and feasible remedial measures • Review water management infrastructure (e.g. WSUD) and repair/renew if necessary

5.2 ASS Amelioration (If Detected)

In the unlikely event that ASS or PASS is detected during the excavations during the construction phases, as determined through the action criteria the soil will need to be suitably ameliorated prior to placement on site.

Amelioration of ASS (if detected) is to be managed by the Environmental Manager and Site Superintendent. The Environmental Manager is to have appropriate experience and training in ASS management in NSW and have all relevant insurance under the lead civil contractor's insurance policies.

The ASS amelioration will be done through incorporation of a neutralising agent, typically agricultural lime (calcium carbonate – $CaCO_3$). Laboratory analysis results determining the strength of ASS will provide a liming rate, if not a liming rate is to be calculated by the Environmental Manager.

Mixing of nominated liming rates into the affected soils will be done within the nominated ASS treatment pads. Methods to incorporate the lime include mixing with excavators, rotary hoeing and ripping. Incorporation is to be undertaken as soon as possible after excavation of the ASS material.

An amelioration record and checklist is provided in Appendix C of the ASSMP. This is to be filled out by the Environmental Manager, with a copy kept on file at the site office. A copy is to be provided to BSC and other relevant stakeholders on completion of the ASS amelioration.

5.2.1 Treatment Pads

Two ASS treatment pad locations have been nominated (refer *Figure 4-6*); one is within the Civil Stage 3 area and will be used for the Early Stages 1 and 2 and Civil Stages 1, 2 and 3. The other is in the Civil Stage 5 area and will be used in Civil Stages 4 and 5. The proposed ASS treatment pads are alongside the nominated stockpile areas. Two ASS treatment pads have been nominated based on the progression of the construction stages, and the division of the site by the central drainage network.

Each ASS treatment pad will be a nominal 30 m x 30 m and be constructed generally in accordance with Figure 5-1. The base of the treatment pad should be a compacted clay layer > 300mm thick to produce an impermeable foundation. The base of the pad should slope at 2-5% to allow leachate to drain to the leachate collection points. The treatment pad must have a bund wall around their perimeter that is 400 mm high and 500 mm wide. This bund should be constructed from fine, non-dispersive clay, which will be tightly compacted to ensure minimal permeability. Additionally, there should be a collection point for leachate designed as a sump. An agricultural lime storage facility will be constructed within or adjacent to the ASS treatment pads. All relevant precautions for human and environmental health will be followed – refer manufacturers specifications.

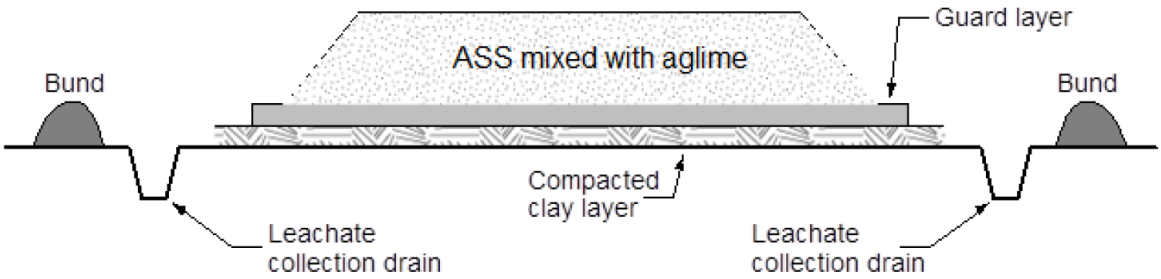


Figure 5-1 Schematic cross section of ASS treatment pad including compacted clay layer, guard layer, leachate collection system and containment bunding (Source: Dear et al 2014)

5.2.2 Mixing of Neutralising Agent

Mixing of the nominated liming rate into the excavated soils will be done within the nominated treatment pads. The base of the treatment pad should be covered evenly with aglime at a rate determined using the below equation:

Base layer kg/m^2 = (0.2 X thickness of layer to be treated (m) x liming rate (kg/tonne)

The sediment material excavated should be placed on the treatment pad in a layer <300 mm in thickness. The material should be allowed to partially dry prior to mixing with the neutralising agent to ensure even mixing and effective amelioration. Common methods to incorporate liming agent include mixing with excavators, disc plough, rotary hoeing and ripping.

5.2.3 Leachate Treatment

If discharge of treated acid leachate is required the water is to be tested prior to minimise impact to downstream surface water environments. Water will be discharged to the surface of the site and allowed to infiltrate, alternatively a discharge location in the central drain will be made.

All discharged water will be tested to ensure a pH value of between 4.0-6.0 in accordance with the existing surface water quality range and action criteria (refer SWGWMP, AWC 2023). A dewatering management plan (ENV, 2023) has been prepared for the development which will provide further detail on discharge criteria.

5.2.4 Verification Testing

Once each batch of ASS has been thoroughly mixed with the prescribed rate of neutralising agent, soil sample collection and analysis are required to verify if adequate neutralisation has been achieved. The batch will need to show appropriate neutralisation prior to re-use or disposal of the soil. Successful amelioration of material can only be verified with a full acid base account (chromium suite including retained acidity) by a NATA accredited laboratory; field pH testing alone is not sufficient. Table 5-2 shows the minimum soil sampling and analysis density of verification testing of stockpiles. Samples need to be collected in accordance with the guidelines by Sullivan *et al*., 2018, and sent to a laboratory for analysis of Net Acidity values. Single, non-random grab samples are not recommended for this type of testing, because they are unlikely to be representative of the treated soil. Instead, composite samples should be taken for analysis.

Table 5-2 Minimum ASS sampling densities for existing stockpiles and verification testing (Source: Sullivan et al, 2018)

Volume	Number of samples
<250 m^3	2
251-500 m^3	3
1000 m^3	4
>1000 m^3	4 plus 1 per additional 500 m^3

Sampling methodology

Where treatment is carried out as a batch process on a treatment pad:

1. The treatment pad should be divided up into areas containing a volume of soil equivalent to the nominated verification testing rate (see Table 5-2). For example, at treatment pad with soil volume of 500 m^3 and a test rate of 3 per 500 m^3, divide the pad into three sections.
2. Within each section, use a randomised procedure to nominate at least six random sampling locations
3. Gather subsamples of treated soil from each of the pre-defined locations on the pad. Subsamples should extend through the total depth of the treated material but avoid sampling the underlying guard layer.
4. Mix the subsamples thoroughly together in a container and ensure a homogenised mixture and representative sample is obtained
5. Gather a 400 g sample from the composited material, and submit it for analysis to a NATA accredited laboratory
6. Leave treated material on pad until result are obtained

5.2.5 Performance Criteria

Verification sampling intends to establish whether sufficient neutralising material has been added to the batch of soil on the treatment pad and whether it has been sufficiently mixed. Verification testing is deemed to have been successful for material when the following is achieved:

- Net Acidity will be less than Zero
- The acid neutralising capacity (ACN) of the treated soil must exceed the potential sulfuric acidity of the soil

The adopted performance criteria equates to there being no positive calculated net acidity in the soil following treatment. Soils that have been treated and has not met these criteria must be re-treated and re-tested until the above performance criteria are met.

5.2.6 Batch Tracking

The Site Works Supervisor is to keep detailed records of each batch of ASS that gets ameliorated. An amelioration record and checklist are provided in Appendix K. This is to be filled out by the Works Supervisor, with a copy kept on file at the site office. A copy is to be provided to BSC and other relevant stakeholders on completion of the ASS amelioration.

Records are to include, for each batch, the following:

- Nominated batch code
- Detailed description of original location, including GPS coordinates, map showing spatial extents of excavation, depth of excavation, date of excavation
- Results of assessment including field test, laboratory analysis and liming rates
    - Details of assessor – date, name, qualifications, laboratory chain of custody
- Lime incorporation methods, dates, locations
- Any acid leachate discharge and testing results – date, volume and pH, discharge location
- Validation testing results
- Details of placement, usage type, location GPS coordinates, depths, map showing spatial extents, approvals and permission if taken off site
- BSC has advised that they intend to keep the treated material onsite with the material spread in 1cm layers adjacent to the drain.
- Details of neutralising agent mixing (volumes, how etc.)
- Verification testing details (Number of samples, sample codes, date, sampler name, chain of custody, laboratory and tests used)

- Verification results (compliance or not, results values)
- Location and details of any movements and final placement (locations - GPS, dimensions)

5.3 Register of Transported Materials

The Principle Contractor is responsible for a register of materials that are to be taken off-site for disposal, treatment or re-use. Prior to waste being transported off-site for re-use or disposal the Contractor must ensure:

- That the relevant resource recovery exemption/order is still current
- The waste must be appropriately classified and if required, tested to verify it meets any specific conditions for its re-use
- The proposed receiver (consumer) of the material must be made aware of the conditions for re-use, including the relevant EPA resource recovery order and exemption (if applicable)

A transport certificate (TC) is the document used to record the transport of a load of trackable waste from the consignor to the receiving facility. The waste movement covers pick-up, delivery to a receiving facility and its acceptance and processing, or rejection, of the waste, as well as any discrepancies in the operation.

It is a requirement that a printed TC accompany the transport of all trackable waste. A TC must be specific to the individual waste load and must accompany the waste during transport. The consignor, transporter and receiving facility must certify relevant parts of the paper TC are correct and sign it. The receiving facility should also retain the signed TC for 4 years from receipt of the waste. The NSW EPA online waste tracking system can be access here: https://www.epa.nsw.gov.au/your-environment/waste/tracking-transporting-hazardous-waste/online-waste-tracking. The online waste tracking application form has been included as Appendix O.

6 Monitoring and Reporting

Immediately prior to the commencement of construction and weekly thereafter, the environmental officer will undertake monitoring of the site to ensure the environmental management controls are in place and functioning effectively. The Internal Environmental Control Audit Sheet is provided in Appendix L.

If controls are not in place or are not effective, appropriate actions will be identified and recorded and the action assigned to someone who will be responsible for insuring it is complete.

6.1 Completion Report

The application for the Subdivision Certificate for each Stage must be accompanied by a Completion Report Environmental Reporting and Compliance. The Completion Report must demonstrate commitments and environmental management has been fully implemented in accordance with approved CEMP, VMP, WFMP, SMP, ASSMP, SWGMP and UFP. The report shall be peer reviewed by an independent environmental expert.

7 Audit and Review

An independent audit of the CEMP is required prior to the commencement of each stage of works. Further audits of the CEMP's implementation may be undertaken at Councils discretion to determine whether the CEMP is being properly implemented and maintained.

If the outcome of the audit indicates that the CEMP is not being properly implemented, corrective actions or a review of the plan may be required.

7.1 Corrective Actions

When an environmental incident, emergency or hazard or a non-compliance with environmental management controls is identified, the person who encounters the issue shall notify the Environmental Officer and both shall record details of the incident/ issue in the *Site WHS Corrective Action Form* (Appendix M).The Environmental Officer will ensure necessary actions to correct the issue and prevent future occurrences are undertaken.

8 References

Australian Wetlands Consulting (2023). *Wallum Estate, Vegetation Management Plan, Revision K*

Australian Wetlands Consulting (2023). *Wallum Estate, Wallum Froglet Management Plan, Revision G.*

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Australian Wetlands Consulting (2023). *Wallum Estate, Surface and Groundwater Management Plan, Revision E*

Birdlife Australian (*undated) Nest Boxes – Technical Information

https://direct.birdlife.org.au/images/uploads/education_sheets/INFO-Nestbox-technical.pdf

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Wallum Estate Subdivision (2023). Dewatering Management Plan, Revision 1.3.

ENV Solutions (2023) *15 Torakina Road, Brunswick Heads, NSW 2483 (Lot 13 DP1251383) Noise and Vibration Management Pla, Revision 1.3*

ENV Solutions (2023) *Wallum Estate, 15 Torakina Road, Brunswick Heads, NSW 2483, Unexpected Finds Plan (ENVSolutions, 2023) Revision 1.0*

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Franks, A and Franks, S (2006). Nest Boxes for Wildlife: A Practical Guide. Blooming Books, M

http://www.toomuclandcare.com.au/wp-content/uploads/2018/03/Nestboxes-For-Wildlife-A-Practical-Guide-by-Alan-and-Stacey-Franks.pdf

Water By Design . (2010, April). *Construction and Establishment Guidelines: Swales, Bioretention Systems and Wetlands v1.1.* Retrieved from Water By Design.

Appendix A

Site Induction Form

Environmental Induction Form

Project Name: ……		Project No.: ……
Presenter: ……	Start time: …… : ……	Finish time: …… : ……

Discussed with staff, contractors or sub-contractors the following during site Induction ***(tick boxes for items discussed)***

	Topic	Control Measure discussed
☐	Hygiene protocols	
☐	Vegetation Management	
☐	Fauna Management	
☐	Acid Sulfate Soil	
☐	Erosion and Sediment Management	
☐	Cultural Heritage	
☐	Dust and Air	
☐	Noise	
☐	Waste management	
☐	Chemical Storage	
☐	Unexpected Finds (Contaminated Material)	
☐	Vehicle Movement	
☐	Monitoring Bore Protection	
☐	Monitoring and Review	

Appendix B

Arrive Clean, Leave Clean Guidelines

Australian Government

Department of the Environment

Arrive Clean, Leave Clean

Guidelines to help prevent the spread of invasive plant diseases and weeds threatening our native plants, animals and ecosystems

The Department acknowledges the traditional owners of country throughout Australia and their continuing connection to land, sea and community. We pay our respects to them and their cultures and to their elders both past and present.

Images
(front cover) John Baker and the Department of the Environment
(back cover) Nick Rains

Arrive Clean, Leave Clean

Help prevent the spread of invasive plant diseases and weeds threatening our native plants, animals and ecosystems

When working in the bush, it's important to remember:

- Any activity in the bush has the potential to spread invasive species, including environmental restoration activities such as weeding and revegetation.
- Revegetation carries a particularly high risk as it involves the introduction of plants and soil. This risk increases through the use of dirty tools and equipment or plants and materials that are not certified to be free of pathogens and weeds.
- Clothing, hats, footwear, tools, equipment, machinery and vehicles can transport invasive species like *Phytophthora cinnamomi*, myrtle rust (*Puccinia psidii*), insects and weeds into our bushland.
- Even your skin and hair, as well as glasses, phones, watches, wallets and other pocket items can carry myrtle rust spores.
- Once these pathogens and weeds invade our bushland, eradication is often impossible. Follow these guidelines to help prevent their spread.

Photos: (left) Wildflowers on Mondurup Peak, Stirling Range before Phytophthora dieback (Robert Olver), (right) Mondurup Peak, Stirling Range after Phytophthora dieback (Department of Parks and Wildlife WA)

Phytophthora cinnamomi

What is *Phytophthora cinnamomi*?

Phytophthora cinnamomi is a soil-borne plant pathogen that attacks the roots of susceptible plants—destroying the root system and reducing the ability of the plant to absorb water and nutrients. This causes symptoms referred to as 'dieback' which can lead to plant death.

Under favourable conditions *Phytophthora* spp. can spread easily and quickly, destroying plants and plant communities. These guidelines to help minimise the risk of spreading *Phytophthora cinnamomi* also apply to other species of *Phytophthora* present in Australia, as the management of those species is similar.

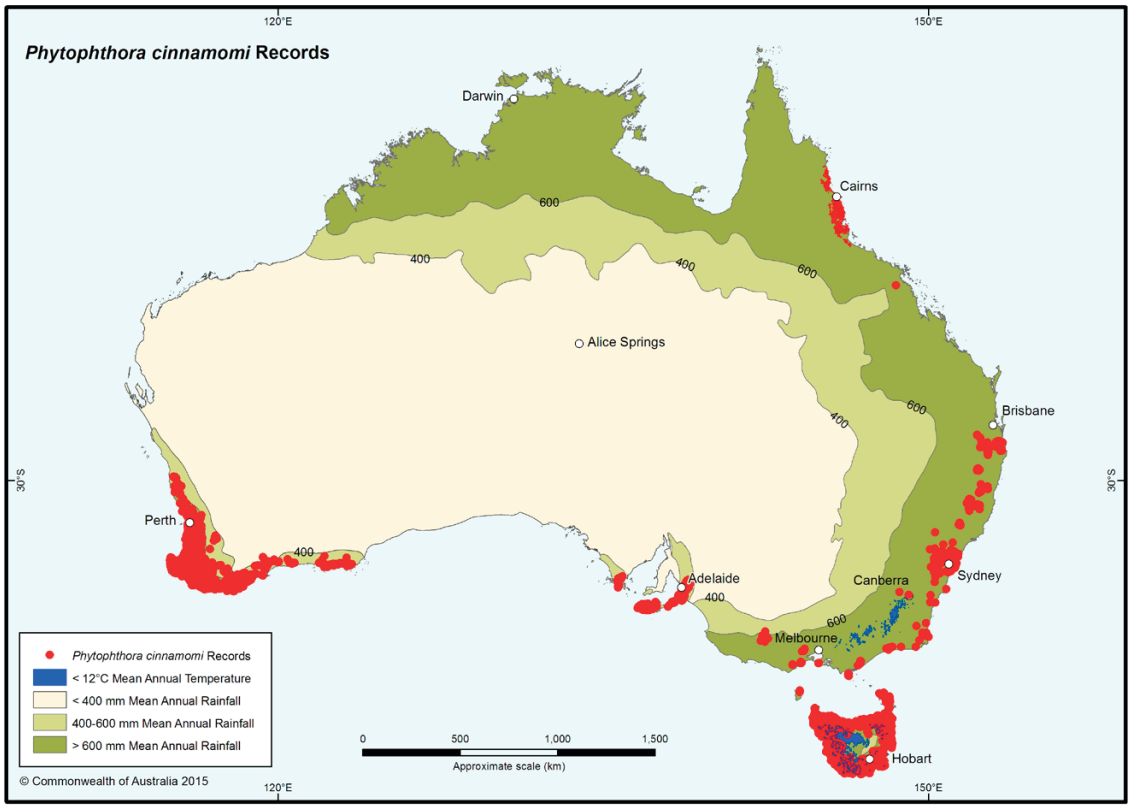
Photo: Impact of *Phytophthora cinnamomi* at Dwellingup, WA (Department of Parks and Wildlife WA)

What does *Phytophthora cinnamomi* threaten?

Thousands of Australian native plant species are susceptible to *Phytophthora cinnamomi*, and several of those species may be at risk of extinction due to its impacts. The dramatic impact of *Phytophthora* spp. infestations on plant communities may also lead to major declines in some insect, bird and animal species due to the loss of shelter, nesting sites and food sources.

Where is *Phytophthora cinnamomi* found?

Phytophthora cinnamomi thrives in warm, moist conditions with temperatures between 15°C and 30°C, and with rainfall greater than 400 millimetres a year. Its impact is greatest in Western Australia, Victoria, Tasmania and South Australia. The Northern Territory remains the only jurisdiction unaffected, as its environmental conditions are generally unfavourable to the pathogen.



Map: *P. cinnamomi* isolations, records of impact and broad climatic envelope of *P. cinnamomi* susceptibility in Australia.

This map was published in the *Threat abatement plan for disease in natural ecosystems caused by Phytophthora cinnamomi* in 2014. It does not represent the precise distribution of the pathogen in Australia and is for general information only.

How does *Phytophthora cinnamomi* spread?

Phytophthora cinnamomi spreads through soil, water and organic matter. It can remain dormant for long periods during dry weather and is impossible in most situations to eradicate from infested areas, which means limiting further spread is critical. Any activity that moves soil, water or plant material can spread the disease. This includes soil on tools, footwear and vehicles.

To help to prevent the spread of this plant disease:

- arrive clean, leave clean: ensure all clothing, hats, footwear, tools, equipment, machinery and vehicles are free of mud, soil and organic matter before entering and exiting bushland
- ensure any soil, plants or other materials entering the site are certified free of weeds and pathogens. You can do this by purchasing from Nursery Industry Accreditation Scheme Australia (NIASA) accredited businesses, and by ensuring that materials conform to Australian Standards—for example, *AS3743–2003 Potting mixes* or *AS4454–2012 Composts, soil conditioners and mulches*.

Myrtle rust

What is myrtle rust?

Myrtle rust is a disease caused by the fungus *Puccinia psidii*, initially identified as *Uredo rangelii*. It affects trees and shrubs in the Myrtaceae plant family—attacking young, soft, actively-growing leaves, shoot tips and young stems, as well as fruits and flower parts.

The first signs of rust infection are tiny raised spots or pustules on infected leaves. After a few days, the pustules erupt into distinctive bright yellow spore masses. Left untreated, the disease can cause deformed leaves, heavy defoliation of branches, dieback, stunted growth and plant death.

Photo: Myrtle rust pustules on scrub turpentine (*Rhodamnia rubescens*) fruit (R.O. Makinson)

What does myrtle rust threaten?

Plants susceptible to myrtle rust are those in the Myrtaceae family, which includes bottle brush (*Callistemon* spp.), tea tree (*Melaleuca* spp. and *Leptospermum* spp.), lilly pillies (*Syzygium* spp.) and eucalypts (*Eucalyptus* spp., *Angophora* spp. and *Corymbia* spp.). The Myrtaceae family in Australia is ecologically important, accounting for about 10% of Australia's native flora, with many Australian plant communities dominated by myrtaceous species.

Knowledge of the impacts of myrtle rust on Australian biodiversity is still limited. Myrtle rust infection may cause significant mortality among younger plants and therefore reduce the number of plants capable of maturing and reproducing. This may contribute to the decline of species, including threatened species, leading to potential impacts on the structure and function of ecosystems dependent on Myrtaceae. At the time of writing, nearly 350 native species are known to be susceptible to myrtle rust infection, some severely. The host list (see **References and resources** below) is expected to grow. However, all Myrtaceae are potentially susceptible and potential hosts for the disease.

Photo: Myrtle rust pustules on scrub turpentine (*Rhodamnia rubescens*) leaves (R.O. Makinson)

Where is myrtle rust found?

Myrtle rust was first detected in Australia in 2010 on the New South Wales central coast. It is now established along the east coast of Australia from southern New South Wales to far north Queensland, mostly east of the Great Escarpment. It is also present in Victoria, mainly at production nurseries and wholesale outlets in and around metropolitan Melbourne. The first detection of myrtle rust in Tasmania was in February 2015 at a property near Burnie on the north-west coast. At the time of writing, myrtle rust has not been detected in the Australian Capital Territory, the Northern Territory, South Australia, Western Australia or on Lord Howe Island or Christmas Island, but moister regions and vegetation types in all these jurisdictions are at risk of myrtle rust establishment. Domestic import restrictions apply for non-infested jurisdictions.

How does myrtle rust spread?

Myrtle rust spores can spread easily via contaminated clothing, hats, footwear, equipment or vehicles. It can also be spread by infected plant material, insects and other animals, or the wind. Even your skin and hair, as well as watches, wallets and other pocket items can carry myrtle rust spores. It is impossible to eradicate myrtle rust from infested bushland, so limiting further spread is critical.

To help to prevent the spread of myrtle rust:

- arrive clean, leave clean:
  - Wash all clothing, hats and gloves between site visits—using warm or hot machine wash with detergent.
  - Ensure all clothing, hats, footwear, tools, equipment, machinery and vehicles are free of mud, soil and organic matter before entering and exiting bushland.
  - Use a solution of 70% ethanol or methylated spirits in 30% water to disinfect items that may be contaminated (including hats, footwear, tools, equipment, machinery, vehicles, walking sticks, tent pegs, phones, glasses, watches, wallets and other personal items).
- ensure any soil, plants or other materials entering the site are certified free of weeds and pathogens. You can do this by purchasing from Nursery Industry Accreditation Scheme Australia (NIASA) accredited businesses, and by ensuring that materials conform to Australian Standards—for example, *AS3743–2003 Potting mixes* or *AS4454–2012 Composts, soil conditioners and mulches*.
- monitor plants carefully as nurseries and plant maintenance facilities may provide ideal conditions for myrtle rust (see Australian Nursery Industry myrtle rust management plan 2012 in **References and resources** below).

Photo: Myrtle rust spores on clothing after chance contact with an infected shrub (R.O. Makinson)

Weeds

What is a weed?

A weed is any plant that has a negative impact on our economy, environment, health and surroundings. Weeds are generally species which are not native to Australia. However, some native species growing outside of their native range can also become invasive. Many weeds are species which have escaped cultivation and become naturalised—that is, they have begun reproducing without human assistance.

What do weeds threaten?

Many weed species are able to invade natural areas and cause disturbance to bushland ecosystems. They can alter plant and animal community composition, cause changes to nutrient cycles, change natural fire regimes, outcompete native species for resources, impact threatened species and threaten biodiversity.

Where are weeds found?

The diversity of weed species recorded in Australia means that most terrestrial and aquatic ecosystems are vulnerable to weed invasion. Weeds have characteristics that help them grow well in many environments—from our towns and cities through to our coasts, deserts and alpine areas.

How do weeds spread?

Weeds typically spread easily by producing large numbers of seeds or reproducing vegetatively. They are often excellent at surviving and reproducing in disturbed environments and are commonly the first species to colonise and dominate in these conditions. Seeds and other plant material can spread into natural and disturbed environments via wind, animals, waterways and people (including contaminated clothing, hats, footwear, tools, equipment, machinery and vehicles).

To help to prevent the spread of weeds:

- arrive clean, leave clean: ensure all clothing, hats, footwear, tools, equipment, machinery and vehicles are free of weed seeds, mud, soil and organic matter before entering and exiting bushland.
- ensure any soil, plants or other materials entering the site are certified free of weeds and pathogens. You can do this by purchasing from Nursery Industry Accreditation Scheme Australia (NIASA) accredited businesses, and by ensuring that materials conform to Australian Standards—for example, *AS3743–2003 Potting mixes* or *AS4454–2012 Composts, soil conditioners and mulches*.
- if revegetating, select indigenous plants that occur naturally in your local area. Undertake weed control work well in advance to minimise the weed seed bank before you start planting. At the very least, slash the flower heads of weed species before they go to seed.

Before beginning a project

Undertake a risk assessment:

- Identify any planned activities with the potential to spread pathogens and weeds. This includes movement of people, equipment, vehicles and materials to/from/through infected or potentially infected areas.
- Determine the project site's pathogen and weed risks through liaison with land managers (for example government agencies, traditional owners, Indigenous Protected Area managers etc.).
- Consult sources of advice and expertise for contingent risks (for example state/territory departments of primary industry, pathology/weed identification services at botanic gardens).

Develop a hygiene management plan:

- Use your risk assessment to determine which hygiene procedures are necessary to prevent the spread of pathogens and weeds, and how and where to apply them.
- Ensure all materials taken onto the site—such as seedlings, mulch, soil, gravel, rock and sand—are certified free of weeds and pathogens. You can do this by purchasing from Nursery Industry Accreditation Scheme Australia (NIASA) accredited businesses, and ensuring materials conform to Australian Standards—for example, *AS3743–2003 Potting mixes* or *AS4454–2012 Composts, soil conditioners and mulches*.
- Create a checklist of hygiene procedures for project managers and participants to use.

Consider the following during project planning:

- Limit the number of sites you visit to one per day. If this is not possible, visit clean sites before infested sites.
- Provide training or briefing to all participants on the risks of spreading pathogens and weeds and risk mitigation strategies. If available, provide maps to participants with the location of infested and clean areas and wash-down points.
- Ensure that rigorous inspections and quality checks are built into the management of the entire supply chain for materials and plant material when carrying out revegetation or translocation activities where pathogens are a potential concern (see Australian Nursery Industry myrtle rust management plan 2012 in **References and resources** below). This is particularly important when working in areas where threatened species and threatened ecological communities are found.
- Where there is the risk of Phytophthora dieback (a plant disease caused by the pathogen *Phytophthora cinnamomi*), schedule activities for the dry season as it spreads more easily in wet and muddy conditions. If necessary, postpone activities and reschedule for a day when the soil is dry and doesn't stick to footwear, equipment and tools.
- If working in a weedy area, try to schedule activities for when the weed species are not in seed.
- Avoid taking vehicles into bushland. If a vehicle is necessary, ensure it is clean and dry on entry and exit, and restrict movement to hard, dry surfaces, formed roads and designated parking areas—avoid driving through puddles and mud. Where myrtle rust is a risk, avoid parking near myrtaceous plants—for example bottle brushes, tea trees, lilly pillies and eucalypts—and thoroughly clean vehicles inside and out between site visits.
- Avoid polystyrene boxes and tools with wooden or cracked handles. Use equipment that can be cleaned easily and thoroughly.
- Minimise the number of personal items you carry. Where myrtle rust is a risk, clean all items—such as GPS devices, glasses, phones, watches, wallets and other items kept in your pockets—with alcohol wipes before entering and leaving sites.

One site per day

Before entering or leaving a site

- Be aware of what plants look like when infected with myrtle rust and Phytophthora dieback (see images above).
- Remove all weed seeds, mud, soil and organic matter from clothing, footwear, tools, equipment, machinery, vehicles, boxes, backpacks, walking sticks, tent pegs and anything else that touches plants or the ground. Stay as clean as possible while in the bush.
- If you are entering clean bushland or have come from an area that is infested with *Phytophthora* spp. or myrtle rust, ensure everything with you is cleaned and disinfected with a solution of 70% ethanol or methylated spirits in 30% water. This includes footwear, tools, equipment, machinery, vehicles, backpacks, walking sticks, tent pegs and personal items.

Disinfecting clothing, footwear, equipment and other personal items

i. Carry a hard brush and a spray bottle of disinfectant—made up of a solution of 70% ethanol or methylated spirits in 30% water. If you are able to carry more, assemble a simple hygiene kit—see Appendix A.

ii. Set up a wash-down area for participants to wash and dry their face and hands and clean their footwear before entering and exiting the site.

iii. To clean footwear, first use a hard brush or stick to remove as much mud, soil and organic matter as possible before disinfecting with a solution of 70% ethanol or methylated spirits in 30% water—applied through a spray bottle or a footbath.

iv. Seal all personal rubbish in a bag and spray the outside of the bag with a solution of 70% ethanol or methylated spirits in 30% water before responsible disposal offsite.

v. Collect all removed mud, soil and organic matter in a bag or bucket, and keep it out of clean bushland.

Disinfecting vehicles and machinery

i. Use a wash-down facility for vehicles and machinery if available, or wash-down on a hard, well-drained surface, for example a road, and on ramps if possible. See **References and resources** below for links to online wash-down guidelines.

ii. Pay particular attention to cleaning mud flaps and tyres.

iii. Dispose of wash-down water so that it drains back into a low area of the infested zone away from waterways. If this is not possible, empty it into a waste container for responsible disposal offsite.

iv. Don't allow wash-down water to drain into clean bushland.

v. Don't drive through wash-down water.

Photo: Wash-down point (Department of Parks and Wildlife WA)

Photo: Truck undercarriage wash-down (South Coast Natural Resource Management, WA)

Additional considerations where myrtle rust is present

- Disposable overalls and caps may be worn over clothing upon entering a site, and removed when leaving the site. However, in high-risk cases, also shower and change into clean clothes (including hats, gloves and footwear).
- Wash all clothing, hats and gloves between site visits using warm or hot machine wash with detergent.
- Do **NOT** remove any plant material from sites infested with myrtle rust. Dispose of plant waste by burial on site. If this is not possible, seal the waste in a plastic bag, seal the bag in a second bag and spray the outside of the bag with a solution of 70% ethanol or methylated spirits in 30% water before responsible disposal offsite.

Revegetation

Where weeds and other disturbances are controlled, natural regeneration can assist the bushland to revegetate over time. Where revegetation activities are necessary, the following steps will help stop the spread of invasive species:

- Arrive clean, leave clean—ensure all clothing, hats, footwear, tools, equipment, machinery and vehicles are free of weed seeds, mud, soil and organic matter before entering and exiting bushland.
- Liaise with land managers and relevant plant specialist stakeholders (for example Australian Network for Plant Conservation, Greening Australia, Landcare groups, botanic gardens, seed banks etc.) to collaborate on the revegetation strategy.
- Select indigenous plants that occur naturally in your local area wherever possible.
- Avoid species with the potential to become weeds of the environment or agriculture.
- If the site is infested with *Phytophthora* spp. or myrtle rust, select species resistant to the disease, or seed from more tolerant individuals of susceptible plant species.
- Consult the Australian Network for Plant Conservation translocation guidelines 2004 (see **References and resources** below). These focus on threatened species but many of the techniques and considerations also apply to non-threatened species.
- Consider a combination of revegetation techniques such as seed production areas, direct sowing and enhancement of natural sites to assist natural regeneration. Many of these will be lower risk than the use of seedlings.
- If using seedlings, purchase them from a supplier that can guarantee high standards of hygiene—such as NIASA-accredited businesses. For added certainty, ensure the supplier allows testing of a random sample of seedlings and soil for *Phytophthora* spp. 3–6 weeks before acceptance of the seedlings. If the pathogen is present, the batch must be rejected.
- Check plants on receipt and at intervals during any holding period. Seek specialist advice if any suspect symptoms appear (for example coloured pustules, leaf necrosis).
- If propagating, maintain high standards of hygiene—see the section on propagation below.
- Plant when the soil is moist but not wet.
- Use mains or disinfected water to irrigate plants.
- If you are aware of a plant pathogen infestation, begin revegetation in the clean part of the bushland before moving to the infested area. Ensure all clothing, hats, footwear, tools, equipment, machinery and vehicles are clean before leaving the infested area.

Weed management

When conducting weed management activities, the following steps will help stop the spread of invasive species:

- Arrive clean, leave clean—ensure all clothing, hats, footwear, tools, equipment, machinery and vehicles are free of weed seeds, mud, soil and organic matter before entering and exiting bushland.
- Schedule weeding for dry soil conditions where possible.
- Use techniques that minimise soil disturbance. For example, mow or slash or use an appropriate herbicide in preference to digging or grading.
- Ensure transport and disposal of plant material does not introduce weeds to new areas. In sites free of myrtle rust, place weeds into a bag or container immediately for removal. Always cover trailers when transporting plant material to prevent anything from falling off. Some weeds can reproduce vegetatively—from leaves, bulbs or other plant material—while others use seeds, and some may require heat or cold treatment before composting, mulching or disposal.
- If a site is infested with myrtle rust, do **NOT** remove any plant material. Dispose of plant waste by burial on site. If this is not possible, seal the waste in a plastic bag, seal the bag in a second bag and spray the outside of the bag with a solution of 70% ethanol or methylated spirits in 30% water before responsible disposal offsite.
- If you are aware of a plant pathogen infestation, begin weeding in the clean part of the bushland before moving to the infested area. Clean all clothing, hats, footwear, tools, equipment, machinery and vehicles before leaving the infested area.

Propagation

The following steps will help stop the spread of invasive species during propagation activities:

- Ensure all benches, equipment, pots and containers are clean and disinfected.
- While using implements such as cutting knives or secateurs, wash them regularly with a solution of 70% ethanol or methylated spirits in 30% water.
- Steam-air pasteurise soil mixes for 30 minutes at 60°C, or select materials that conform to Australian Standard *AS3743–2003 Potting mixes* or *AS4454–2012 Composts, soil conditioners and mulches*. These standards require the materials to be free from plant pathogens, pests, harmful chemicals and weeds.
- Avoid bringing soil on boots and equipment into the nursery areas.
- If possible, keep pots on raised wire-mesh benches at least 30 centimetres off the ground. Otherwise, keep them on free-draining blue metal.
- Keep the whole nursery area clean and free of dead plant material and rubbish.

References and resources—general

Guidelines for the translocation of threatened plants in Australia—Second edition	2004	Vallee L, Hogbin T, Monks L, Makinson B, Matthes M and Rossetto M; Australian Network for Plant Conservation, Canberra	https://www.anbg.gov.au/anpc/publications/translocation.html
Leave no trace Australia		Web resources	www.lnt.org.au/resources/biosecurity/bio-security.html www.lnt.org.au/resources/skills-ethics-series.html

References and resources—wash-down procedures

Vehicle and machinery checklists—clean-down procedures	2014	Biosecurity Queensland, Department of Agriculture, Fisheries and Forestry; State of Queensland	https://www.daff.qld.gov.au/__data/assets/pdf_file/0011/58178/IPA-Cleandown-Procedures.pdf
Weed out the seeds—How to clean down your vehicle and machinery to help prevent the spread of weed seeds	2011	Biosecurity Queensland, Department of Agriculture, Fisheries and Forestry; State of Queensland	https://www.youtube.com/watch?v=dTNDecjTVfI
A guide for machinery hygiene for civil construction	2011	Civil Contractors Federation, State of Victoria, Department of Primary Industries, Department of Sustainability and Environment, VicRoads and the Association of Land Development Engineers	www.civilcontractors.com/Uploads/files/LR%20CCF%20Machinery%20Hygiene%20Bklt%2040pp.pdf
Keeping it clean: A Tasmanian field hygiene manual to prevent the spread of freshwater pests and pathogens	2010	NRM South, Tasmania	dpipwe.tas.gov.au/Documents/15130802_52keepingitcleanspreadswe.pdf
Biosecurity videos		NRM South, Tasmania	www.nrmsouth.org.au/biosecurity/
Field hygiene kits for landholders or community groups in Tasmania—available for purchase		NRM South, Tasmania	Landholders www.nrmsouth.org.au/wp-content/uploads/2014/08/Biosecurity-kits-sales-flyer-2015-Landholders.pdf Community groups www.nrmsouth.org.au/wp-content/uploads/2014/08/Biosecurity-kits-sales-flyer-2015-community.pdf

References and resources—seed production areas

Sowing seeds: bridging the gap between ex situ collections and reintroduction	2012	Guja L, North T, Taylor D and McAuliffe J; Australasian Plant Conservation 21(3)	www.anbg.gov.au/anpc/apc/21-3_guja.html
Developing seed production areas for native plants—Corangamite region guidelines	2008	Heyes S, Butler M, Gartlan C and Ovington A; Corangamite Seed Supply and Revegetation Project	www.florabank.org.au/files/documents/seedproductionareas/Corangamite%20Seed%20Production%20Area%20Guidelines08%20P1.pdf
Introducing seed production areas: an answer to native seed shortages	2008	Vanzella B; Greening Australia	www.florabank.org.au/files/newsattachments/SPA%20handout_%20master%20GACR%20Bindi%20Vanzella%20March08.pdf

References and resources—*Phytophthora cinnamomi*

Managing Phytophthora dieback—Guidelines for local government	2000	Dieback Working Group	https://www.dwg.org.au/images/dieback_publications/Managing_Phytophthora_Dieback_guidelines.pdf
Managing Phytophthora dieback in bushland—A guide for landholders and community conservation groups	2008	Dieback Working Group	https://www.dwg.org.au/images/dieback_publications/Managing_Phytophthora_Dieback_in_Bushland.pdf
Resistant native plant species—A list of resistant native plant species from Western Australia from the Centre of Phytophthora Science and Management at Murdoch University		Dieback Working Group	https://www.dwg.org.au/images/dieback_publications/Western_Australian_Natives_Resistant.pdf
Susceptible native plant species—A list of susceptible native plants species from Western Australia from the Centre of Phytophthora Science and Management at Murdoch University		Dieback Working Group	https://www.dwg.org.au/images/dieback_publications/Western_Australian_natives_susceptible.pdf

Management of *Phytophthora cinnamomi* for biodiversity conservation in Australia: Part 1—A review of current management.	2005	O'Gara E, Howard K, Wilson B and Hardy GEStJ—a report by the Centre for Phytophthora Science and Management, Murdoch University, Western Australia funded by the Australian Government Department of the Environment and Heritage	www.environment.gov.au/biodiversity/invasive-species/publications/management-phytophthora-cinnamomi-biodiversity-conservation
Management of *Phytophthora cinnamomi* for biodiversity conservation in Australia: Part 2—National best practice guidelines. Appendix 1—*Phytophthora cinnamomi* Appendix 2—The rationale of current management options Appendix 3—Areas vulnerable to disesase caused by *Phytophthora cinnamomi* Appendix 4—The responses of native Australian plant species to *Phytophthora cinnamomi*	2005	O'Gara E, Howard K, Wilson B and Hardy GEStJ—a report by the Centre for Phytophthora Science and Management, Murdoch University, Western Australia funded by the Australian Government Department of the Environment and Heritage	www.environment.gov.au/biodiversity/invasive-species/publications/management-phytophthora-cinnamomi-biodiversity-conservation
Management of *Phytophthora cinnamomi* for biodiversity conservation in Australia: Part 3—Risk assessment for threats to ecosystems, species and communities: A review	2005	Wilson B, Howard K, O'Gara E and Hardy GEStJ—a report by the Centre for Phytophthora Science and Management, Murdoch University, Western Australia funded by the Australian Government Department of the Environment and Heritage	www.environment.gov.au/biodiversity/invasive-species/publications/management-phytophthora-cinnamomi-biodiversity-conservation
Management of *Phytophthora cinnamomi* for biodiversity conservation in Australia: Part 4—Risk assessment models for species, ecological communities and areas.	2005	Centre for Phytophthora Science and Management—a report by the Centre for Phytophthora Science and Management, Murdoch University, Western Australia funded by the Australian Government Department of the Environment and Heritage	www.environment.gov.au/biodiversity/invasive-species/publications/management-phytophthora-cinnamomi-biodiversity-conservation

Threat abatement plan for disease in natural ecosystems caused by *Phytophthora cinnamomi*	2014	Australian Government Department of the Environment	www.environment.gov.au/resource/threat-abatement-plan-disease-natural-ecosystems-caused-Phytophthora-cinnamomi
Background: Threat abatement plan for disease in natural ecosystems caused by *Phytophthora cinnamomi*	2014	Australian Government Department of the Environment	www.environment.gov.au/resource/threat-abatement-plan-disease-natural-ecosystems-caused-Phytophthora-cinnamomi
Response of selected South Australian native plant species to *Phytophthora cinnamomi*	2012	Kueh KH, McKay SF, Facelli E, Facelli JM, Velzeboer RMA, Able AJ, Scott ES	onlinelibrary.wiley.com/doi/10.1111/j.1365-3059.2012.02593.x/full
Infection of native plants by *Phytophthora cinnamomi*—key threatening process listing	2002	New South Wales Government Office of Environment and Heritage	www.environment.nsw.gov.au/determinations/PhytophthoraKTPListing.htm
Stamp out the spread of Phytophthora dieback		Royal Botanic Gardens Sydney	www.rbgsyd.nsw.gov.au/__data/assets/pdf_file/0008/106937/Phytophthora_brochure.pdf
Are you a carrier? Phytophthora dieback is a silent plant killer		Royal Botanic Gardens Sydney	www.rbgsyd.nsw.gov.au/__data/assets/pdf_file/0007/106936/Phytophthora_flyer.pdf
Management of *Phytophthora cinnamomi* in production forests	2009	Tasmanian Government Forest Practices Authority	www.fpa.tas.gov.au/__data/assets/pdf_file/0004/58054/Flora_technical_note_8_Phytophthora.pdf
Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects Guide 7: Pathogen management	2011	NSW Roads and Maritime Services	www.rms.nsw.gov.au/documents/about/environment/biodiversity_guidelines.pdf

References and resources—myrtle rust

Look out for myrtle rust	2010	New South Wales Department of Primary Industries	www.dpi.nsw.gov.au/__data/assets/pdf_file/0010/364870/myrtle-rust-brochure.pdf
Identification of myrtle rust	2010	New South Wales Department of Primary Industries	www.dpi.nsw.gov.au/__data/assets/pdf_file/0009/337374/identification-myrtle-rust.pdf
Preventing spread of myrtle rust in bushland	2010	New South Wales Department of Primary Industries	www.dpi.nsw.gov.au/__data/assets/pdf_file/0008/362096/preventing-spread-Myrtle-Rust-bushland.pdf
New South Wales Department of Primary Industries myrtle rust resources page		New South Wales Department of Primary Industries	www.dpi.nsw.gov.au/biosecurity/plant/myrtle-rust/resources
Australian Nursery Industry myrtle rust management plan	2012	Nursery and Garden Industry Australia	www.ngia.com.au/Folder?Action=View%20File&Folder_id=135&File=Myrtle%20Rust%20Management%20Plan%202012%20Final%20V2.pdf
Myrtle rust—current information including national and international host lists; bibliography.	2014	The Australian Network for Plant Conservation	https://www.anbg.gov.au/anpc/resources/Myrtle_Rust.html
Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects Guide 7: Pathogen management	2011	NSW Roads and Maritime Services	www.rms.nsw.gov.au/documents/about/environment/biodiversity_guidelines.pdf
Current Biosecurity Threats		Biosecurity Tasmania, Department of Primary Industries, Parks, Water and Environment	dpipwe.tas.gov.au/biosecurity/current-biosecurity-threats

References and resources—weeds

Australian Weeds Strategy—A national strategy for weed management in Australia	2006	Natural Resource Management Ministerial Council, Australian Government Department of the Environment and Water Resources	www.environment.gov.au/biodiversity/invasive/weeds/publications/strategies/pubs/weed-strategy.pdf
Weeds in Australia web pages		Australian Government Department of the Environment	www.weeds.gov.au
Weeds of National Significance (WoNS) web pages		Australian Weeds Committee	www.weeds.org.au
Vehicle and machinery checklists—clean-down procedures	2014	Biosecurity Queensland, Department of Agriculture, Fisheries and Forestry; State of Queensland	https://www.daff.qld.gov.au/__data/assets/pdf_file/0011/58178/IPA-Cleandown-Procedures.pdf
Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects Guide 6: Weed management	2011	NSW Roads and Maritime Services	www.rms.nsw.gov.au/documents/about/environment/biodiversity_guidelines.pdf

Appendix A

Example checklists

Risk assessment checklist

Determine all risks associated with the potential transfer of pathogens or weeds to/from/through the project site (consider all participants handling plant material and equipment, from collection to site through to on-site works and clean-up).

Liaise with the project site's land managers to determine the presence of:

☐ *Phytophthora* spp.

☐ Myrtle rust

☐ Weeds

Liaise with the project site's land managers to determine the presence of:

☐ Vulnerable native plant communities

☐ Species susceptible to *Phytophthora* spp. or myrtle rust

☐ Threatened species or communities listed under Commonwealth or state/territory legislation

Identify any planned activities with the potential to introduce or spread pathogens or weeds:

☐ Introduction of plant material to a site (seedlings, seeds, mulch etc.)

☐ Introduction of other materials to a site (soil, gravel, rock, sand etc.)

☐ Vehicle or machinery access to a site

☐ Any potential soil disturbance

Hygiene management plan checklist

To prevent the risks having an impact:

☐ Plan to visit only one site per day

☐ Schedule activities for the right conditions

☐ Use equipment that can be cleaned easily and thoroughly

☐ Minimise personal items that can carry pathogens

☐ Include training sessions so participants are aware of why hygiene is necessary, how to arrive clean, stay clean and leave clean

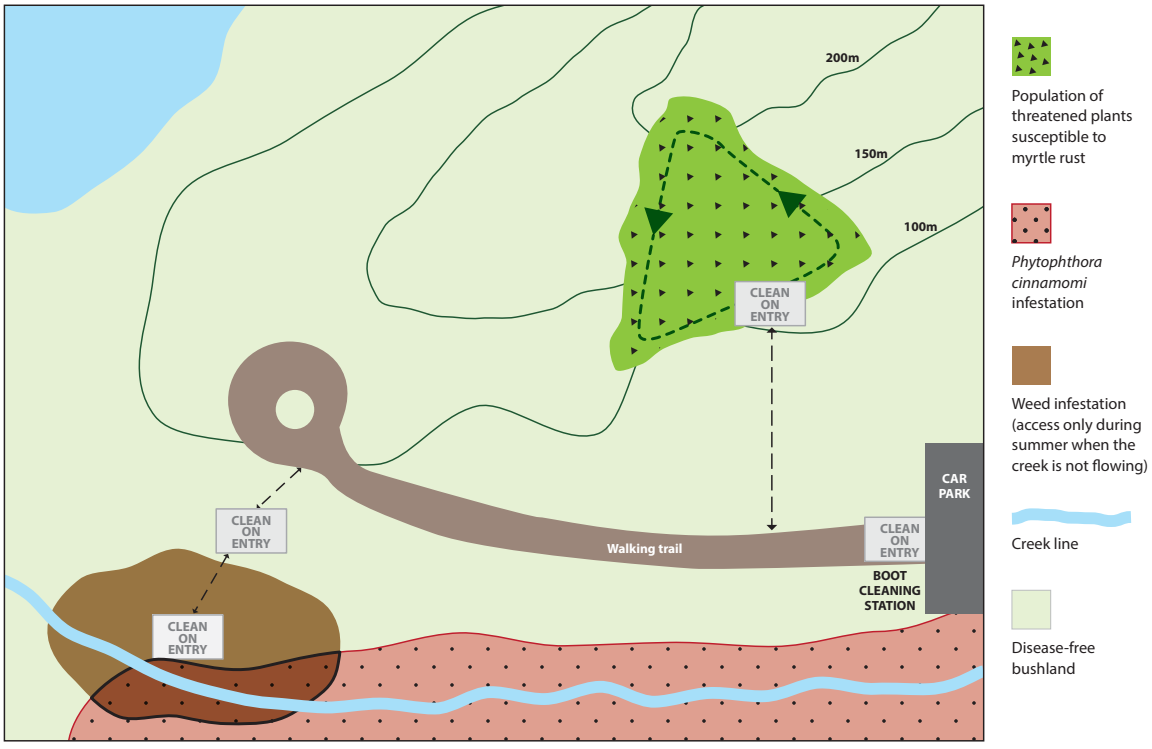
☐ Establish access controls including routes of access and timing on a management map

☐ Establish hygiene controls including hygiene procedures, hygiene infrastructure, clean on entry locations and wash-down points on a management map

☐ Maintain wash-down facilities and hygiene infrastructure

☐ Record and monitor site for any accidental spread of pathogens or weeds

Example hygiene management map



A large area within the project site is disease-free bushland, including a population of threatened plants susceptible to myrtle rust. This population must be monitored regularly during and after the project for any indications of disease.

There is an infestation of the weed arum lily (*Zantedeschia aethiopica*) limited to a small area on either side of the creek. Part of this area is also infested with *Phytophthora cinnamomi* which is present along much of the creek line. To avoid the spread of *Phytophthora cinnamomi*, all weed control activities should be scheduled during the dry season when the creek is not flowing.

'Clean on entry' access to the site is via a boot cleaning station at the car park entrance. From the walking trail there is one pathway of access to the population of threatened plants and another to the arum lily population. At both of these 'clean on entry' points there will be hygiene kits containing hard brushes, spray bottles of disinfectant and alcohol wipes.

Biosecurity hygiene kit: assemble a simple kit with the following items:

☐ Plastic tub with a lid (to carry items and to use as a footbath)

☐ Stiff brush

☐ Newspaper to cover the footwell of a vehicle (replace with clean newspaper regularly)

☐ Dustpan and brush; possibly also a long-handled broom

☐ Plastic bag for sweepings and dirty newspaper

☐ Drum of water and some disinfectant, for example a solution of 70% ethanol or methylated spirits in 30% water; or 20% household bleach (with 5% active ingredient) in 80% water; or quaternary ammonium disinfectant diluted according to manufacturer's directions.

☐ Spray bottle with a solution of 70% ethanol or methylated spirits in 30% water

☐ Alcohol wipes or gel for hands and personal items

Photo: Biosecurity hygiene kit (Department of Parks and Wildlife WA)

environment.gov.au

BIO382.0215

Appendix C

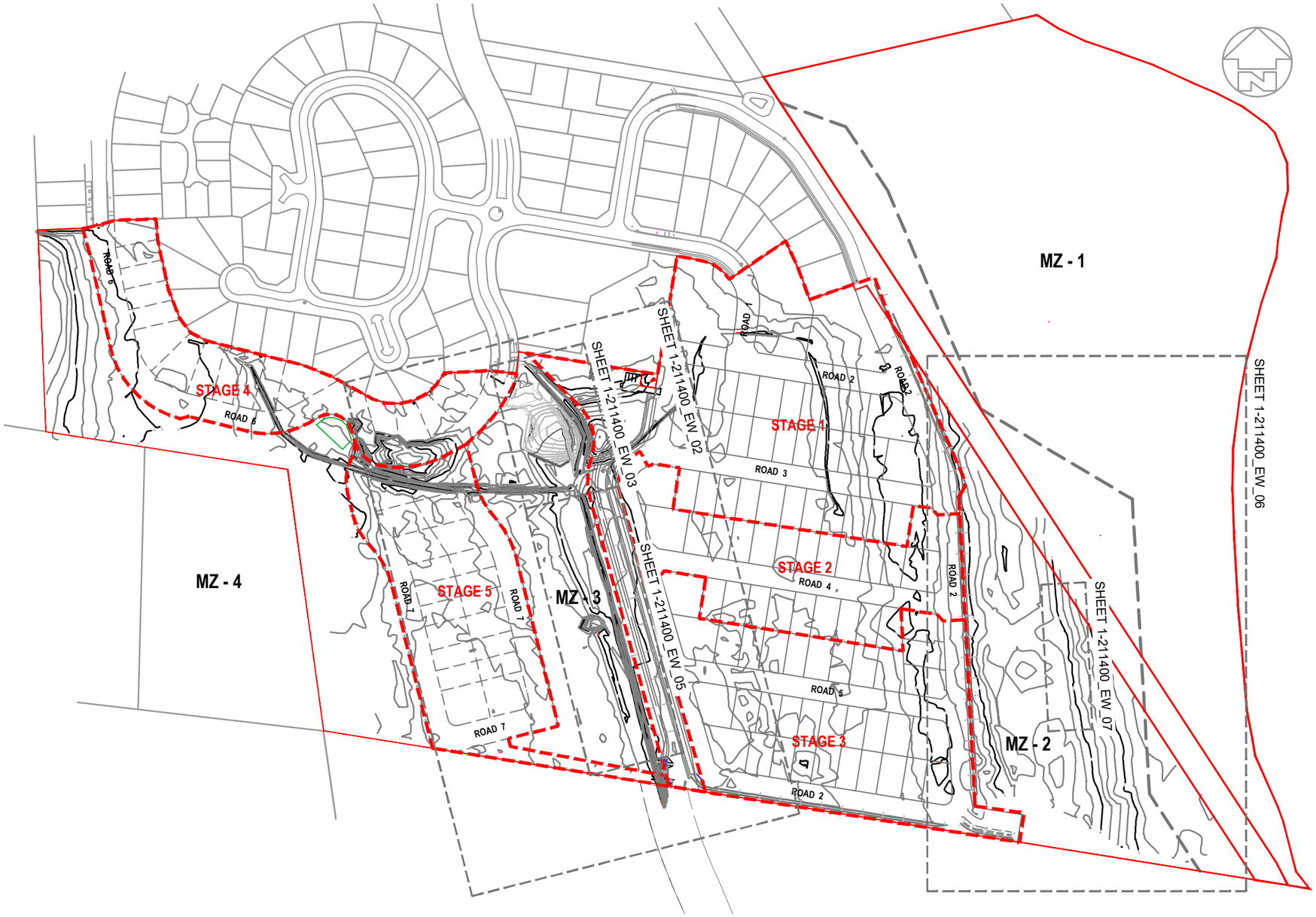
Landscape Plans

WALLUM ESTATE
BRUNSWICK HEADS

EARLY ECOLOGICAL WORKS PACKAGE

REV C - FOR APPROVAL - 20.06.23

DRAWING LIST



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www.awconsult.com.au

CLIENT: CLARENCE PROPERTY

PARTNER: CivilTech Consulting Engineers

DRAWING: LOCALITY PLAN AND DRAWING INDEX

PROJECT: WALLUM ESTATE
EARLY ECO WORKS PACKAGE

REV.	ISSUE / AMENDMENTS	DATE
A	*FOR DISCUSSION*	*16.02.22*
B	*FOR REVIEW*	*12.04.22*
C	*FOR APPROVAL*	*20.06.23*

ENG CERT
Wade Fletcher
CivilTech Consulting Engineers
Chartered Professional Engineer
EA ID: 2954545

ADDRESS
LOT 13
DP 1251383,
TORAKINA DR
BRUNSWICK
HEADS

SCALE 0 50 100m

REV. C

DESIGNED	IC/SS	CAD FILE No. 1-211400_EW.DWG
DRAWN	SS	
CHECKED	DMC	DWG No. 1-211400_EW_00

BENCH MARK
SSM195050
4.705mRL

BENCH MARK
SSM8903
3.895mRL

EP1

EP2

MZ-1

MZ-2

MZ-3

MZ-4

CREEK

SWAMPSONS

REMOVE DUMPED RUBBISH AND EXOTIC VEGETATION THAT HAS ESTABLISHED FROM GREEN WASTE DISPOSAL INTO MZ - 4 AREA 1300m2
CONDUCT BUSH REGENERATION TECHNIQUES REFER EARLY WORKS REPORT FOR METHODOLOGY

INFILL PLANTING 1/m2
AREA 300m2

TEMPORARY CROSSING OVER DRAIN MIN DIAMETER PIPE Ø0.6m

EARTHWORK VOLUME
APPROX = 1,300m³

SEDIMENT FENCE 2-4 / 08

NORTHWEST CONSTRUCTED WF PONDS
REFER SHEET 03

SOUTHWEST CONSTRUCTED WF PONDS
REFER SHEET 05

EASTERN CONSTRUCTED WF PONDS - REFER SHEET 07

ASS AMELIORATION LOCATION

BUNTING FENCE TO BE LOCATED ON MZ-4 EXTENT FOR CLEAR DELINEATION OF NO GO ZONE

LEGEND

- PROPERTY BOUNDARY
- COMPOUND - SITE OFFICE - INDICATIVE
- STOCKPILE CUT FOR FUTURE USE
- ASS AMELIORATION LOCATION (IF REQUIRED)
- EXTENT OF CUT - VOLUME = 1,300m³
- EP1 ENTRY POINT - CONSTRUCTION FENCE GATE WITH PADLOCK
- RUMBLE STRIPS AT SITE EXIT POINT
- TEMP DRAIN CROSSING
- TEMPORARY ACCESS TRACK
- TEMP CONSTRUCTION FENCING
- NO GO ZONE FENCE - BUNTING + SIGNAGE
- SEDIMENT FENCE - REFER SHEET 08
- RETAINED WF HABITAT
- WF BREEDING PONDS
- EARTH BUND
- IMPACTED SEDGE VEGETATION REF SHEET 09 TRANSLOCATE INTO WF BREEDING PONDS
- RUBBISH REMOVAL / WEED CONTROL
- WEED CONTROL / INFILL PLANTING

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CLIENT: CLARENCE PROPERTY

PARTNER: CivilTech Consulting Engineers

DRAWING:
GENERAL ARRANGEMENT AND SITE ACCESS PLAN

PROJECT: WALLUM ESTATE
EARLY ECO WORKS PACKAGE

REV.	ISSUE / AMENDMENTS	DATE
A	FOR DISCUSSION	16.02.22
B	FOR REVIEW	12.04.22
C	FOR APPROVAL	20.06.23

ENG CERT
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BRUNSWICK HEADS

SCALE 1:2500 @ A3
0 50 100m

REV. C

DESIGNED	IC/SS	CAD FILE No. 1-211400_EW.DWG
DRAWN	SS	
CHECKED	DMC	DWG No. 1-211400_EW_01

NORTHWEST CONSTRUCTED WF PONDS - REFER SHEET 03

ALLOCASUARINA LITTORALIS x 26

LARGE TREATMENT SWALE

PROPOSED SECONDARY DRAIN

EXISTING DRAIN

ALLOCASUARINA LITTORALIS x 20

SOUTHWEST CONSTRUCTED WF PONDS - REFER SHEET 05

MZ-3

EP2

BENCH MARK SSM8903 3.895mRL

ASSISTED NATURAL REGENERATION TO OCCUR

INSTALL TEMPORARY CULVERT CROSSING OVER DRAIN MIN DIAMETER PIPE Ø0.6m

2-4 08 SEDIMENT FENCE

ASS AMELIORATION LOCATION IF REQUIRED

LEGEND

- PROPERTY BOUNDARY
- COMPOUND SITE OFFICE
- STOCKPILE CUT FOR FUTURE USE REFER DETAIL 02 SHEET 08
- ASS AMELIORATION LOCATION (IF REQUIRED)
- EXTENT OF CUT - VOLUME = 1,300m³
- EP2 ENTRY POINT - CONSTRUCTION FENCE GATE WITH PADLOCK
- RUMBLE STRIPS AT SITE EXIT POINT
- TEMP DRAIN CROSSING
- ACCESS TRACK
- SEDIMENT FENCE - REFER SHEET 08
- NO GO ZONE FENCE - BUNTING + SIGNAGE
- EXISTING WATERWAY

- RETAINED WF HABITAT
- WF BREEDING PONDS
- EARTH BUND
- *ALLOCASUARINA LITTORALIS* GLOSSY BLACK COCKATOO FEED TREE - 5m SPACING
- EXISTING TREES TO BE RETAINED

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DRAWING: **CENTRAL DRAIN HABITAT & REHABILITATION ZONE**

PROJECT: **WALLUM ESTATE**
EARLY ECO WORKS PACKAGE

REV.	ISSUE / AMENDMENTS	DATE
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B	*FOR REVIEW*	*12.04.22*
C	*FOR APPROVAL*	*20.06.23*

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BRUNSWICK HEADS

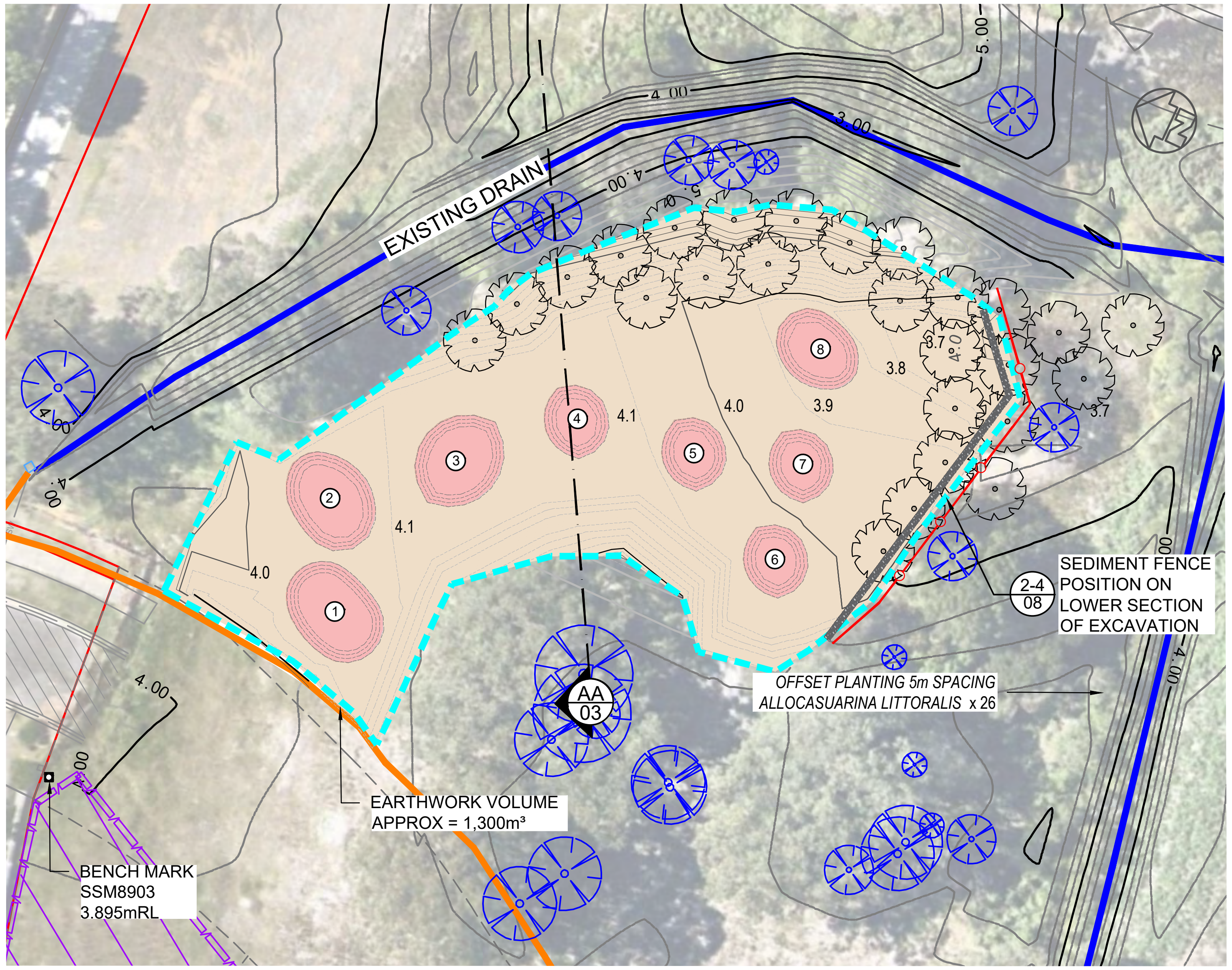
SCALE 1:1000 @ A3 (0, 10, 20, 30, 40m)

REV. C

DESIGNED IC/SS
DRAWN SS
CHECKED DMC

CAD FILE No. **1-211400_EW.DWG**

DWG No. **1-211400_EW_02**



CONSTRUCTED WF BREEDING PONDS PROPERTIES - NORTH WEST								
POND 1	ESL	FSL	BEL	BE DEPTH	F DEPTH m	AREA m²	CUT VOL m³	FILL VOL m³
1	4.0	3.7	3.4	0.6	0.3	47.0	27.8	14.1
2	4.0	3.8	3.5	0.5	0.2	44.0	21.6	13.2
3	4.1	3.8	3.5	0.6	0.3	42.0	24.8	12.6
4	4.1	3.8	3.5	0.6	0.3	23.0	13.4	6.9
5	4.0	3.7	3.4	0.6	0.3	23.0	13.4	6.9
6	4.0	3.7	3.4	0.6	0.3	23.0	13.4	6.9
7	3.9	3.6	3.3	0.6	0.3	23.0	13.4	6.9
8	3.8	3.5	3.2	0.6	0.3	33.0	19.4	9.9
						TOTAL m³	146.8	77.4
TOTAL VOLUME OF TRANSLOCATED WF HABITAT @ DEPTH OF 03m IN PROPOSED PONDS								77.4
TOTAL VOLUME OF IMPACTED WALLUM HEATH MATERIAL OVER EXCAVATED SITE @0.3 DEPTH								180

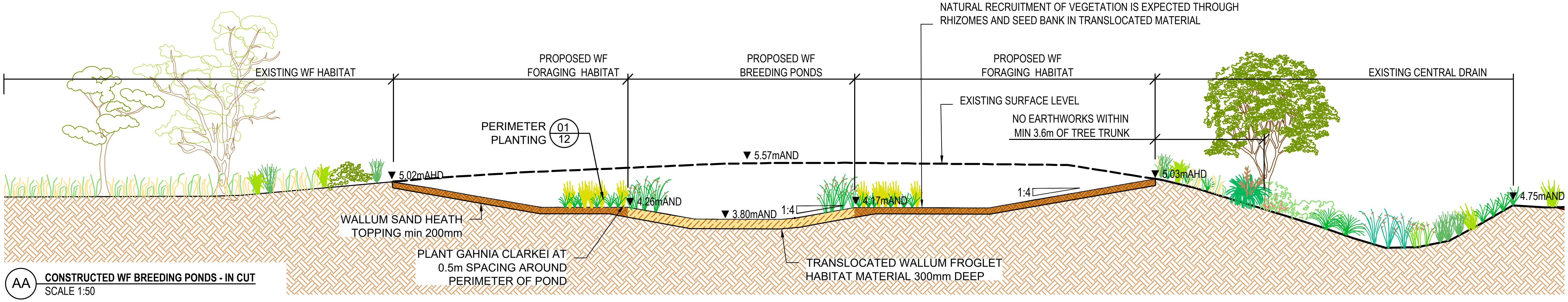
CODE
ESL = EXISTING SURFACE LEVEL
FSL = FINISHED SURFACE LEVEL
BEL = BULK EARTHWORKS LEVEL
BE DEPTH = BULK EARTHWORKS DEPTH
F DEPTH = FINISH DEPTH
DIM = DIMENSIONS IN METERS
CUT VOLm³ = TOTAL VOLUME OF MATERIAL REMOVED
FILL VOLm³ = TOTAL VOLUME OF MATERIAL INSTALLED
mAHD = LEVELS IN METER AUSTRALIAN HEIGHT DATUM

EARTHWORKS METHODOLOGY

- NO TREES ARE TO BE IMPACTED IN THIS WORKS. MIN DISTANCE OF 3.6m FROM TREE TRUNK TO EARTHWORKS EXTENT
- EARTHWORKS EXTENT TO BE LOCATED BY A SURVEYOR AND BUNTING FENCE AND ENVIRONMENTAL NO GO ZONE SIGNS INSTALLED
- FINAL EXTENT TO BE CONFIRMED BY ARBORIST OR ECOLOGIST TAKING INTO ACCOUNT THE SURROUNDING TREES TPZ.
- WALLUM HEATH TOP SOIL, ORGANIC MATTER AND VEGETATION TO BE STOCKPILED WITHIN THE EARTHWORKS EXTENT. TOP DRESS AREA WITH STOCKPILE ORGANIC MATERIAL BULK EARTHWORKS. APPROX 400m³ (TOTAL AREA 2000m² x DEPTH 200mm)
- CLEAN SAND APPROPRIATE FOR FILL TO BE EXCAVATED FROM SITE AND MOVED TO STOCKPILE LOCATION REFER SHEET 01
- APPROX 1,300m³ OF CUT TO BE TRANSPORTED FROM NORTH WESTERN SITE TO WESTERN STOCKPILE LOCATION.
- INSTALL 300mm OF TRANSLOCATED 'LIVE SOIL' FROM IMPACTED WF BREEDING HABITAT ON EASTERN SIDE OF DEVELOPMENT TO ACHIEVE DESIGN FINISHED FLOOR LEVEL - REFER SHEET 01B
- TOPDRESS 200mm OF STOCKPILED TOPSOIL, ORGANIC MATTER AND VEGETATION FROM IMPACTED WALLUM HEATH OVER EXCAVATED SITE. VOLUME = 280m³ AREA = 1338m²
- REFER NW WF POND PLANTING PLAN 01 SHEET 12 FOR PLANTING SCHEDULE
- NATURAL REGENERATION OF VEGETATION IS EXPECTED IN TRANSLOCATED MATERIAL. REVIEW SUCCESS OF REGENERATION IN 6MTH TO DETERMINE IF FURTHER ACTION IS REQUIRED.

LEGEND

- PROPERTY BOUNDARY
- EXTENT OF CUT - VOLUME = 1,300m³
- PROPOSED CONTOUR
- EXISTING WATERWAY
- NO GO ZONE FENCE - BUNTING + SIGNAGE
- SEDIMENT FENCE - REFER SHEET 08
- EXISTING TREES TO BE RETAINED
- *ALLOCASUARINA LITTORALIS* COCKATOO FEED TREE - 5m SPACING
- TRANSLOCATED "LIVE SOIL" DEPTH 300mm
- TOPDRESS WALLUM SAND HEATH TOP SOIL DEPTH 200mm



AA **CONSTRUCTED WF BREEDING PONDS - IN CUT**
SCALE 1:50

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PARTNER: CivilTech Consulting Engineers

DRAWING: **NORTH WEST WF POND & SECTION AA**

PROJECT: **WALLUM ESTATE EARLY ECO WORKS PACKAGE**

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SCALE 1:500@ A3 (0, 10, 20, 30, 40m)

REV. **C**

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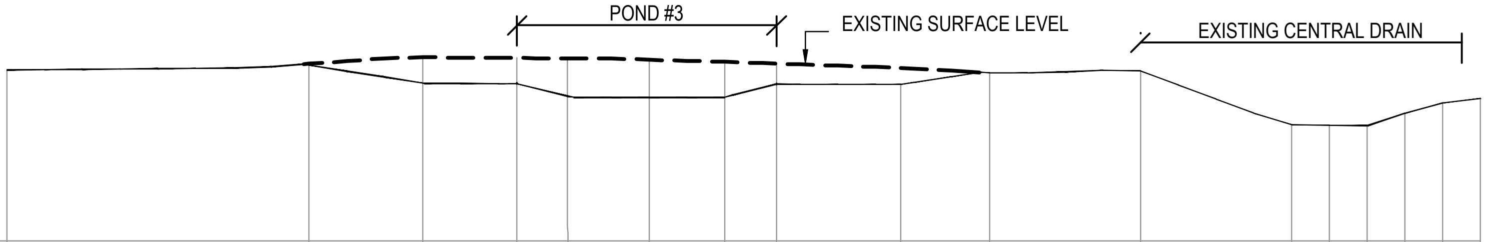
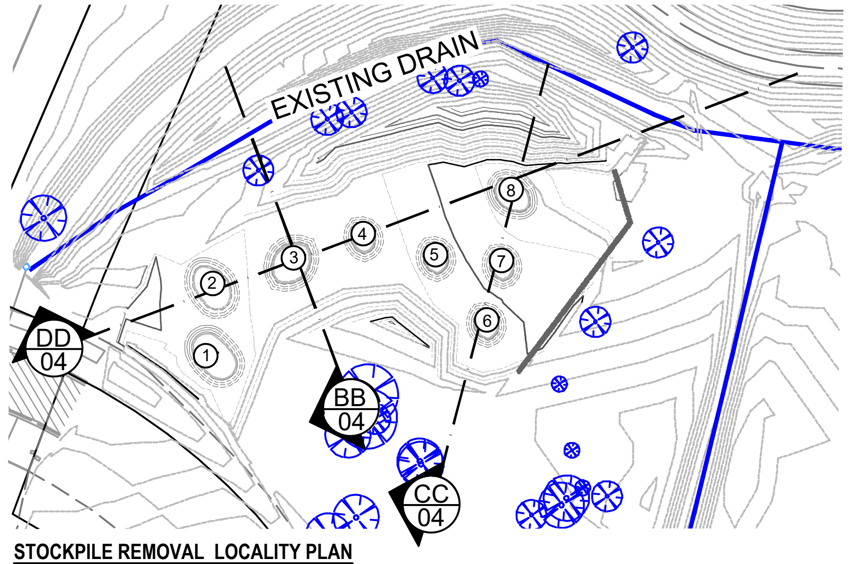
CHECKED	DMC	DWG No. **1-211400_EW_03**



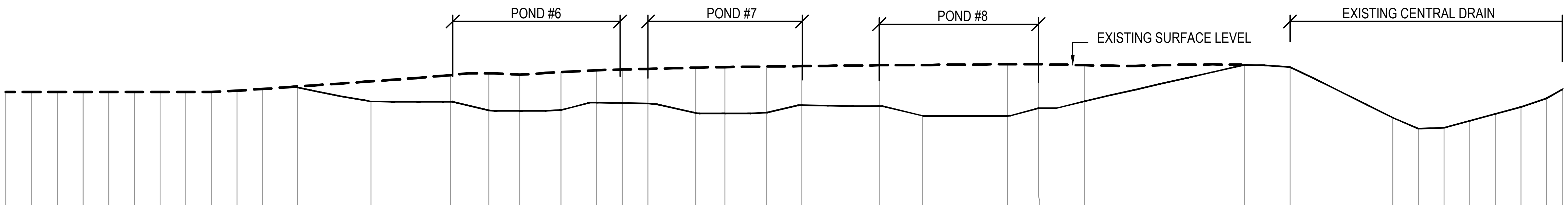
CUT/FILL	-0.04	-0.68	-0.68		-1.00	-0.94	-0.56	-0.36	+0.04							-0.03
DESIGN	4.650	4.177	4.163	3.833	3.800	3.800	4.148	4.140	4.493							3.746
EXISTING	4.686	4.857	4.844	4.829	4.795	4.741	4.707	4.554	4.450	4.499	3.078	3.059	3.054	3.378	3.652	3.772
CHAINAGE	8.000	11.000	13.500	14.839	17.000	19.000	20.000	23.652	26.000	30.000	34.000	35.000	36.000	37.000	38.000	39.000

1:200 @ A3
0 20 40 60 80m

BB **CONSTRUCTED WF BREEDING PONDS - IN CUT**
SCALE 1:200



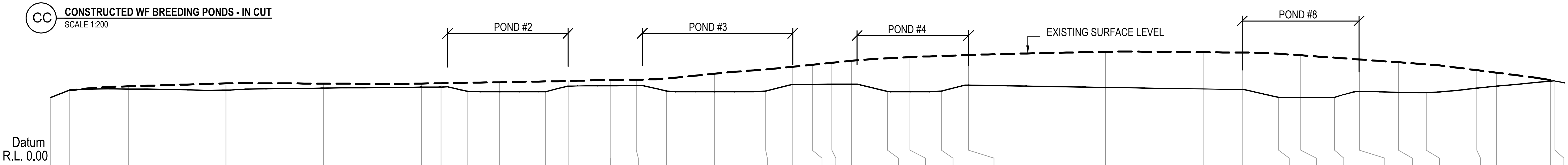
STOCKPILE REMOVAL LOCALITY PLAN
SCALE 1:100



CUT/FILL												-0.84	-1.01	-1.47	-1.42	-1.20	-1.27	-1.31	-1.35	-1.79
DESIGN											4.628	4.066	4.058	3.717	3.700	3.731	4.016	4.004	3.992	3.615
EXISTING	4.442	4.441	4.441	4.441	4.440	4.440	4.440	4.442	4.486	4.556	4.626	4.906	5.068	5.168	5.119	5.229	5.283	5.315	5.340	5.390
CHAINAGE	1.000	2.000	3.000	4.000	5.000	6.000	7.000	8.000	9.000	10.000	11.281	14.222	17.300	18.807	20.000	21.619	23.000	24.000	25.000	26.860

CUT/FILL	-1.81	-1.82	-1.53	-1.59	-1.99	-2.02	-1.71	-1.42	-0.06									
DESIGN	3.600	3.631	3.920	3.884	3.507	3.500	3.813	4.068	5.496									
EXISTING	5.410	5.435	5.447	5.478	5.494	5.517	5.525	5.483	5.499	5.412	3.442	3.010	3.038	3.310	3.582	3.854	4.197	
CHAINAGE	28.000	29.629	31.000	34.000	35.699	39.000	40.300	42.000	48.233	50.000	54.000	55.000	56.000	57.000	58.000	59.000	60.000	60.604

CC **CONSTRUCTED WF BREEDING PONDS - IN CUT**
SCALE 1:200



CUT/FILL		-0.00	-0.14	-0.34	-0.23	-0.19	-0.20	-0.47	-0.50	-0.25	-0.25	-0.30	-0.30	-0.72	-0.92	-1.09	-0.90	-1.00
DESIGN	3.492	3.879	3.934	3.884	3.984	4.028	4.036	3.810	3.800	3.800	4.084	4.109	4.117	3.830	3.800	3.826	4.174	4.177
EXIST		3.880	4.074	4.229	4.211	4.215	4.232	4.266	4.300	4.333	4.333	4.404	4.416	4.522	4.716	4.890	5.078	5.179
CH	11.000	12.000	15.000	20.000	25.000	30.000	31.000	32.386	35.000	36.637	36.750	40.000	41.000	42.545	45.000	47.614	49.000	50.000

CUT/FILL	-1.10	-1.20	-1.72	-1.77		-1.54	-1.82	-1.88	-1.90	-2.23	-2.16		-1.64	-1.53	-1.37	-0.70		-0.13
DESIGN	4.180	4.183	3.814	3.800	3.828	4.135	4.024	3.940	3.906	3.506	3.500	3.503	3.808	3.769	3.741	4.077	4.337	4.220
EXIST	5.281	5.382	5.523	5.571		5.674	5.841	5.818	5.801	5.734	5.662		5.447	5.303	5.160	4.773		4.346
CH	51.000	52.000	53.842	55.000	56.616	58.000	65.000	70.000	72.000	73.867	75.000	76.723	78.000	80.000	81.408	85.000	87.765	88.000

1:100 @ A3
0 10 20 30 40m

DD **CONSTRUCTED WF BREEDING PONDS - IN CUT**
SCALE 1:100

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CLIENT: CLARENCE PROPERTY

PARTNER: CivilTech Consulting Engineers

DRAWING: **STOCKPILE CUT SECTIONS BB - DD**

PROJECT: **WALLUM ESTATE EARLY ECO WORKS PACKAGE**

REV.	ISSUE / AMENDMENTS	DATE
A	*FOR DISCUSSION*	*16.02.22*
B	*FOR REVIEW*	*12.04.22*
C	*FOR APPROVAL*	*20.06.23*

ENG CERT
Wade Fletcher
CivilTech Consulting Engineers
Chartered Professional Engineer
EA ID: 2954545

ADDRESS
LOT 13
DP 1251383,
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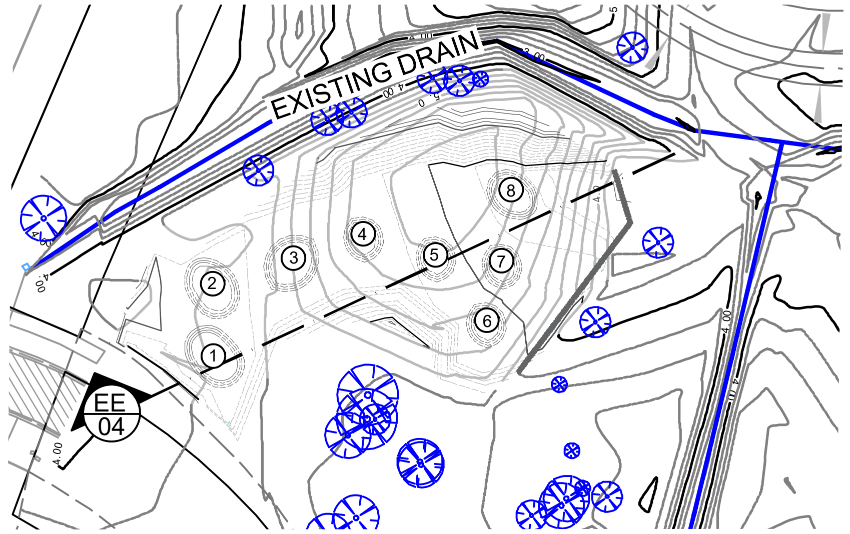
BRUNSWICK
HEADS

SCALE

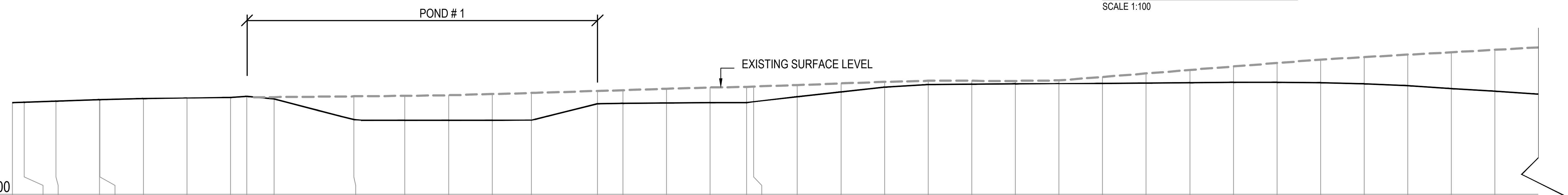
REV. **C**

DESIGNED IC/SS
DRAWN SS
CHECKED DMC

CAD FILE No. **1-211400_EW.DWG**
DWG No. **1-211400_EW_04**

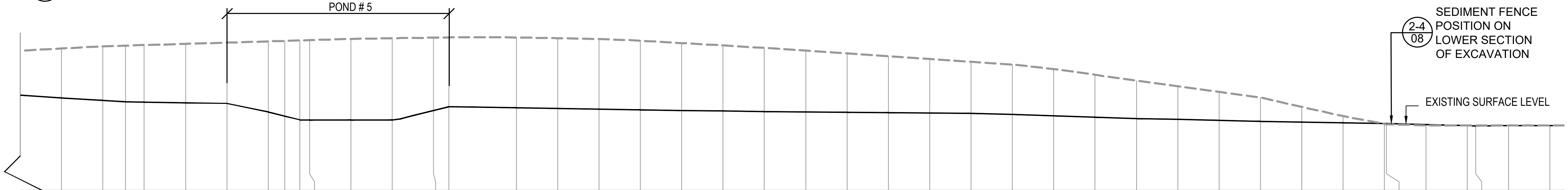


STOCKPILE REMOVAL LOCALITY PLAN
SCALE 1:100



CHAINAGE	EXISTING	DESIGN	CUT/FILL
0.000	4.10	4.10	
0.267	4.11	4.11	+0.00
1.000	4.13	4.13	+0.00
1.997	4.17	4.17	+0.00
2.000	4.17	4.17	+0.00
3.000	4.20	4.20	+0.00
4.000	4.21	3.98	+0.00
5.000	4.22		+0.00
5.377	4.22		+0.00
6.000	4.23	4.19	-0.04
7.831	4.25	3.71	-0.53
9.000	4.26	3.70	-0.56
10.000	4.27	3.70	-0.57
11.000	4.30	3.70	-0.60
11.902	4.32	3.70	-0.62
13.000	4.36	4.08	-0.28
14.000	4.39	4.08	-0.30
15.000	4.42	4.09	-0.33
16.000	4.45	4.10	-0.35
16.836	4.46	4.10	-0.36
17.000	4.47	4.12	-0.35
18.000	4.51	4.23	-0.27
19.000	4.54	4.34	-0.20
20.000	4.58	4.45	-0.12
21.000	4.60	4.51	-0.09
22.000	4.60	4.52	-0.08
23.000	4.60	4.53	-0.07
24.000	4.61	4.54	-0.07
25.000	4.69	4.55	-0.15
26.000	4.77	4.55	-0.22
27.000	4.85	4.56	-0.29
28.000	4.93	4.57	-0.36
29.000	5.01	4.57	-0.44
30.000	5.09	4.56	-0.53
31.000	5.15	4.53	-0.61
32.000	5.20	4.49	-0.71
33.000	5.26	4.43	-0.83
34.000	5.31	4.36	-0.95
35.000	5.37	4.30	-1.07

EE **CONSTRUCTED WF BREEDING PONDS - IN CUT**
SCALE 1:100



CHAINAGE	EXISTING	DESIGN	CUT/FILL
36.000	5.43	4.23	-1.19
37.000	5.48	4.17	-1.31
37.544	5.49	4.13	-1.36
38.000	5.51	4.13	-1.38
39.000	5.54	4.11	-1.42
40.000	5.57	4.10	-1.47
41.000	5.60	4.08	-1.51
41.398	5.61	4.08	-1.53
41.765	5.62	3.70	-1.92
42.000	5.63	3.70	-1.93
43.000	5.66	3.70	-1.96
44.000	5.67	3.70	-1.97
45.000	5.69	4.02	-1.66
45.320	5.70	4.02	-1.69
47.000	5.69	3.99	-1.70
48.000	5.67	3.98	-1.70
49.000	5.66	3.96	-1.70
50.000	5.61	3.94	-1.67
51.000	5.56	3.93	-1.63
52.000	5.50	3.91	-1.58
53.000	5.44	3.90	-1.54
54.000	5.37	3.89	-1.48
55.000	5.31	3.88	-1.43
56.000	5.24	3.87	-1.37
57.000	5.17	3.86	-1.31
58.000	5.11	3.86	-1.25
59.000	5.04	3.83	-1.21
60.000	4.93	3.80	-1.13
61.000	4.79	3.76	-1.03
62.000	4.65	3.73	-0.92
63.000	4.51	3.71	-0.80
64.000	4.37	3.69	-0.69
65.000	4.24	3.67	-0.57
66.000	4.01	3.64	-0.37
67.000	3.79	3.63	-0.16
68.000	3.60	3.61	+0.01
68.049	3.59	3.61	+0.02
69.000	3.57	3.58	+0.02
70.000	3.57	3.56	-0.01
70.202	3.57	3.56	-0.01
71.000	3.57	3.56	-0.00
72.000	3.56	3.56	-0.00

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CLIENT: CLARENCE PROPERTY

PARTNER: CivilTech Consulting Engineers

DRAWING: **STOCKPILE - SECTIONS - EE**

PROJECT: **WALLUM ESTATE**
EARLY ECO WORKS PACKAGE

REV.	ISSUE / AMENDMENTS	DATE
A	*FOR DISCUSSION*	*16.02.22*
B	*FOR REVIEW*	*12.04.22*
C	*FOR APPROVAL*	*20.06.23*

ENG CERT
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CivilTech Consulting Engineers
Chartered Professional Engineer
EA ID: 2954545

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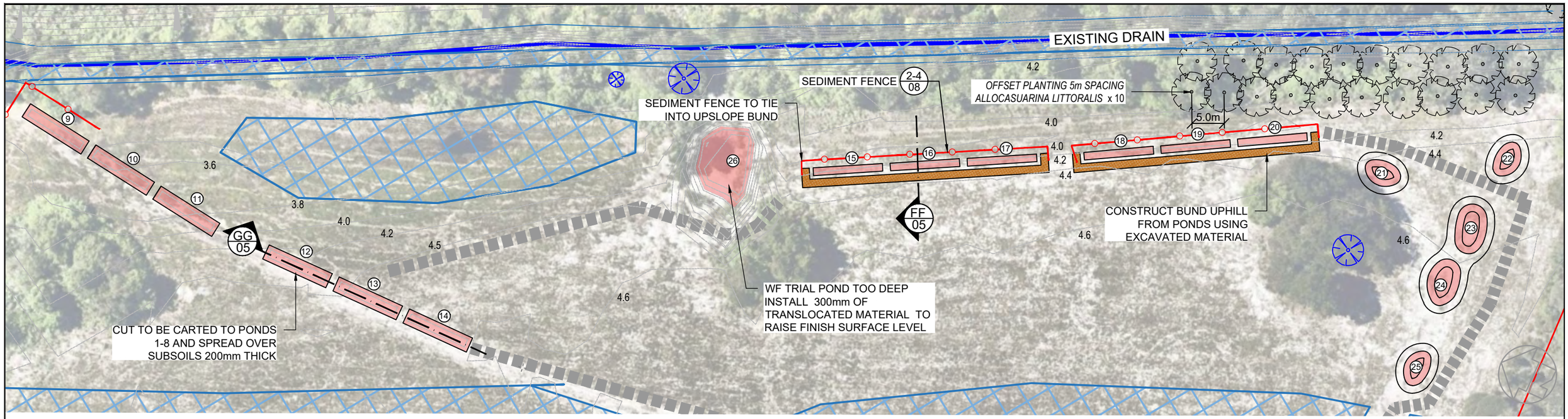
HEADS

SCALE 1:100 @ A3
0 10 20 30 40m

REV. **C**

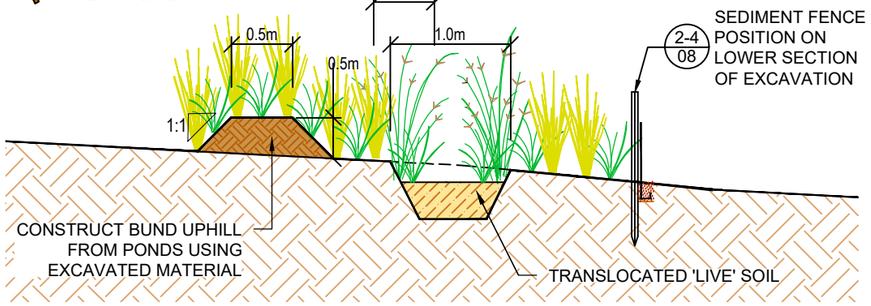
DESIGNED IC/SS
DRAWN SS
CHECKED DMC

CAD FILE No. **1-211400_EW.DWG**
DWG No. **1-211400_EW_04B**



LEGEND

- PROPERTY BOUNDARY
- RUMBLE STRIPS AT SITE EXIT POINT
- TEMP DRAIN CROSSING
- ACCESS TRACK
- NO GO ZONE FENCE - BUNTING + SIGNAGE
- WF BREEDING PONDS
- EARTH BUND
- *ALLOCASUARINA LITTORALIS* GLOSSY BLACK COCKATOO FEED TREE - 5m SPACING
- EXISTING TREES TO BE RETAINED
- RETAINED WF HABITAT
- SEDIMENT FENCE - REFER SHEET 08

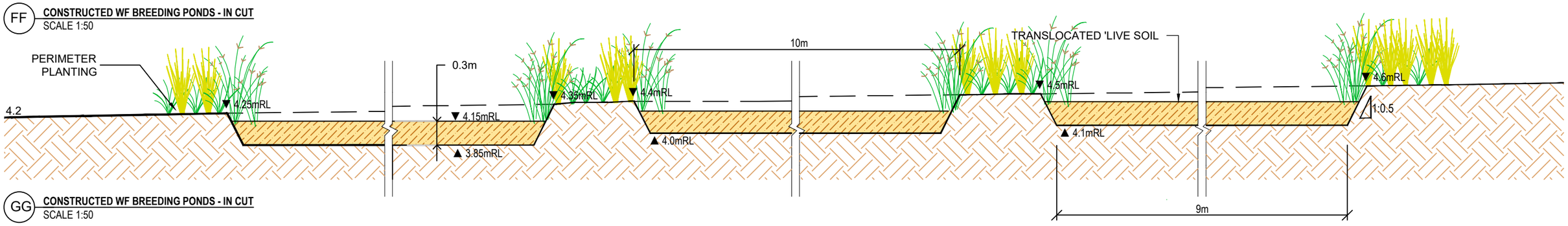


CONSTRUCTED WF BREEDING PONDS PROPERTIES - SOUTH WEST								
POND 1	ESL	FSL	BEL	BE DEPTH	F DEPTH m	AREA m^2	CUT VOL m^3	FILL VOL m^3
9	3.6	3.4	3.1	0.5	0.2	18	8.9	5.4
10	3.6	3.5	3.2	0.4	0.1	18	7.1	5.4
11	3.7	3.6	3.3	0.4	0.1	18	7.1	5.4
12	4.1	3.8	3.5	0.6	0.3	18	10.7	5.4
13	4.4	4.0	3.7	0.7	0.4	18	12.5	5.4
14	4.6	4.2	3.9	0.7	0.4	18	12.5	5.4
15	4.2	4.0	3.7	0.5	0.2	9.0	4.2	2.7
16	4.2	4.1	3.8	0.4	0.1	9.0	2.8	2.7
17	4.2	4.0	3.7	0.5	0.2	9.0	3.7	2.7
18	4.2	3.9	3.6	0.6	0.3	9.0	4.6	2.7
19	4.2	4.1	3.8	0.4	0.1	9.0	2.8	2.7
20	4.2	4.0	3.7	0.5	0.2	9.0	3.7	2.7
21	4.4	4.1	3.8	0.6	0.3	10.0	6.0	3.0
22	4.4	4.2	3.9	0.5	0.2	11.0	5.5	3.3
23	4.5	4.1	3.8	0.7	0.4	30.0	20.6	9.0
24	4.6	4.2	3.9	0.7	0.4	30.0	20.6	9.0
25	4.7	4.3	4.0	0.7	0.4	10.0	7.0	3.0
26	3.5	3.9	NA	0.7	0.4	47.0	0.0	10.0
						TOTAL m^3	140.0	85.9
TOTAL VOLUME OF TRANSLOCATED WF HABITAT @ DEPTH OF 03m IN PROPOSED PONDS								85.9

CODE

- **ESL** = EXISTING SURFACE LEVEL
- **FSL** = FINISHED SURFACE LEVEL
- **BEL** = BULK EARTHWORKS LEVEL
- **BE DEPTH** = BULK EARTHWORKS DEPTH
- **F DEPTH** = FINISH DEPTH
- **DIM** = DIMENSIONS IN METERS
- **CUT VOLm^3** = TOTAL VOLUME OF MATERIAL REMOVED
- **FILL VOLm^3** = TOTAL VOLUME OF MATERIAL INSTALLED
- **mAHD** = LEVELS IN METER AUSTRALIAN HEIGHT DATUM

FF **CONSTRUCTED WF BREEDING PONDS - IN CUT**
SCALE 1:50



GG **CONSTRUCTED WF BREEDING PONDS - IN CUT**
SCALE 1:50

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CLIENT: CLARENCE PROPERTY

PARTNER: CivilTech Consulting Engineers

DRAWING: **SOUTH WEST WF PONDS**

PROJECT: **WALLUM ESTATE**
EARLY ECO WORKS PACKAGE

REV.	ISSUE / AMENDMENTS	DATE
A	*FOR DISCUSSION*	*16.02.22*
B	*FOR REVIEW*	*12.04.22*
C	*FOR APPROVAL*	*20.06.23*

ENG CERT
Wade Fletcher
CivilTech Consulting Engineers
Chartered Professional Engineer
EA ID: 2954545

ADDRESS
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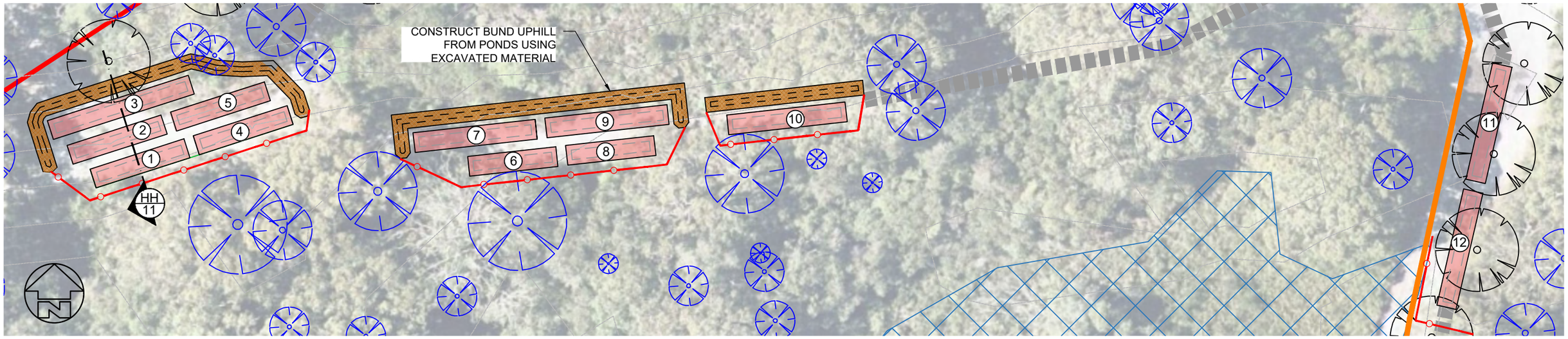
BRUNSWICK
HEADS

SCALE 1:100 @ A3
0 10 20 30 40m

REV. C

DESIGNED IC/SS
DRAWN SS
CHECKED DMC

CAD FILE No. **1-211400_EW.DWG**
DWG No. **1-211400_EW_05**



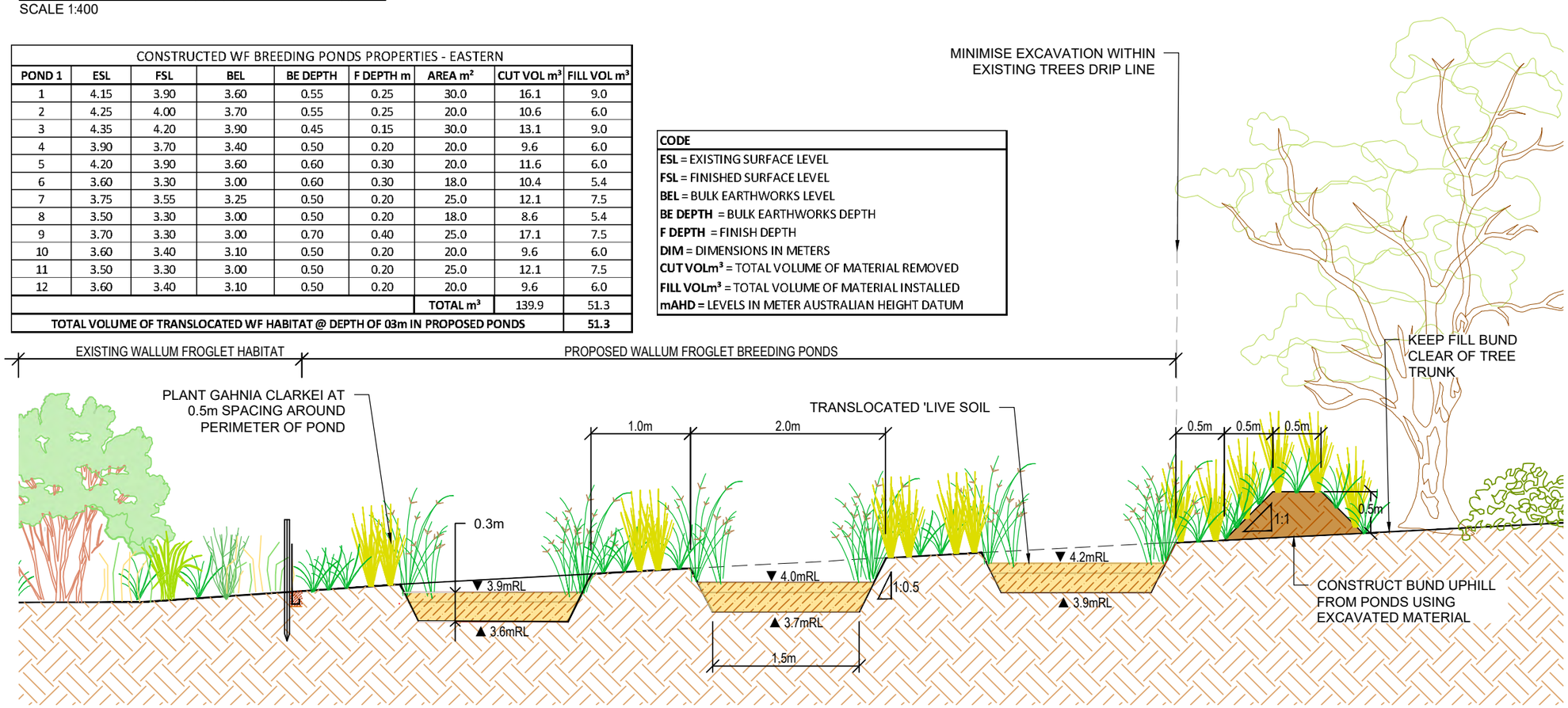
EASTERN CONSTRUCTED WF BREEDING PONDS - PLAN
SCALE 1:400

SCALE 1:400

0 5 10 15 20 25m

CONSTRUCTED WF BREEDING PONDS PROPERTIES - EASTERN								
POND 1	**ESL**	**FSL**	**BEL**	**BE DEPTH**	**F DEPTH m**	**AREA m²**	**CUT VOL m³**	**FILL VOL m³**
1	4.15	3.90	3.60	0.55	0.25	30.0	16.1	9.0
2	4.25	4.00	3.70	0.55	0.25	20.0	10.6	6.0
3	4.35	4.20	3.90	0.45	0.15	30.0	13.1	9.0
4	3.90	3.70	3.40	0.50	0.20	20.0	9.6	6.0
5	4.20	3.90	3.60	0.60	0.30	20.0	11.6	6.0
6	3.60	3.30	3.00	0.60	0.30	18.0	10.4	5.4
7	3.75	3.55	3.25	0.50	0.20	25.0	12.1	7.5
8	3.50	3.30	3.00	0.50	0.20	18.0	8.6	5.4
9	3.70	3.30	3.00	0.70	0.40	25.0	17.1	7.5
10	3.60	3.40	3.10	0.50	0.20	20.0	9.6	6.0
11	3.50	3.30	3.00	0.50	0.20	25.0	12.1	7.5
12	3.60	3.40	3.10	0.50	0.20	20.0	9.6	6.0
						TOTAL m³	139.9	51.3
TOTAL VOLUME OF TRANSLOCATED WF HABITAT @ DEPTH OF 03m IN PROPOSED PONDS								**51.3**

CODE
ESL = EXISTING SURFACE LEVEL
FSL = FINISHED SURFACE LEVEL
BEL = BULK EARTHWORKS LEVEL
BE DEPTH = BULK EARTHWORKS DEPTH
F DEPTH = FINISH DEPTH
DIM = DIMENSIONS IN METERS
CUT VOLm³ = TOTAL VOLUME OF MATERIAL REMOVED
FILL VOLm³ = TOTAL VOLUME OF MATERIAL INSTALLED
mAHD = LEVELS IN METER AUSTRALIAN HEIGHT DATUM



HH **EASTERN WF BREEDING PONDS - TYPICAL SECTION**
SCALE 1:50

LEGEND

- DEVELOPMENT BOUNDARY
- NO GO ZONE FENCE - BUNTING + SIGNAGE
- SEDIMENT FENCE - REFER SHEET 08
- EXISTING WF HABITAT
- EARTH BUND
- WF BREEDING PONDS
- EXISTING TREES TO BE RETAINED
- *EUCALYPTUS ROBUSTA* QTY
  KOALA FEED TREE - 10m SPACING

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CLIENT: CLARENCE PROPERTY

PARTNER: CivilTech Consulting Engineers

DRAWING: **EASTERN WF BREEDING PONDS TYPICAL SECTION**

PROJECT: **WALLUM ESTATE**
EARLY ECO WORKS PACKAGE

REV.	ISSUE / AMENDMENTS	DATE
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EA ID: 2954545

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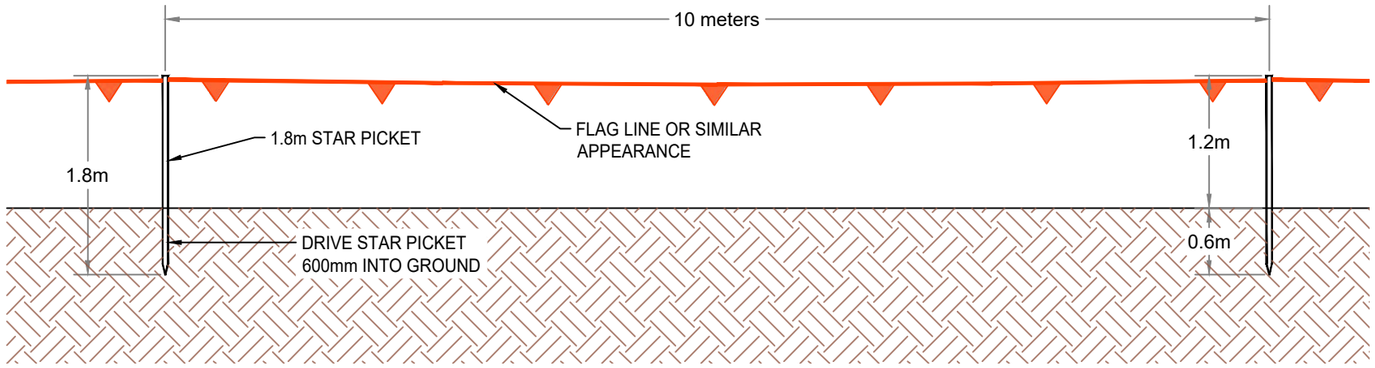
BRUNSWICK
HEADS

SCALE 1:50
0 1.0 2.0m

REV. C

DESIGNED	IC/SS	CAD FILE No. **1-211400_EW.DWG**
DRAWN	SS	
CHECKED	DMC	DWG No. **1-211400_EW_07**



01 08 **NO GO ZONE FENCE - BUNTING + SIGNAGE - ELEVATION**

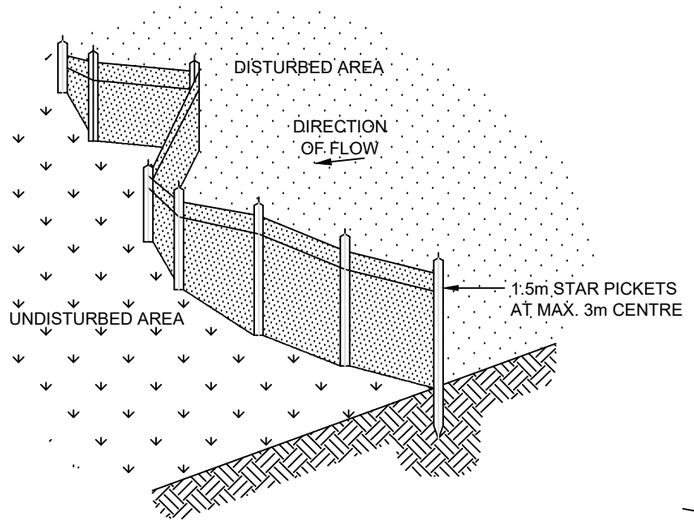
SCALE 1:50

'NO GO ZONE FENCING'

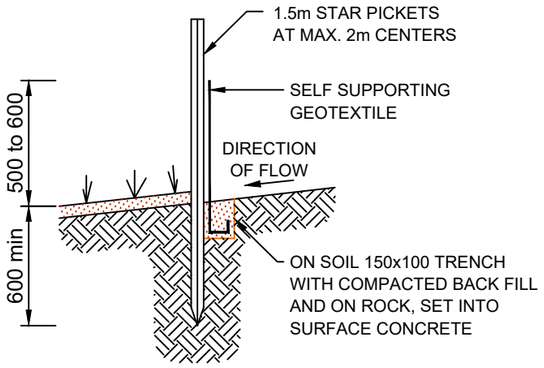
1. INSTALL WF PROTECTIVE FENCE AS INDICATED ON SHEET 1-211400_EW_ 01
2. CONSTRUCT FENCE AS SHOWN IN SECTION LEFT
3. WHERE POSSIBLE ALIGN FENCE ALONG EXISTING ROADS, ON SIDE OF CONSTRUCTED PONDS
4. ALIGNMENT TO WORK AROUND EXITING VEGETATION
5. INSTALL 'NO GO ZONE' SIGNS AS SHOWN BELOW , EVERY 50m ALONG PROTECTIVE FENCE
6. SIGN TO BE A4 AND LAMINATED

ENVIRONMENTAL
NO GO ZONE
AUTHORISED
ACCESS ONLY
CLARENCE PROPERTY

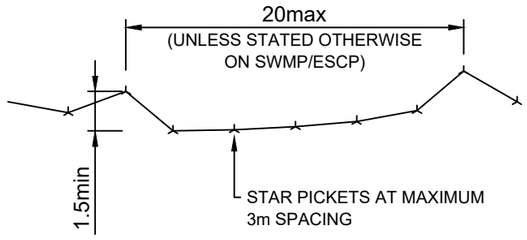
05 08 **NO GO ZONE FENCE -SIGN**
SCALE 1:50



02 08 **SEDIMENT FENCE - PERSPECTIVE**
SCALE NTS



03 09 **SEDIMENT FENCE - TYPICAL DETAIL**
SCALE 1:50



04 08 **SEDIMENT FENCE - TYPICAL DETAIL**
SCALE NTS

SEDIMENT FENCE CONSTRUCTION NOTES:

1. CONSTRUCT SEDIMENT FENCE AS CLOSE AS POSSIBLE TO PARALLEL TO THE CONTOURS OF THE SITE.
2. DRIVE 1.5 METER LONG STAR PICKETS INTO GROUND, 3 METERS APART.
3. DIG A 150 DEEP TRENCH ALONG THE UPSLOPE LINE OF THE FENCE FOR THE BOTTOM OF THE FABRIC TO BE ENTRENCHED.
4. BACK FILL TRENCH OVER BASE OF FABRIC
5. FIX SELF-SUPPORTING GEOTEXTILE TO UPSLOPE SIDE OF POSTS WITH WIRE TIES OR AS RECOMMENDED BY GEOTEXTILE MANUFACTURER.
6. JOIN SECTIONS OF FABRIC AT A SUPPORT POST WITH A 150 OVERLAP.

STOCKPILE CONSTRUCTION NOTES:

1. PLACE STOCKPILES MORE THAN 2 (PREFERABLY 5) METERS FROM EXISTING VEGETATION, CONCENTRATED WATER FLOW, ROADS AND HAZARD AREAS.
2. CONSTRUCT ON CONTOUR AS LOW, FLAT, ELONGATED MOUNDS.
3. THIS AREA IS TO BE STRIPPED OF ORGANIC MATERIAL AND CLEAN SAND AND TOPSOIL TO BE KEPT SEPARATE FOR REUSE.
4. WHERE THERE IS SUFFICIENT AREA, TOPSOIL STOCKPILES SHALL BE LESS THAN 3m IN HEIGHT.
5. BATTER SLOPE MAXIMUM 1:2.5
6. CONSTRUCT EARTH BANKS ON THE UPSLOPE SIDE TO DIVERT WATER AROUND STOCKPILES AND SEDIMENT FENCES 1 TO 2 METERS DOWNSLOPE

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CLIENT: CLARENCE PROPERTY
PARTNER: CivilTech Consulting Engineers

DRAWING: **DETAILS SHEET**
PROJECT: **WALLUM ESTATE**
EARLY ECO WORKS PACKAGE

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ENG CERT
Wade Fletcher
CivilTech Consulting Engineers
Chartered Professional Engineer
EA ID: 2954545

ADDRESS
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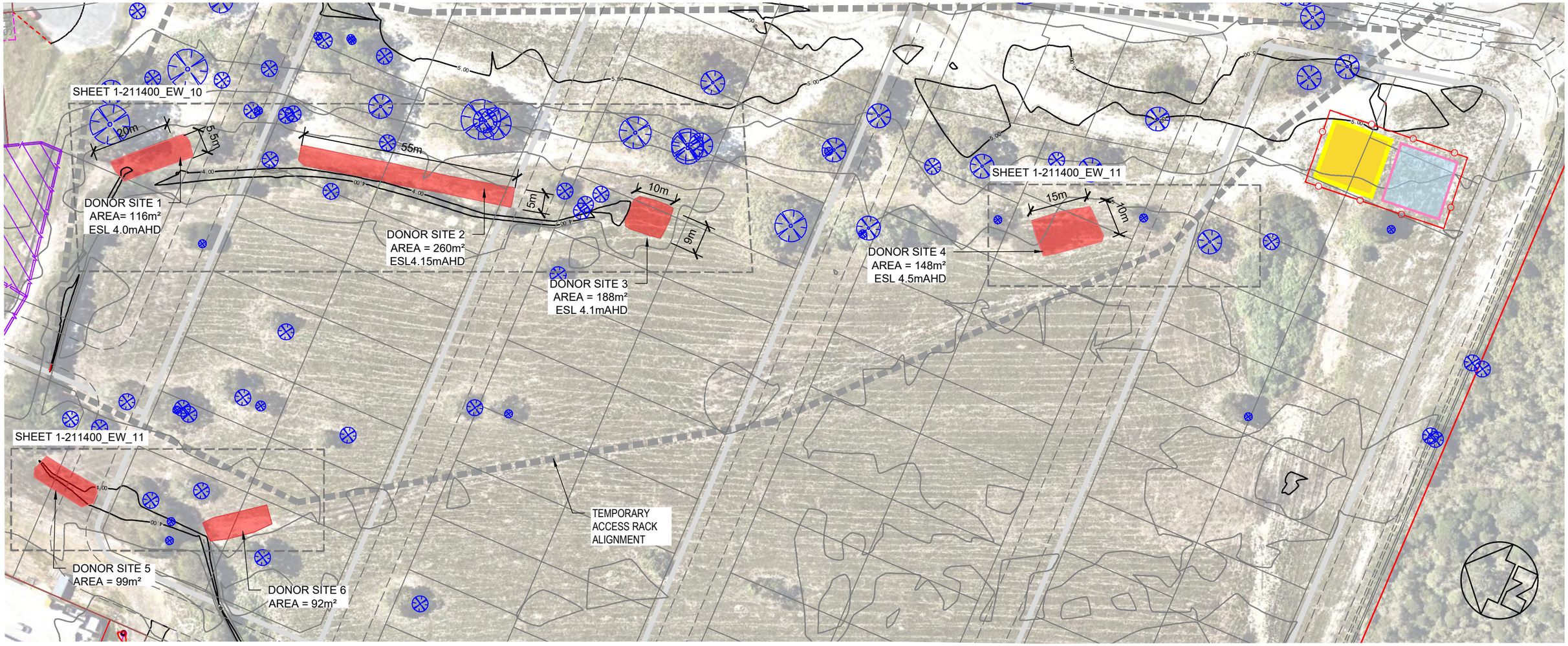
BRUNSWICK HEADS

SCALE
REV. **C**

DESIGNED	IC/SS	CAD FILE No. **1-211400_EW.DWG**
DRAWN	SS	
CHECKED	DMC	DWG No. **1-211400_EW_08**



WF DONOR MATERIAL AND WALLUM HEATH TRANSLOCATION METHODOLOGY

PRIOR TO THE TRANSLOCATION OF ANY WALLUM FROGLET HABITAT FROM THE PROPOSED HOUSE LOT AREA, WALLUM FROGLET POPULATION SURVEYS ARE TO BE CARRIED OUT BEFORE AND AFTER RAINFALL EVENTS AT THESE SITES TO ESTABLISH BOTH POPULATION SIZE AND DENSITY OF EXISTING WALLUM FROGLET'S IN THE WALLUM FROGLET HABITAT AREAS TO BE MOVED.
REFER WALLUM MANAGEMENT PLAN FOR SURVEY METHODOLOGY.

AREA OF HIGH VALUE WF BREEDING HABITAT THAT ARE TO BE REMOVED IN PROPOSED DEVELOPMENT WORKS HAVE BEEN IDENTIFIED BY A QUALIFIED ECOLOGIST. SEE PLAN ABOVE IN RED.

- THE PROPOSED CONSTRUCTED WF BREEDING PONDS REQUIRES A TOTAL OF 215m³
- AREA OF "LIVE SOIL" DONOR MATERIAL AVAILABLE IS 240m³
- EXCAVATE 300mm OF TRANSLOCATED MATERIAL INCLUDING VEGETATION AND PLACE IN CONSTRUCTED WF BREEDING PONDS, TO A DEPTH OF 300mm.
- REFER - SHEETS 03, 05 & 07 FOR BREEDING POND DESIGNS.

REQUIRED WF BREEDING PONDS DONOR MATERIAL			
CONSTRUCTED POND AREA		**TOTAL m²**	**TOTAL m³**
NORTH WEST WF PONDS		258	77.4
SOUTH WEST WF PONDS		300.0	85.9
EASTERN WF PONDS		271.0	51.3
	TOTAL	829	214.6
FILL PONDS 300mm FROM BAULK EARTHWORKS LEVEL WITH TRANSLOCATED DONOR MATERIAL.			

IMPACTED WF BREEDING PONDS DONOR MATERIAL AVAILABLE			
CONSTRUCTED POND AREA		**TOTAL m²**	**TOTAL m³**
DONOR SITE 1		116	34.8
DONOR SITE 2		260	78
DONOR SITE 3		88	26.4
DONOR SITE 4		148	44.4
DONOR SITE 5		99	29.7
DONOR SITE 6		92	27.6
	TOTAL	803	240.9
LIVE SOIL TO BE EXCAVATED AT A DEPTH OF 300mm. INCLUDING WALLUM HEATH VEGETATION FOR			
THERE IS APPROX 26m³ OF SURPLUS DONOR MATERIAL TO BE USED AS REQUIRED.			
ESL = EXSTING SURFACE LEVEL			

LEGEND

- PROPERTY BOUNDARY
- COMPOUND - SITE OFFICE - INDICATIVE
- STOCKPILE CUT FOR FUTURE USE
- ASS AMELIORATION LOCATION (IF REQUIRED)
- ACCESS TRACK
- EXISTING TREES TO BE RETAINED
- IMPACTED SEDGE VEGETATION

FINAL EXTENT OF "LIVE SOIL" DONOR MATERIAL TO BE MARKET OUT BY PROJECT ECOLOGIST PRIOR TO EXCAVATION

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DRAWING: **"LIVE SOIL" WF BREEDING PONDS DONOR MATERIAL PLAN 01**

PROJECT: **WALLUM ESTATE**
EARLY ECO WORKS PACKAGE

REV.	ISSUE / AMENDMENTS	DATE
A	*FOR DISCUSSION*	*16.02.22*
B	*FOR REVIEW*	*12.04.22*
C	*FOR APPROVAL*	*20.06.23*

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Chartered Professional Engineer
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DP 1251383,
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SCALE 1:1000 @ A3 (0, 10, 20, 30, 40m)
REV. C
DESIGNED IC/SS
DRAWN SS
CHECKED DMC
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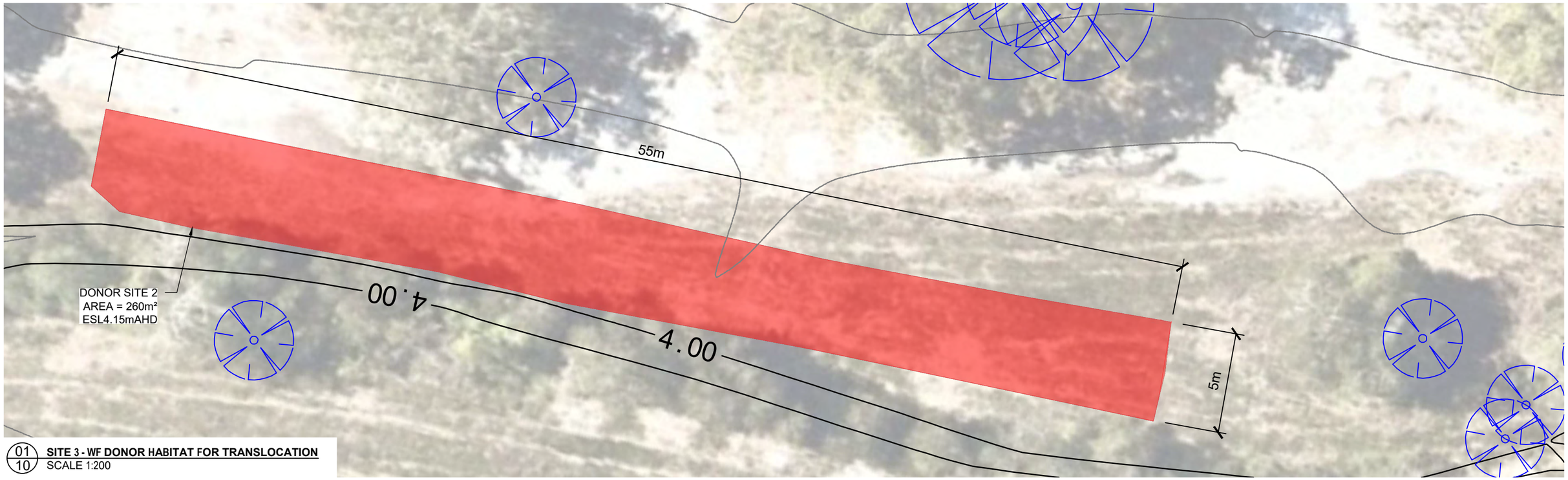
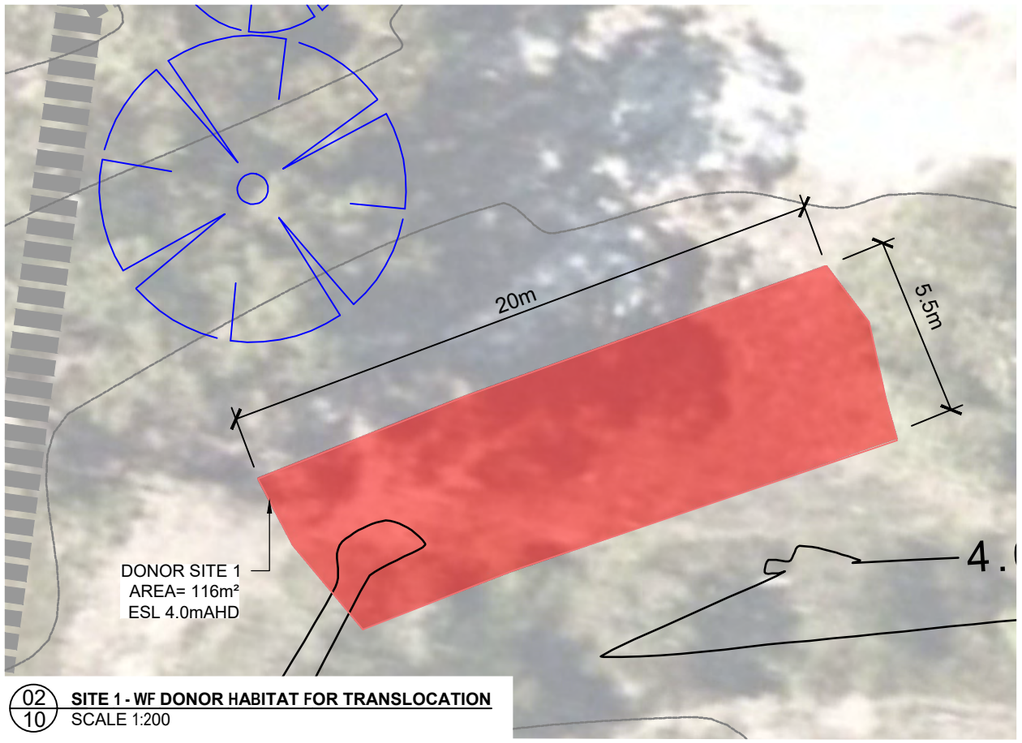
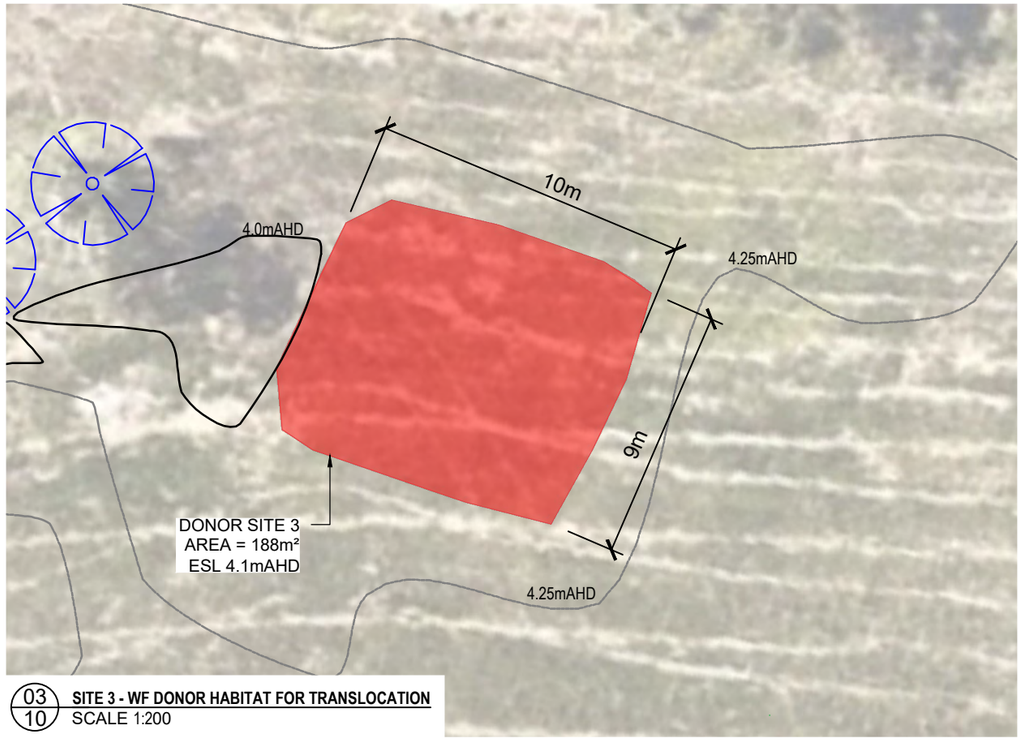


01/10 **SITE 3 - WF DONOR HABITAT FOR TRANSLOCATION**
SCALE 1:200



02/10 **SITE 1 - WF DONOR HABITAT FOR TRANSLOCATION**
SCALE 1:200



03/10 **SITE 3 - WF DONOR HABITAT FOR TRANSLOCATION**
SCALE 1:200

LEGEND

- TEMP ACCESS TRACK
- EXISTING TREES TO BE RETAINED
- IMPACTED SEDGE VEGETATION TRANSLOCATE INTO WF BREEDING PONDS EXCAVATE AT DEPTH OF 300mm

FINAL EXTENT OF "LIVE SOIL" DONOR MATERIAL TO BE MARKET OUT BY PROJECT ECOLOGIST PRIOR TO EXCAVATION

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DRAWING: **"LIVE SOIL" DONOR MATERIAL DETAILED PLAN 01**

PROJECT: **WALLUM ESTATE**
EARLY ECO WORKS PACKAGE

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SCALE 1:200 @ A3
0 1.0 2.0 3.0 4.0 5.0m

REV. C

DESIGNED	IC/SS	CAD FILE No. 1-211400_EW.DWG
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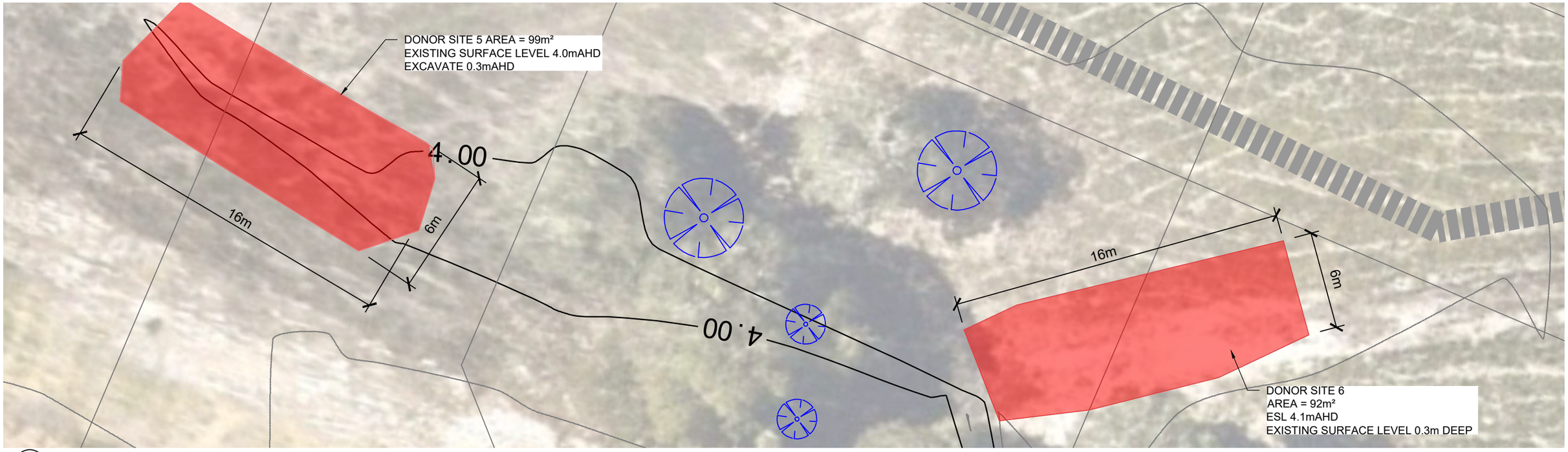
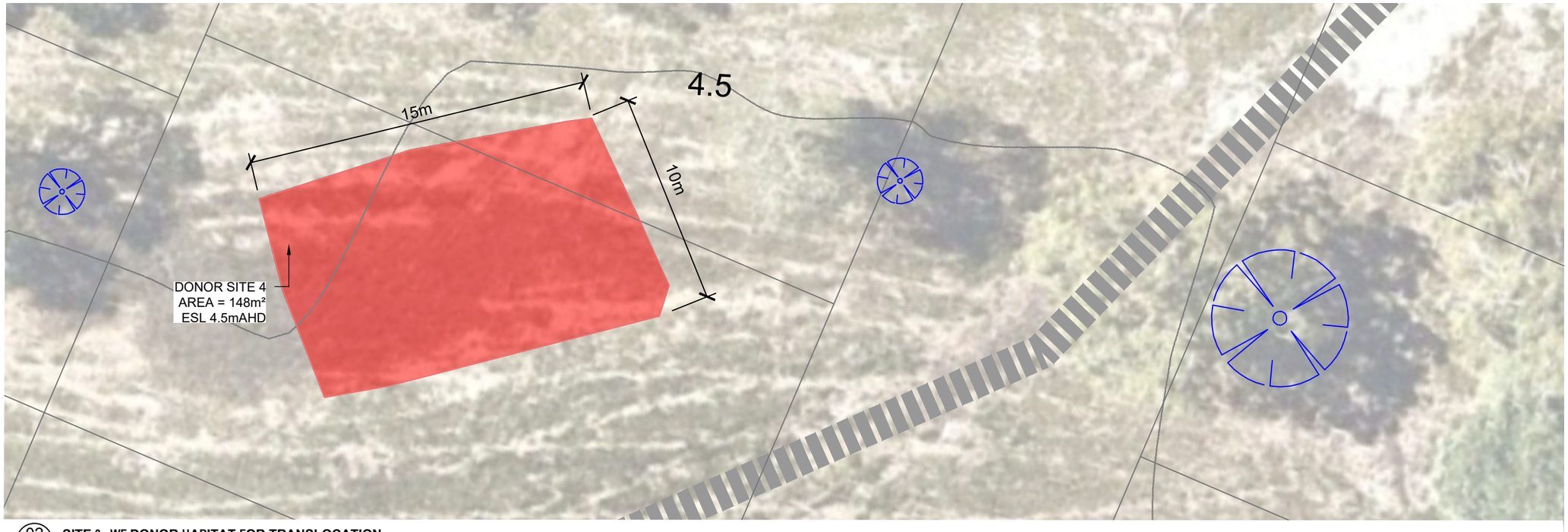


01/11 **SITE 5-6 - WF DONOR HABITAT FOR TRANSLOCATION**
SCALE 1:200



02/11 **SITE 3 - WF DONOR HABITAT FOR TRANSLOCATION**
SCALE 1:200

LEGEND

- TEMP ACCESS TRACK
- EXISTING TREES TO BE RETAINED
- IMPACTED SEDGE VEGETATION TRANSLOCATE "LIVE SOIL 300mm DEEP INTO WF BREEDING PONDS

FINAL EXTENT OF "LIVE SOIL" DONOR MATERIAL TO BE MARKET OUT BY PROJECT ECOLOGIST PRIOR TO EXCAVATION

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DRAWING: **"LIVE SOIL" DONOR MATERIAL DETAILED PLAN 02**

PROJECT: **WALLUM ESTATE**
EARLY ECO WORKS PACKAGE

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SCALE 1:200 @ A3 (0 1.0 2.0 3.0 4.0 5.0m)
REV. C

DESIGNED	IC/SS	CAD FILE No. 1-211400_EW.DWG
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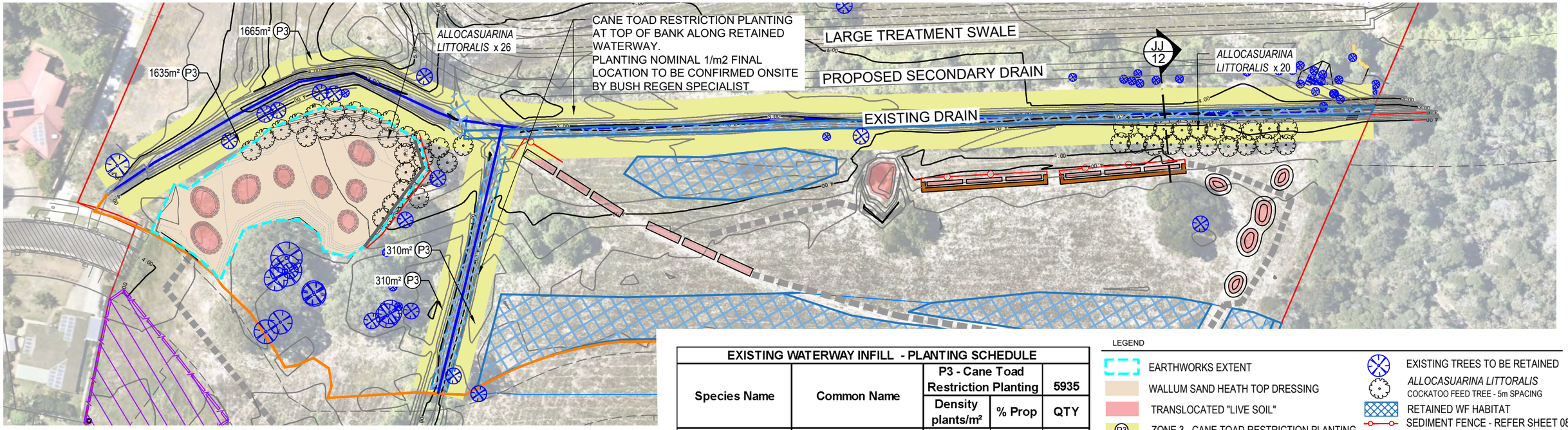
CHECKED	DMC	DWG No. 1-211400_EW_11



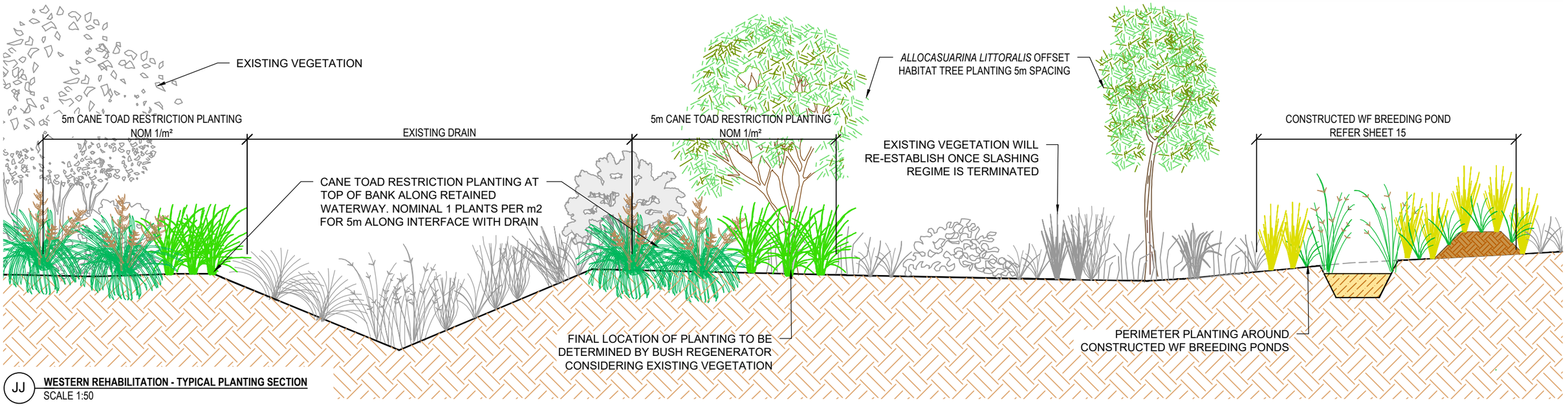
WESTERN REHABILITATION - PLAN
SCALE 1:1000

EXISTING WATERWAY INFILL - PLANTING SCHEDULE				
Species Name	Common Name	P3 - Cane Toad Restriction Planting		5935
		Density plants/m²	% Prop	QTY
Gahnia clarkei	Saw-sedge	1	20%	1187
Gahnia sieberiana	Red-fruit Saw Sedge	1	20%	1187
Imperata cylindrica	Blady grass	1	20%	1187
Lomandra longifolia	Spiny-headed mat-rush	1	20%	1187
Lomandra hystrix	Green mat-rush	1	20%	1187
		TOTAL	100%	5935
A nominal amount of 1/m2 has been applied for this zone. To be infill planted within existing vegetation. Area calculated by length of waterway x 5m				

LEGEND

- EARTHWORKS EXTENT
- WALLUM SAND HEATH TOP DRESSING
- TRANSLOCATED "LIVE SOIL"
- (P3) ZONE 3 - CANE TOAD RESTRICTION PLANTING — REFER SHEET 12 FOR DETAILS
- EXISTING TREES TO BE RETAINED
- *ALLOCASUARINA LITTORALIS* — COCKATOO FEED TREE - 5m SPACING
- RETAINED WF HABITAT
- SEDIMENT FENCE - REFER SHEET 08
- NO GO ZONE FENCE

WESTERN REHAB - HABITAT TREES OFFSET PLANTING			
Scientific name	Common name	Spacing	Total Qty
Allocasuarina littoralis	She Oak	5m	46
			46
Plant size - Tube stock between 300-500mm tall (Forestry Tube Stock)			
Install tree guards on all treees planted to protect from wallabies			



JJ **WESTERN REHABILITATION - TYPICAL PLANTING SECTION**
SCALE 1:50

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DRAWING: **CENTRAL DRAIN HABITAT & REHABILITATION ZONE**
PROJECT: **WALLUM ESTATE**
EARLY ECO WORKS PACKAGE

REV.	ISSUE / AMENDMENTS	DATE
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SCALE 1:1000 @ A3 (0, 10, 20, 30, 40m)
REV. C
DESIGNED IC/SS
DRAWN SS
CHECKED DMC
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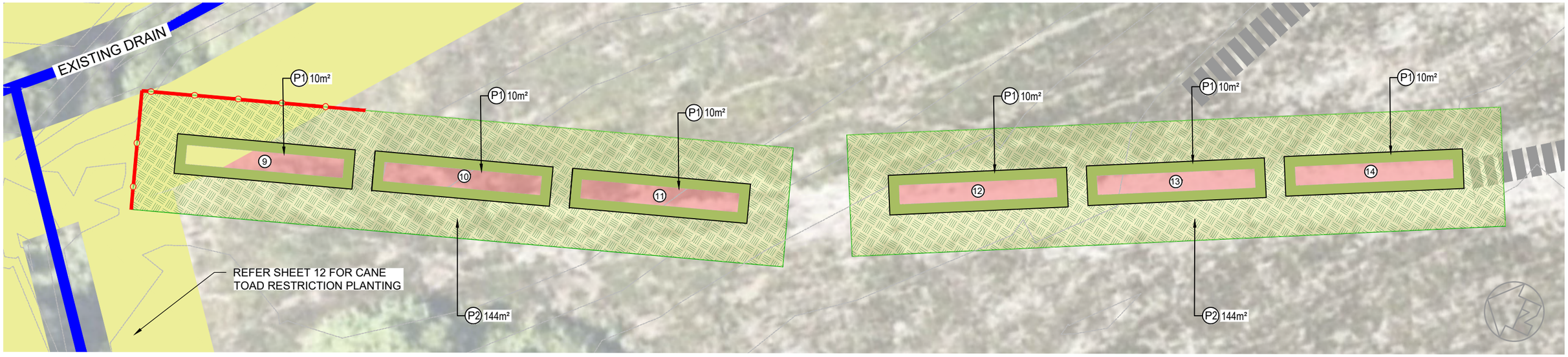
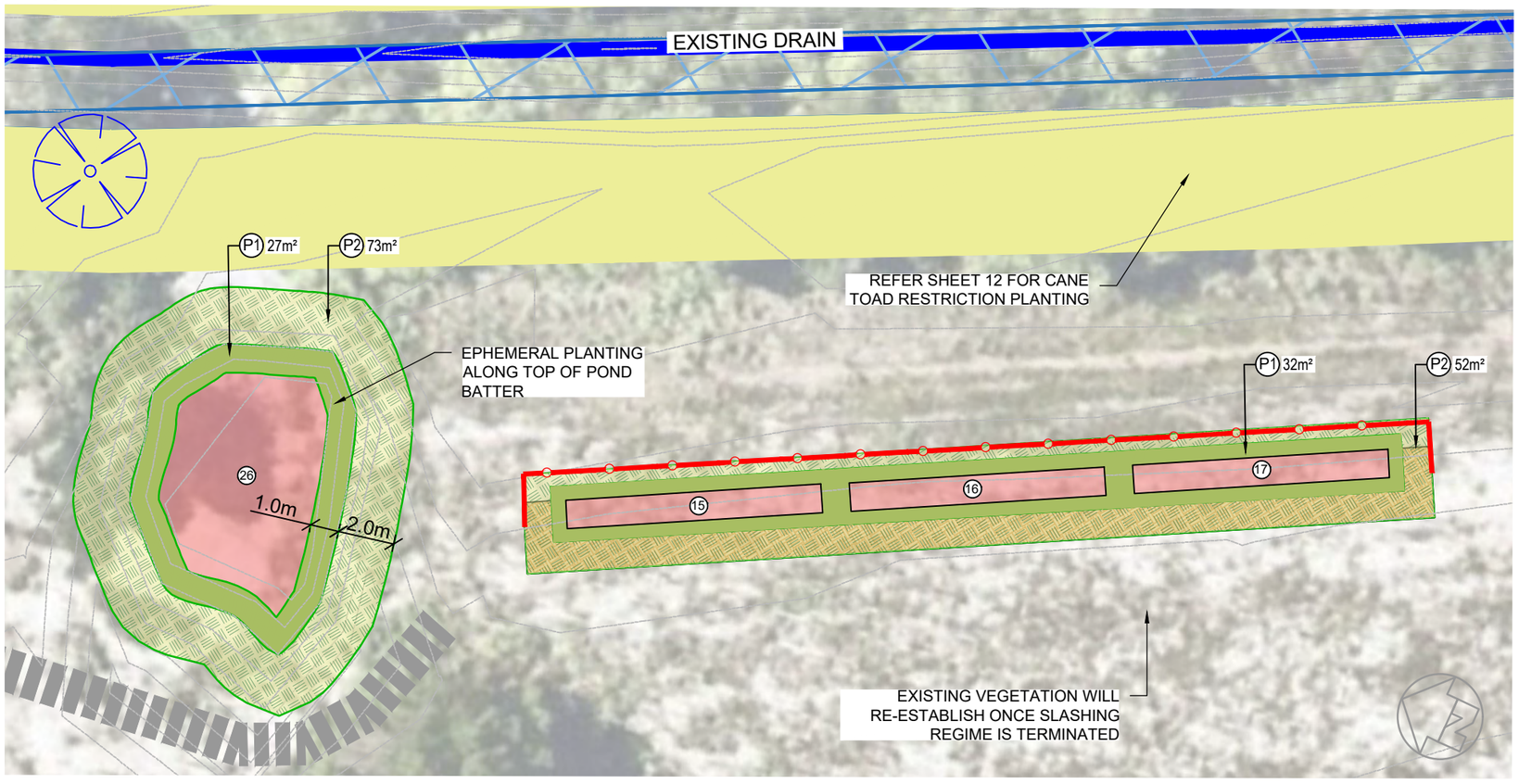


01/14 **SOUTH WEST WF POND PLANTING PLAN 01**
SCALE 1:200



02/14 **SOUTH WEST WF POND PLANTING PLAN 01**
SCALE 1:200

LEGEND

- EARTHWORKS EXTENT
- WALLUM SAND HEATH TOP DRESSING
- TRANSLOCATED "LIVE SOIL"
- P1 ZONE 1 - EPHEMERAL PLANTING
  DENSITY 4/m²
- P2 ZONE 2 - PERIMETER PLANTING
  DENSITY 4/m²
- P3 ZONE 3 - CANE TOAD RESTRICTION PLANTING
  REFER SHEET 12 FOR DETAILS
- EXISTING TREES TO BE RETAINED
- RETAINED WF HABITAT
- CONTOUR
- NO GO ZONE FENCE
- SEDIMENT FENCE - REFER SHEET 08
- EXISTING WATERWAY

SOUTH WEST PONDS 9 - 25 - PLANTING SCHEDULE

Species Name	Common Name	P1 - Ephemeral		206	P2 - Perimeter		555
		Density plants/m²	% Prop	QTY	Density plants/m²	% Prop	QTY
*Baumea articulata**	Jointed rush	4	25%	206			
Baloskion pallens	Bog Rush				4	20%	444
Baloskion tetraphyllum	Plume Rush				4	15%	333
Baumea rubiginosa	Slender twig rush	4	20%	165			
Blechnum indicum	Water Fern	4	20%	165			
Gahnia clarkei	Saw-sedge				4	15%	333
Gahnia sieberiana	Red-fruit Saw Sedge				4	15%	333
*Lepironia articulata**	Grey Sedge	4	25%	206			
Lomandra longifolia	Spiny-headed mat-rush				4	15%	333
Philydrum lanuginosum	Frogsmouth	4	10%	82			
Schoenus brevifolius	Zig-zag bog rush				4	20%	444
	TOTAL		100%	824		100%	2220

*Plant at bottom of batter ephemeral batter

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DRAWING: **SOUTH WEST WF POND PLANTING PLAN 01 - 02**
PROJECT: **WALLUM ESTATE**
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SCALE 1:200 @ A3 (0 1.0 2.0 3.0 4.0 5.0m)
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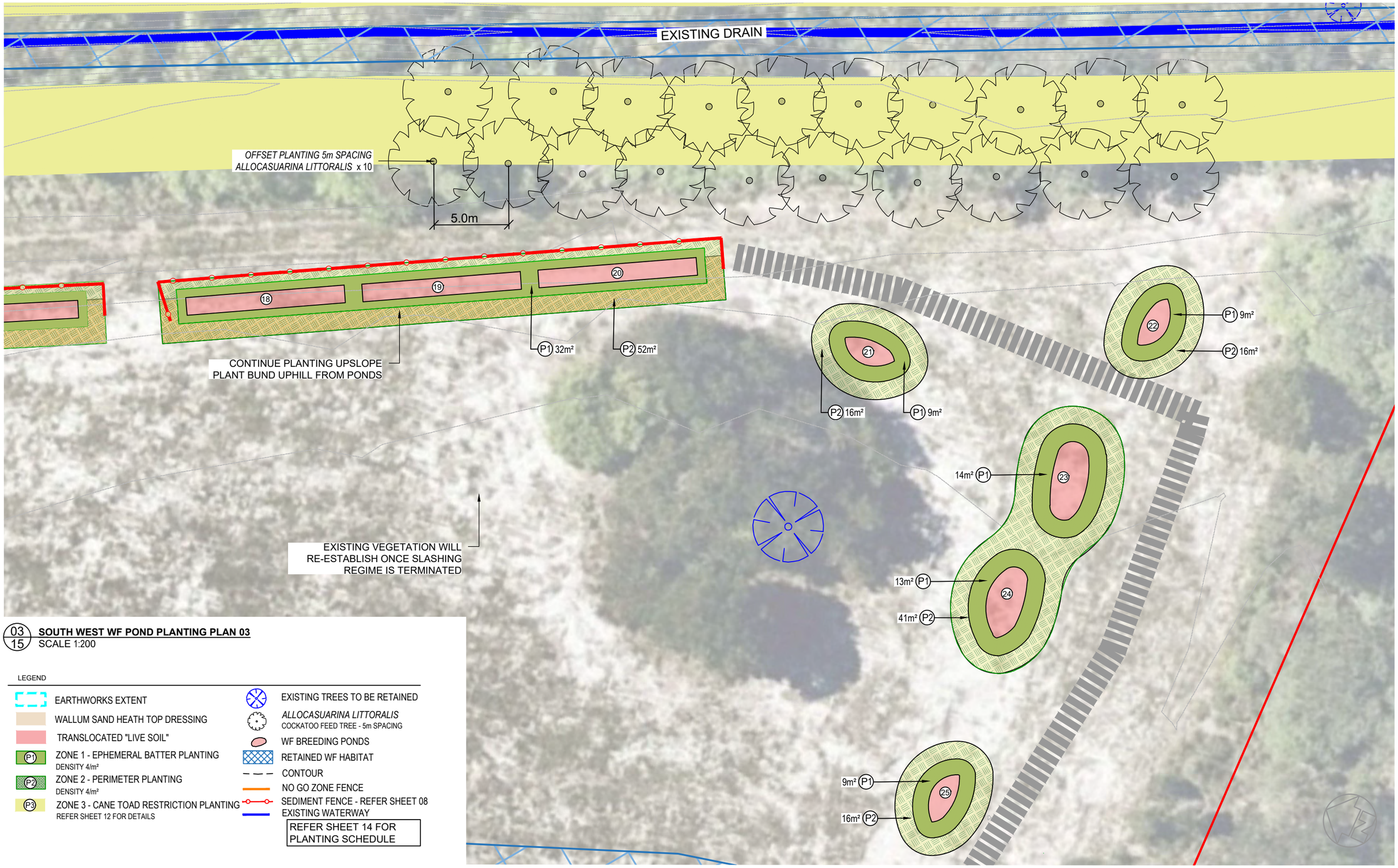

03
15 **SOUTH WEST WF POND PLANTING PLAN 03**
SCALE 1:200

LEGEND

- EARTHWORKS EXTENT
- WALLUM SAND HEATH TOP DRESSING
- TRANSLOCATED "LIVE SOIL"
- P1 ZONE 1 - EPHEMERAL BATTER PLANTING
  DENSITY 4/m²
- P2 ZONE 2 - PERIMETER PLANTING
  DENSITY 4/m²
- P3 ZONE 3 - CANE TOAD RESTRICTION PLANTING
  REFER SHEET 12 FOR DETAILS
- EXISTING TREES TO BE RETAINED
- *ALLOCASUARINA LITTORALIS*
  COCKATOO FEED TREE - 5m SPACING
- WF BREEDING PONDS
- RETAINED WF HABITAT
- CONTOUR
- NO GO ZONE FENCE
- SEDIMENT FENCE - REFER SHEET 08
- EXISTING WATERWAY

REFER SHEET 14 FOR PLANTING SCHEDULE

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DRAWING: **SOUTH WEST WF POND PLANTING PLAN 03**

PROJECT: **WALLUM ESTATE**
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SCALE 1:200 @ A3
0 1.0 2.0 3.0 4.0 5.0m

REV. **C**

DESIGNED	IC/SS	CAD FILE No. **1-211400_EW.DWG**
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LEGEND

- PROPERTY BOUNDARY
- TRANSLOCATED "LIVE SOIL"
- (P1) ZONE 1 - EPHEMERAL BATTER PLANTING
  DENSITY 4/m²
- (P2) ZONE 2 - PERIMETER PLANTING
  DENSITY 4/m²
- EXISTING TREES TO BE RETAINED
- *ALLOCASUARINA LITTORALIS*
  COCKATOO FEED TREE - 5m SPACING
- *EUCALYPTUS ROBUSTA* QTY
  KOALA FEED TREE - 10m SPACING
- RETAINED WF HABITAT
- NO GO ZONE FENCE
- SEDIMENT FENCE - REFER SHEET 08
- EXISTING SANDY TRACK TO BE RIPPED TO PROMOTE REGENERATION. KEEP CLEAR OF TREE ROOTS

EASTERN REHAB - HABITAT TREES OFFSET PLANTING

Scientific name	Common name	Spacing	Total Qty
Allocasuarina littoralis	She Oak	5m	30
Eucalyptus robusta	Swamp Mahogany	10m	72
			102
Plant size - Tube stock between 300-500mm tall (Forestry Tube Stock)			
Install tree guards on all treees planted to protect from wallabies			

EUCALYPTUS ROBUSTA x 30
MIN 10m SPACING

ALLOCASUARINA LITTORALIS x 30
MIN 5m SPACING

DO NO RIP MAIN TRACK TO SIMPSON CREEK AS THIS IS TO UPGRADED IN FUTURE WORKS

RIP EXISTING COMPACTED SANDY TRACKS TO PROMOTE NATURAL REGENERATION THROUGH EXISTING SEED BANK

MZ-1

MZ-2

EXISTING WF HABITAT TO BE RETAINED

BUNTING FENCE TO BE LOCATED ON EARTHWORKS EXTENT FOR CLEAR DELINEATION OF NO GO ZONE

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DRAWING: **EASTERN HABITAT & REHABILITATION ZONE**

PROJECT: **WALLUM ESTATE**
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REV. C

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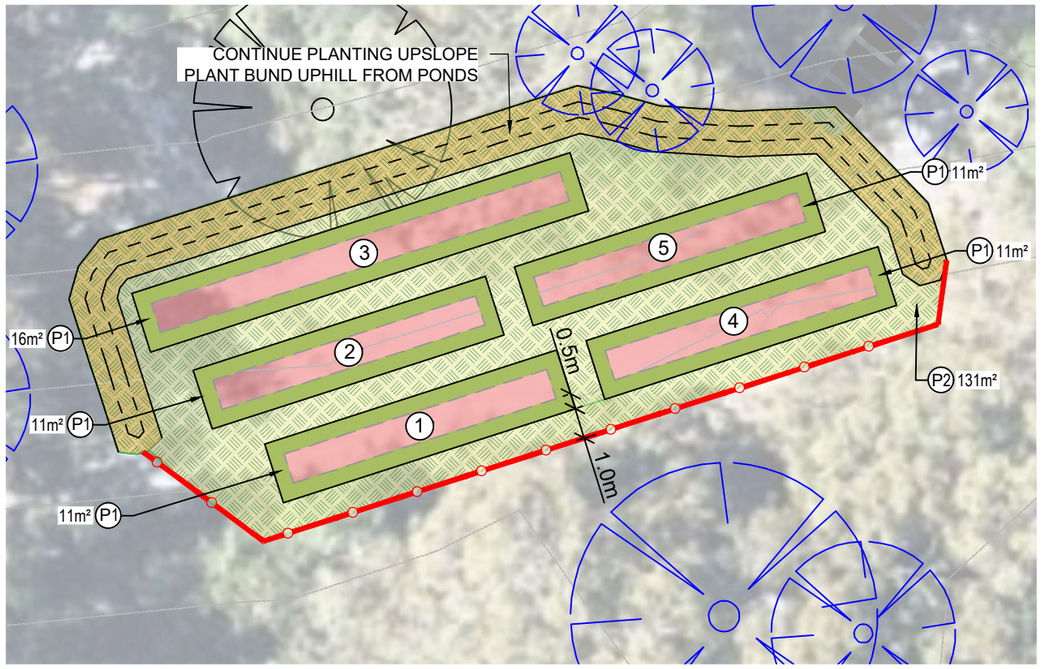
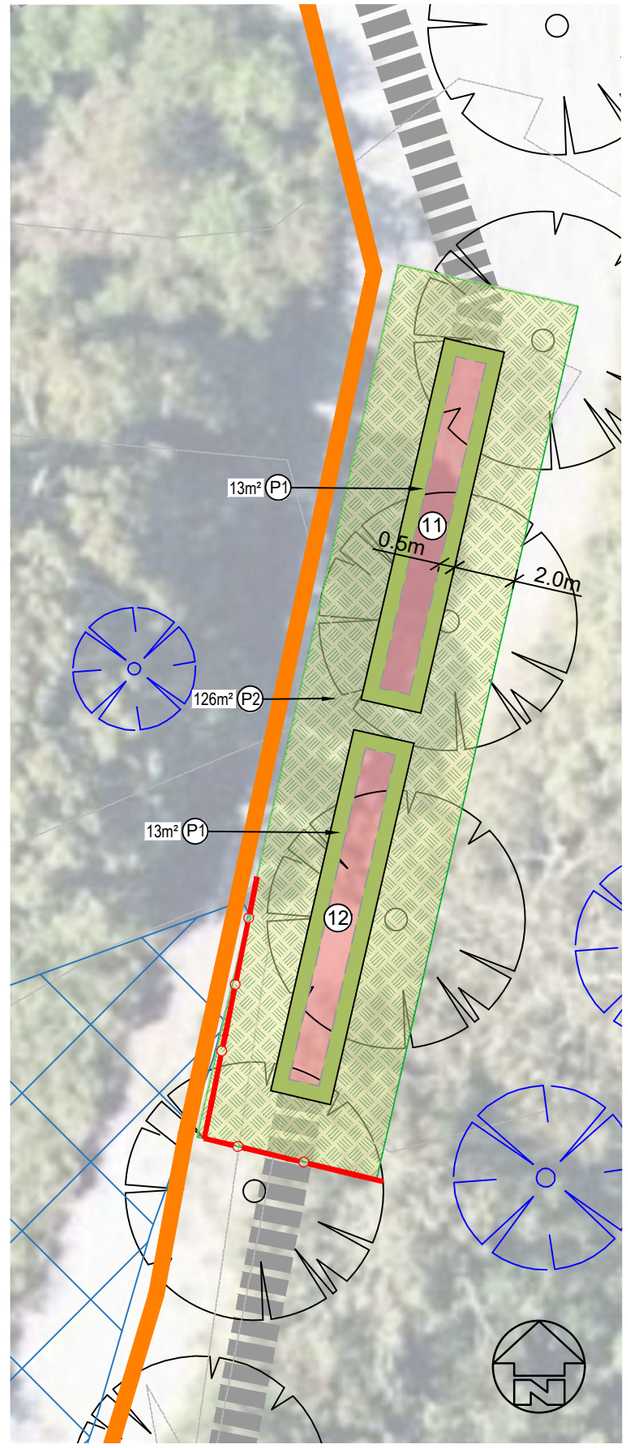


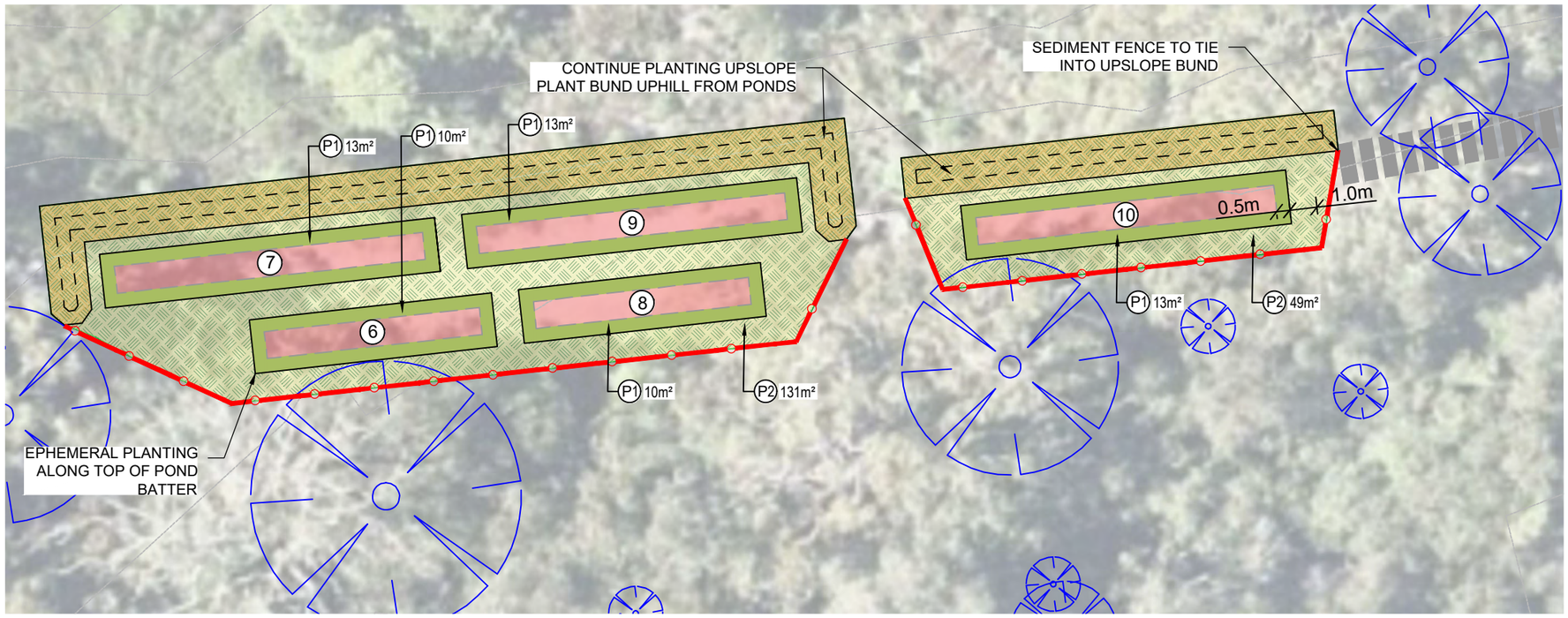
01/17 **EASTERN CONSTRUCTED WF BREEDING PONDS**
SCALE 1:200

EASTERN PONDS 1 - 12 - PLANTING SCHEDULE							
Species Name	Common Name	P1 - Ephemeral		145	P2 - Perimeter		437
		Density plants/m²	% Prop	QTY	Density plants/m²	% Prop	QTY
*Baumea articulata**	Jointed rush	4	25%	206			
Baloskion pallens	Bog Rush				4	20%	444
Baloskion tetraphyllum	Plume Rush				4	15%	333
Baumea rubiginosa	Slender twig rush	4	20%	165			
Blechnum indicum	Water Fern	4	20%	165			
Gahnia clarkei	Saw-sedge				4	15%	333
Gahnia sieberiana	Red-fruit Saw Sedge				4	15%	333
*Lepironia articulata**	Grey Sedge	4	25%	206			
Lomandra longifolia	Spiny-headed mat-rush				4	15%	333
Philydrum lanuginosum	Frogsmouth	4	10%	82			
Schoenus brevifolius	Zig-zag bog rush				4	20%	444
		TOTAL	100%	824		100%	2220

LEGEND

- TRANSLOCATED "LIVE SOIL"
- P1 ZONE 1 - EPHEMERAL BATTER PLANTING
  DENSITY 4/m²
- P2 ZONE 2 - PERIMETER PLANTING
  DENSITY 4/m²
- EXISTING TREES TO BE RETAINED
- *ALLOCASUARINA LITTORALIS*
  COCKATOO FEED TREE - 5m SPACING
- *EUCALYPTUS ROBUSTA* QTY
  KOALA FEED TREE - 10m SPACING
- RETAINED WF HABITAT
- NO GO ZONE FENCE
- SEDIMENT FENCE - REFER SHEET 08





02/17 **EASTERN CONSTRUCTED WF BREEDING PONDS**
SCALE 1:200

03/17 **EASTERN CONSTRUCTED WF BREEDING PONDS**
SCALE 1:200

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DP 1251383,
TORAKINA DR
BRUNSWICK
HEADS

SCALE 1:200 @ A3
0 1.0 2.0 3.0 4.0 5.0m
REV. C

DESIGNED IC/SS
DRAWN SS
CHECKED DMC

CAD FILE No. 1-211400_EW.DWG
DWG No. 1-211400_EW_17

EARTHWORKS

- REFER TO AWC_1_211400_EW_01-07 FOR EARTHWORKS DOCUMENTATION.
- THE EXTENT OF THE WORKS ARE SUSCEPTIBLE TO FINISHED CONSTRUCTION TOLERANCES. AS SUCH, A TOLERANCE OF +/-50MM APPLIES.

STOCKPILES

- THE POSITION OF ANY STOCKPILES MUST BE APPROVED BY THE SITE SUPERINTENDENT.
- ADEQUATE PROTECTION FOR PILED MATERIAL MUST BE SUPPLIED TO PREVENT WIND AND WATER EROSION.
- NOTHING MAY BE REMOVED FROM THE STOCKPILE EXCEPT NOXIOUS WEEDS THAT MAY GERMINATE DURING THE STORAGE PERIOD.
- ALL STOCKPILES SHALL BE ENCLOSED WITHIN A SEDIMENT FENCE.

NATURAL REGENERATION TECHNIQUE

TRANSLOCATED SLABS & 'LIVE' TOPSOIL SOURCED FROM IMPACTED WF HABITAT.

IT IS ANTICIPATED THAT SEED AND RHIZOME BANK WITHIN THE "LIVE" TOPSOIL AND TRANSLOCATED STABS WILL STRIKE AND NATURALLY REGENERATE THE CREATED HABITAT.

INDICATIVE STOCKPILE LOCATIONS ARE IDENTIFIED ON SHEET AWC_AWC_1_211400_EW_01

WEED CONTROL

- WEEDS ARE LIMITED ON SITE. CONTRACTORS MUST BE CAREFUL NOT TO IMPORT WEEDS VIA INTRODUCED PLANT STOCK OR MACHINERY ETC.
- WHISKEY GRASS IS THE DOMINANT WEED SPECIES ON SITE, FOUND IN BOTH MZ1 AND MZ2.
- ONLY CONTRACTORS THAT ARE EXPERIENCED AND TRAINED IN PLANT IDENTIFICATION AND WEED REMOVAL TECHNIQUES SHALL BE EMPLOYED TO REMOVE VEGETATION AND WEEDS.

PLANTING EXTENTS

PERIMETER PLANTING IS TO BE IMPLEMENTED AROUND ALL CONSTRUCTED FROG PONDS. REFER SHEET OFFSET TREES ARE TO BE INSTALLED ARE PER SHEET AWC_1_211400_EW_12 & 16

PLANT ESTABLISHMENT

IF NATURAL REGENERATION IS POOR AND THE OVERALL PLANT COMMUNITY HEALTH IS LOW WITHIN THE CREATED WF BREEDING PONDS, PONDS MUST BE PLANTED.

IN THIS SCENARIO AN AUDIT WILL BE UNDERTAKEN OF ALL PONDS AND GUIDANCE FROM AWC WILL BE PROVIDED IN REGARDS TO PLANTING AREAS, DENSITIES AND SCHEDULE.

.

PRE-ORDERING

THE CONTRACTOR SHALL BE RESPONSIBLE FOR ENSURING THAT ALL PLANT MATERIAL IS

AVAILABLE TO SIZE AND SPECIES TYPE NOMINATED IN THE PLANT SCHEDULES.

FOR SPECIES IN LARGE QUANTITIES THIS WILL REQUIRE THE PRE ORDERING AND GROWING ON OF SPECIES

BY A SELECTED NURSERY. PROPOSED PRE ORDER PLANTS ARE TO BE SOURCED AND APPROVED IN CONSULTATION WITH THE DESIGNER.

CONFIRM ANY CHANGES WITH THE DESIGNERS AND DOCUMENT THE CHANGE IN THE AS-CONSTRUCTED DRAWINGS. PLANT AVAILABILITY SHOULD BE DISCUSSED AT THE SITE INCEPTION MEETING. NO SUBSTITUTION OF PLANT SPECIES SHOULD BE MADE WITHOUT WRITTEN APPROVAL FROM THE DESIGNER OR AN ECOLOGIST.

PLANT STOCK

PLANT SPECIES REFER TO AWC_1_211400_EW_12-17

DAMAGED OR FAILED PLANTS MUST BE REPLACED WITH PLANTS OF THE SAME TYPE AND SIZE.

PLANTS

GENERAL: PROVIDE LOCAL PROVENANCE PLANTS WHERE AVAILABLE WITH LARGE HEALTHY ROOT SYSTEMS, NO EVIDENCE OF ROOT CURL, RESTRICTION OR DAMAGE. PLANTS SHOULD BE VIGOROUS, WELL ESTABLISHED, FREE FROM PEST AND DISEASE AND OF A FORM CONSISTENT WITH THE SPECIES OR VARIETY.

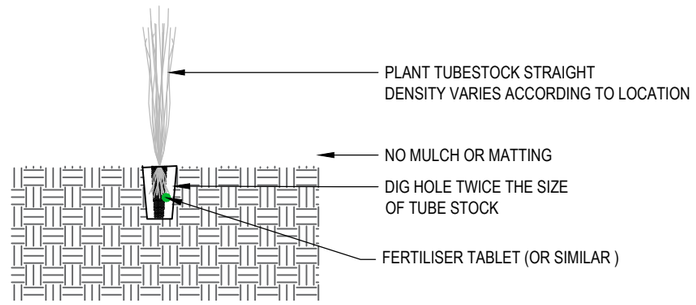
- PLANT STOCK SHOULD BE HARDENED OFF IN A NURSERY WITH CLIMATE SIMILAR TO THE SUBJECT SITE.
- PLANTS SHOULD BE AN AVERAGE 300-500MM HIGH INCLUDING POT AND NOT LESS THAN 200MM IN HEIGHT
- PLANT STOCK TO BE IN "TUBE STOCK" OR SIMILAR
- REPLACEMENT: REPLACE DAMAGED OR FAILED PLANTS WITH PLANTS OF THE SAME TYPES AND SIZE.

PLANTING TIMING

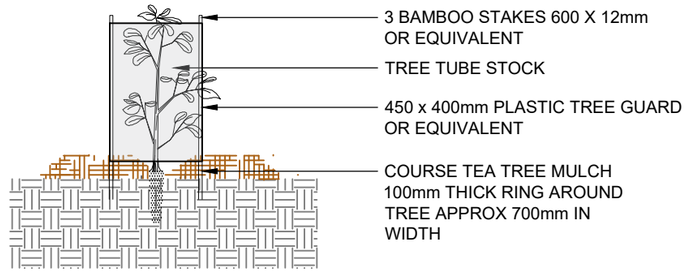
DO NOT PLANT IN UNSUITABLE WEATHER CONDITIONS SUCH AS EXTREME HEAT, COLD, WIND OR RAIN. IN OTHER THAN SANDY SOILS, SUSPEND EXCAVATION WHEN THE SOIL IS WET.

PLANTING TECHNIQUE

PLANT HOLES SHOULD BE TWICE THE SIZE OF THE TUBE STOCK. PLANTS SHOULD BE CAREFULLY REMOVED FROM THE TUBE TO ENSURE THEIR STEMS ARE NOT BROKEN FROM THE ROOT BALL. THE TOP OF THE ROOT BALL SHOULD BE SLIGHTLY LOWER THAN THE SURFACE LEVEL AFTER TOPSOIL HAS BEEN FIRMLY PLACED IN THE PLANTING HOLE AND AROUND THE PLANT. WATER CRYSTALS AND FERTILISER MAY BE USED TO ASSIST WITH ESTABLISHMENT; HOWEVER FERTILISER SHOULD NOT BE NECESSARY IN AMELIORATED SOILS.



01/18 **FROG POND PLANTING - TUBE STOCK**
SCALE NTS



02/18 **HABITAT TREES - TUBE STOCK & TREE GUARD**
SCALE NTS

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www.awconsult.com.au

CLIENT: CLARENCE PROPERTY

PARTNER: CivilTech Consulting Engineers

DRAWING: **PLANTING NOTES & DETAILS**

PROJECT: **WALLUM ESTATE**
EARLY ECO WORKS PACKAGE

REV.	ISSUE / AMENDMENTS	DATE
A	FOR DISCUSSION	16.02.22
B	FOR REVIEW	12.04.22
C	FOR APPROVAL	20.06.23

ENG CERT
Wade Fletcher
CiviliTech Consulting Engineers
Chartered Professional Engineer
EA ID: 2954545

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BRUNSWICK
HEADS

SCALE

REV. C

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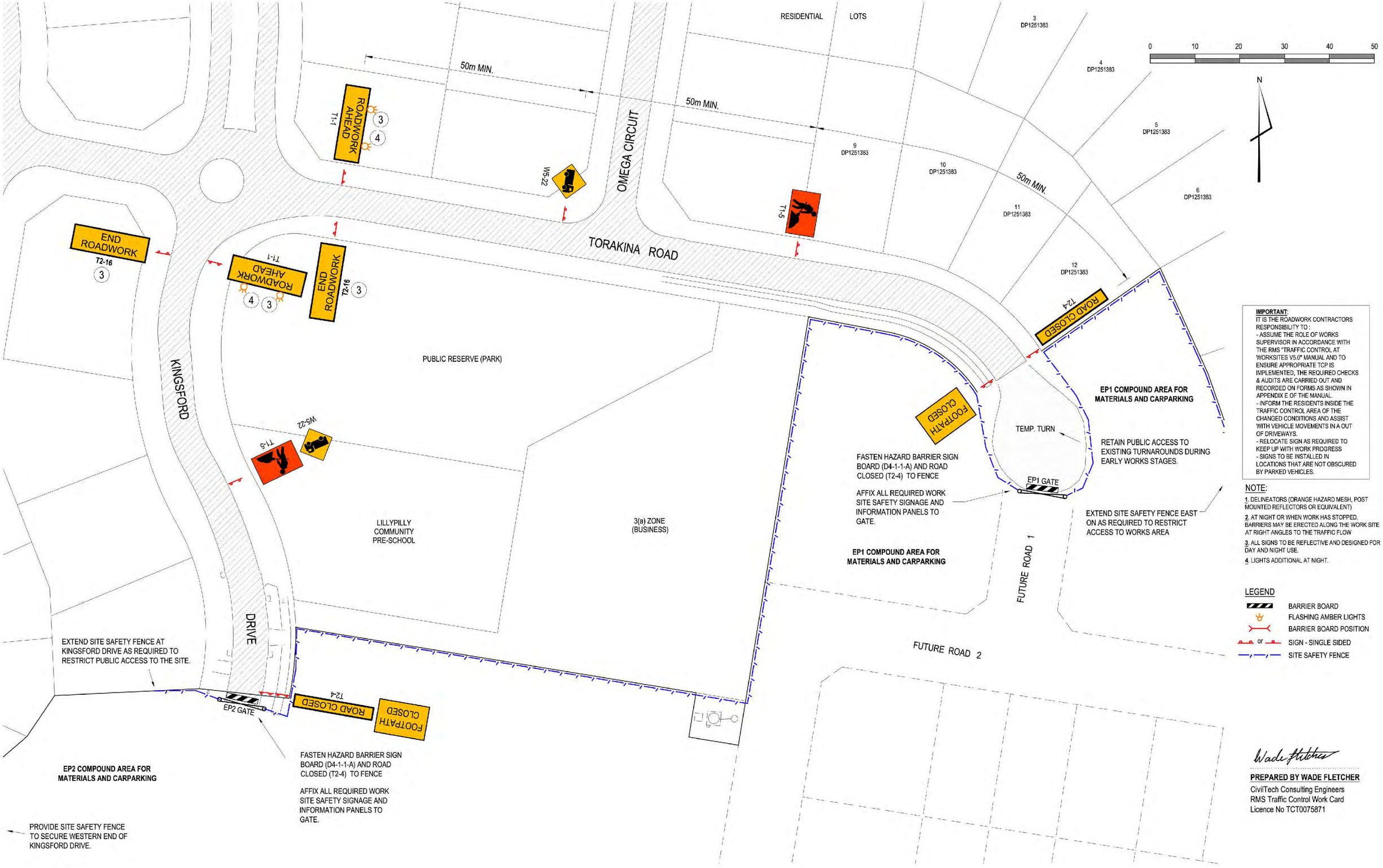
DRAWN SS
CHECKED DMC

CAD FILE No. **1-211400_EW.DWG**
DWG No. **1-211400_EW_18**



IMPORTANT:
IT IS THE ROADWORK CONTRACTORS RESPONSIBILITY TO :
- ASSUME THE ROLE OF WORKS SUPERVISOR IN ACCORDANCE WITH THE RMS "TRAFFIC CONTROL AT WORKSITES V5.0" MANUAL AND TO ENSURE APPROPRIATE TCP IS IMPLEMENTED, THE REQUIRED CHECKS & AUDITS ARE CARRIED OUT AND RECORDED ON FORMS AS SHOWN IN APPENDIX E OF THE MANUAL.
- INFORM THE RESIDENTS INSIDE THE TRAFFIC CONTROL AREA OF THE CHANGED CONDITIONS AND ASSIST WITH VEHICLE MOVEMENTS IN A OUT OF DRIVEWAYS.
- RELOCATE SIGN AS REQUIRED TO KEEP UP WITH WORK PROGRESS
- SIGNS TO BE INSTALLED IN LOCATIONS THAT ARE NOT OBSCURED BY PARKED VEHICLES.

NOTE:

1. DELINEATORS (ORANGE HAZARD MESH, POST MOUNTED REFLECTORS OR EQUIVALENT)
2. AT NIGHT OR WHEN WORK HAS STOPPED, BARRIERS MAY BE ERECTED ALONG THE WORK SITE AT RIGHT ANGLES TO THE TRAFFIC FLOW
3. ALL SIGNS TO BE REFLECTIVE AND DESIGNED FOR DAY AND NIGHT USE.
4. LIGHTS ADDITIONAL AT NIGHT.

LEGEND

- BARRIER BOARD
- FLASHING AMBER LIGHTS
- BARRIER BOARD POSITION
- SIGN - SINGLE SIDED (or)
- SITE SAFETY FENCE

Wade Fletcher

PREPARED BY WADE FLETCHER
CivilTech Consulting Engineers
RMS Traffic Control Work Card
Licence No TCT0075871

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CLIENT: CLARENCE PROPERTY

PARTNER: CivilTech Consulting Engineers

DRAWING: **TRAFFIC MANAGEMENT PLAN**

PROJECT: **WALLUM ESTATE**
EARLY ECO WORKS PACKAGE

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REV. **C**

DESIGNED	IC/SS	CAD FILE No. **1-211400_EW.DWG**
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DA 10.2021.575.1 CONDITIONS

3. Vegetation Removal

This development consent does not authorise any native tree to be ringbarked, cut down, lopped, removed, or damaged, or caused to be ringbarked, cut down, lopped, removed or damaged beyond those in the area identified as "extent of works" on the Vegetation Management Plan (VMP). No native trees or vegetation may be cleared or removed until a Subdivision Certificate has been issued relevant to those trees and vegetation.

4. Discovery of Aboriginal Relics

Upon discovery of any Aboriginal relics within the meaning of the National Parks and Wildlife Act 1974, the developer shall immediately notify the NSW Department of Planning Industry and Environment (DPIE), Tweed Byron Local Aboriginal Land Council and the Bundjalung of Byron Bay Aboriginal Corporation (Arakwal) and must immediately cease works within the vicinity until such time as the necessary permits have been obtained from DPIE to continue the work. The developer must comply with any further request made by DPIE to cease work for the purposes of archaeological assessment AND recording.

5. Integrated Approvals from other State Government Approval Bodies

This development consent includes an Integrated development approval under Sections 4.46 and 4.47 of the Environmental Planning and Assessment Act 1979, an authorisation under section 100B of the Rural Fires Act 1997 in respect of bush fire safety for subdivision for the purpose of creating residential land, and is subject to the General Terms of Approval from the RFS dated 23 December 2021 contained in **Schedule 1** of this Notice of Determination.

THE FOLLOWING CONDITIONS MUST BE COMPLIED WITH PRIOR TO COMMENCEMENT OF SUBDIVISION WORKS

The following conditions apply to all stages.

47. Prestart Meeting - ecological restoration works

The Environmental Manager must arrange a prestart site meeting with Council Ecologist/ Environmental Health Officer prior to commencement of any ecological restoration works.

Advisory note: A minimum 2 weeks' notice must be given to Council prior to the meeting.

48. CEMP - Reporting and Review

An independent environmental audit of CEMP implementation is to be undertaken by a suitably qualified person/s and submitted to Council for approval prior to the commencement of each Stage of the development. Any non-compliance/s are to be documented along with contingency measures undertaken with suggested alterations to future stages and the CEMP updated accordingly.

The review of compliance with the CEMP should include but not be limited to:

a. Surface water quality monitoring and impacts;
b. Adequacy of erosion and sediment control measures;
c. Groundwater level and quality;
d. Acid frog monitoring and habitat health;
e. Threatened species monitoring and health;
f. Vegetation rehabilitation and management progress;
g. Mosquito management;
h. Dust control;
i. Noise and vibration management;
j. Acid sulfate soil management; and
k. Contaminated land management.

49. Trees to be retained and fenced

Trees to be retained are to be protected by a fence so as to minimise disturbance to existing ground conditions within the dripline of the trees. The fence is to be constructed:

a. with a minimum height of 1.2 metres,
b. outside the dripline of the tree,
c. of steel star pickets at a maximum distance of 2 metres between pickets,
d. using a minimum of 3 strands of steel wire,
e. to enclose the tree, and
f. with orange barrier mesh, or similar, attached to the outside of the fence and continuing around its perimeter

The fence is to be maintained for the duration of the site clearing, preparation and construction works.

50. Signs to be erected on building and demolition sites

A sign must be erected in a prominent position on the work site:

a. stating that unauthorised entry to the work site is prohibited, and
b. showing the name of the person in charge of the work site and a telephone number at which that person may be contacted outside working hours.

Any such sign is to be removed when the work has been completed.

51. Copies of Approved Plans

Copies of approved plans required by conditions of this consent including ASSMP, BPoM CEMP, SMP, SWGMP, UFP, VMP, and WFMP must be keep in a prominent location on site where they can be easily accessed by construction and operational personnel.

52. Approved Environmental Plans must be implemented

All controls and measures must be maintained in accordance with approved plans and reports. The Environmental Manager nominated by the applicant is required to ensure that the construction management and all construction staff are made aware of their responsibility to abide by the plans approved under this consent.

53. Acid Sulfate Soils

Acid sulfate soil controls, and management measures are to be in place in accordance with the approved Management Plans. All treatment and storage facilities be in place prior the commencement of any subdivision works.

54. Dewatering of Excavations

Dewatering of excavations must be conducted in accordance with the approved dewatering management plan. Only clean and unpolluted water is to be discharged to Council's stormwater drainage system or any watercourse to ensure compliance with the Protection of Environment Operations Act.

55. Subdivision Work

Subdivision work in accordance with the development consent must not be commenced until a Subdivision Works Certificate has been issued, a principal certifying authority has been appointed and at least 2 days' written notice for the intention to commence works has been made, in accordance with the requirements of the Environmental Planning and Assessment Act and Regulations. The written notice for the intention to commence works must also include names and contact details of the certifying engineer and principal contractor.

Note. Subdivision work means any physical activity authorised to be carried out under the conditions of this development consent for the subdivision of land, including earthwork, road work, stormwater drainage work, landscaping work, tree/vegetation removal, erosion and sediment control, traffic control, etc.

56. Public Liability Insurance

The developer and/or contractor must produce evidence to the Principal Certifying Authority of public liability insurance cover for a minimum of $20 million. Council is to be nominated as an interested party on the policy.

57. Erosion and sediment measures

Erosion and sedimentation controls are to be in place in accordance with the approved Erosion and Sediment Control Plan.

No soil or fill material is to be placed within the dripline of a tree so as to cause changes in surface level by more than 50mm from the existing level and such soil is not to be compacted. Such soil fill must not be finer than that being covered in situ, e.g. clay must not be placed over loam soil.

Note: Council may impose on-the-spot fines for non-compliance with this condition.

58. Metered Stand Pipe required

Prior to the commencement of any civil works requiring water from Council water main, a metered Stand Pipe for temporary water supply must be supplied and installed by Council. Contact Council's Water and Recycling Department to arrange for this requirement on 02 6626 7000.

Note: Council may impose on-the-spot fines for non-compliance with this condition.

THE FOLLOWING CONDITIONS MUST BE COMPLIED WITH DURING CONSTRUCTION OF SUBDIVISION WORKS

THE CONTRACTOR IS TO READ THE DEVELOPMENT APPLICATION CONSENT DA10.2021.575 FOR A COMPLETE LIST OF CONDITIONS.

AWC
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www.awconsult.com.au

CLIENT: CLARENCE PROPERTY

PARTNER: CivilTech Consulting Engineers

DRAWING: DA 10.2021.575.1 CONSTRUCTION CONDITIONS 01

PROJECT: WALLUM ESTATE EARLY ECO WORKS PACKAGE

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ENG CERT
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Chartered Professional Engineer
RPEQ ID: 2954545

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SCALE

REV. C

DESIGNED	IC/SS	CAD FILE No. 1-211400_EW.DWG
DRAWN	SS	DWG No. 1-211400_EW_20
CHECKED	DMC	

DA 10.2021.575.1 CONDITIONS

THE FOLLOWING CONDITIONS MUST BE COMPLIED WITH DURING CONSTRUCTION OF SUBDIVISION WORKS

These conditions to apply to all stages of the development.

59. Protection of Native Trees
All trees nominated to be retained by notation or condition as a requirement of the development consent shall be maintained and protected in accordance with AS 4970-2009 - Protection of Trees on Development Sites for the duration of the constriction works.

60. Care to be taken when placing services near trees
To minimise root disturbance where services are to be laid in close proximity to trees, any excavation within the Tree Protection Zone (TPZ) for installation of underground services is to be done by directional drilling or in manually excavated trenches in accordance with Section 4.5.5 of AS4970-2009. Works must be conducted under the supervision of the project arborist (minimum AQF level 5 qualified arborist) and may include the use of pneumatic or hydraulic tools such as air knifes.

61. Landscaping
All landscaping on any part of the site must accord with the requirement to plant only appropriate local native species as marked on the stamped plans.

62. Protection of native fauna from disturbance
a. Any clearing of native vegetation and/or earthworks ('works') as part of any development approval from Council must not commence until the area proposed for such works has been inspected for the presence of all fauna species using the site by a suitably qualified and experienced individual.
b. Works specified in (a) must be temporarily suspended within a range of 25m from any tree which is concurrently occupied by a koala and other native fauna and must not resume until the koala and other fauna has moved from the tree of its own volition.
c. Works must not commence until the area proposed for clearing has been inspected for the presence of koalas and other native fauna and approval given in writing by a suitably qualified individual.
d. Approval to proceed with the clearing of vegetation in accordance with this section is only valid for the day on which the inspection has been undertaken.

The individual referred to in (a and c) above, or a nominated representative, must remain on site during any approved clearing of vegetation.

63. Acid Sulfate Soils Management
Acid sulfate soils must be managed and disposed of in accordance with the approved Construction Environmental Management Plan.

64. Unexpected Findings Protocol - Contamination & Remediation
Construction works must be carried out in accordance with the approved Unexpected Findings Protocol (UFP).

65. Soil disturbance and excavation groundworks
All soil disturbance and excavation groundworks must be carried out in accordance with the approved ASSMP, BPoM, CEMP, SMP, SWGMP, UFP, VMP, and WFMP

66. North South Drain Construction - Role of Environmental Manager
The Environmental Manager must be on site at all times during excavation works for construction of the new north south drain. The approved CEMP must be implemented to ensure all measures and contingencies are upheld to protect the receiving environment beyond the drain excavation, including the Everitt's and Simpson Creek and native wallum frogs and their habitats.

67. Burning of felled trees prohibited
The burning of trees and associated vegetation felled during clearing operations is not permitted. Where possible, vegetation is to be mulched and reused on the site.

68. Builders rubbish to be contained on site
All builder's rubbish is to be contained on the site in a 'Builders Skips' or an enclosure. Footpaths, road reserves and public reserves are to be maintained clear of rubbish, building materials and all other items.

69. All excavated soils to be disposed of off-site
All excavated soils to be disposed of off-site and in accordance with NSW EPA Waste Classification Guidelines (2014) and approved environmental management plans.

70. Removal of demolition and other wastes
All wastes, including asbestos and lead-contaminated wastes, associated with these works are to be handled and disposed of in accordance with the requirements of the Work Cover Authority. The applicant/owner is to produce documentary evidence that this condition has been met. Wastes must be disposed of at a Licenced Waste Facility. All wastes removed from the site must be managed and disposed of in accordance with the NSW EPA Waste Classification Guidelines (2014) https://www.epa.nsw.gov.au/your-environment/waste/classifying-waste/waste-classification-guidelines

71. Excavated natural materials and demolition waste disposal
Any and all excavated natural materials and demolition and builders waste transported from the site must be accompanied (a copy kept with the transporter) by a NSW Protection of The Environment Operations Act s143 Notice.
Template s143 Notices are available at https://www.epa.nsw.gov.au/-/media/epa/corporate-site/resources/wasteregulation/160095-notices143-form.docx

72. Destination for all excavated materials during construction
The works contractor responsible for the construction and excavation of the basement must develop and maintain a register of materials that will be taken off-site for treatment, disposal, or any other purpose. The register must accurately record the destination and volume of every load of material (including clean soil, recyclable material, acid sulfate or potential acid sulfate soil, radiological waste, asbestos containing materials, sludge from dewatering treatment tanks, etc.). Individual vehicle registrations associated with off-site transport of materials and excavation waste to be recorded in the register.

Council must be provided with a copy of the completed register prior to the issuing of the Subdivision Certificate.

Advisory note: No transporting of unclassified waste, hazardous materials or material contaminated by demolition waste is permitted to be delivered to unapproved private land within NSW. Heavy penalties apply under the Contaminated Land Management Act for any failure to manage site waste materials.

73. Prevention of water pollution
Only clean and unpolluted water is to be discharged to Council's stormwater drainage system or any watercourse to ensure compliance with the Protection of Environment Operations Act.

74. Site Waste Minimisation and Management
All works must comply with the objectives of waste minimisation and waste management of Part B8.1.2 of DCP 2014.

75. Access must be permitted to Council officers
Access must be permitted to any authorised Council officers during normal business hours for the purpose of ensuring compliance with consent conditions.

76. Noise and Vibration Management Plan
Operations must be undertaken in accordance with the Noise and Vibration Management Plan as approved by Council and any conditions of consent imposed to control operational noise.

77. Construction noise
Construction noise is to be limited as follows:.

a) For construction periods of four (4) weeks and under, the L10 noise level measured over a period of not less than fifteen (15) minutes when the construction site is in operation must not exceed the background level by more than 20 dB(A).
b) For construction periods greater than four (4) weeks and not exceeding twenty_six (26) weeks, the L10 noise level measured over a period of not less than fifteen (15) minutes when the construction site is in operation must not exceed the background level by more than 10 dB(A).

THE FOLLOWING CONDITIONS MUST BE COMPLIED WITH DURING CONSTRUCTION OF SUBDIVISION WORKS

78. Construction times
Construction works must not unreasonably interfere with the amenity of the neighbourhood. In particular construction noise, when audible from adjoining residential premises, can only occur:

c) Monday to Friday, from 7 am to 6 pm.
d) Saturday, from 8 am to 1 pm.

No construction work to take place on Saturdays and Sundays adjacent to Public Holidays and Public Holidays and the Construction Industry Awarded Rostered Days Off (RDO) adjacent to Public Holidays.

Note: Council may impose on-the-spot fines for non-compliance with this condition.

79. Public safety requirements
All care is to be taken to ensure the safety of the public in general, road users, pedestrians and adjoining property. Council is not held responsible for any negligence caused by the undertaking of the works.

80. Council Specification
All works to be constructed to at least the minimum requirements of the "*Northern Rivers Local Government Design and Construction Manual*"

81. Approved Plans to remain on site
A copy of the approved Subdivision Works Certificate including plans, details and specifications must remain at the site at all times during the construction of the subdivision.

84. Conservation Limits on Parts Lot 324 and Lot 402
The eastern residual part of Lot 324 and south western residual part of Lot 402 must be managed to prohibit the following:
a. the destruction or removal of any local indigenous trees, shrubs, grasses or other vegetation, or the planting of any flora other than local indigenous flora,
b. any act or omission which may adversely affect any local indigenous flora or any indigenous fauna or their related habitats,
c. any act or omission which may result in the deterioration in the natural state or in the flow, supply, quantity, or quantity of any body of water or in the natural moisture regime of the area,
d. the creation or maintenance of any tracks through the area,
e. the removal, introduction or disturbance of any soil, rock, or other minerals,
f. any structures or dwellings,
g. the dumping of rubbish or refuse, including garden refuse and weed propagules, nor the use of any of the area for storage of any substance or material.

THE CONTRACTOR IS TO READ THE DEVELOPMENT APPLICATION CONSENT DA10.2021.575 FOR A COMPLETE LIST OF CONDITIONS.

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CLIENT: CLARENCE PROPERTY
PARTNER: CivilTech Consulting Engineers

DRAWING: DA 10.2021.575.1 CONSTRUCTION CONDITIONS 01
PROJECT: WALLUM ESTATE EARLY ECO WORKS PACKAGE

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REV. C

DESIGNED	IC/SS	CAD FILE No. 1-211400_EW.DWG
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Appendix D

Sediment and Erosion Control Plan (Bulk Earth Works)

SEDIMENT BASIN - SIZING CALUCLATIONS

Site area	Site						Remarks
	West & South	East	NS Drain	-	-	-	
Total catchment area (ha)	6.61	1.55	5.5				NS drain pre bulk earthworks
Disturbed catchment area (ha)	6.61	1.55	0.41				
Soil analysis							
Soil landscape	9540br (Black Rock)						DIPNR mapping (if relevant)
Soil Texture Group	C	C	C				Sections 6.3.3(c), (d) and (e)
Rainfall data							
Design rainfall depth (days)	5	5	5				See Sections 6.3.4 (d) and (e)
Design rainfall depth (percentile)	75	75	75				See Sections 6.3.4 (f) and (g)
x-day, y-percentile rainfall event	39.6	39.6	39.6				See Section 6.3.4 (h)
Rainfall intensity: 2-year, 6-hour storm	17	17	17				See IFD chart for the site
Rainfall erosivity (R-factor)	6780	6780	6780				Automatic calculation from above data

Site	$Q_{tc,0.25}$ (m^3/s)	Area factor	Min Basin surface area (m^2)	Depth of settling zone (m)	Settling zone volume (m^3)	Sediment storage volume (m^3)	Required basin volume (m^3)	Basin shape			Available basin volume (m^3)	Sufficient basin volume provided
								L:W Ratio	Length (m)	Width (m)		
West & South	0.415	635	263	0.6	158	158	**316**	10	51.3	5.1	**591**	YES
East	0.123	635	78	0.6	47	47	**94**	10	28.0	2.8	**386**	YES
NS Drain	0.362	635	230	0.6	138	138	**276**	10	47.9	4.8	**1062**	YES
-	0.000		0	0	0	0	0		0.0	0.0		
-	0.000		0	0	0	0	0		0.0	0.0		
-	0.000		0	0	0	0	0		0.0	0.0		

Peak flow calculations, 1

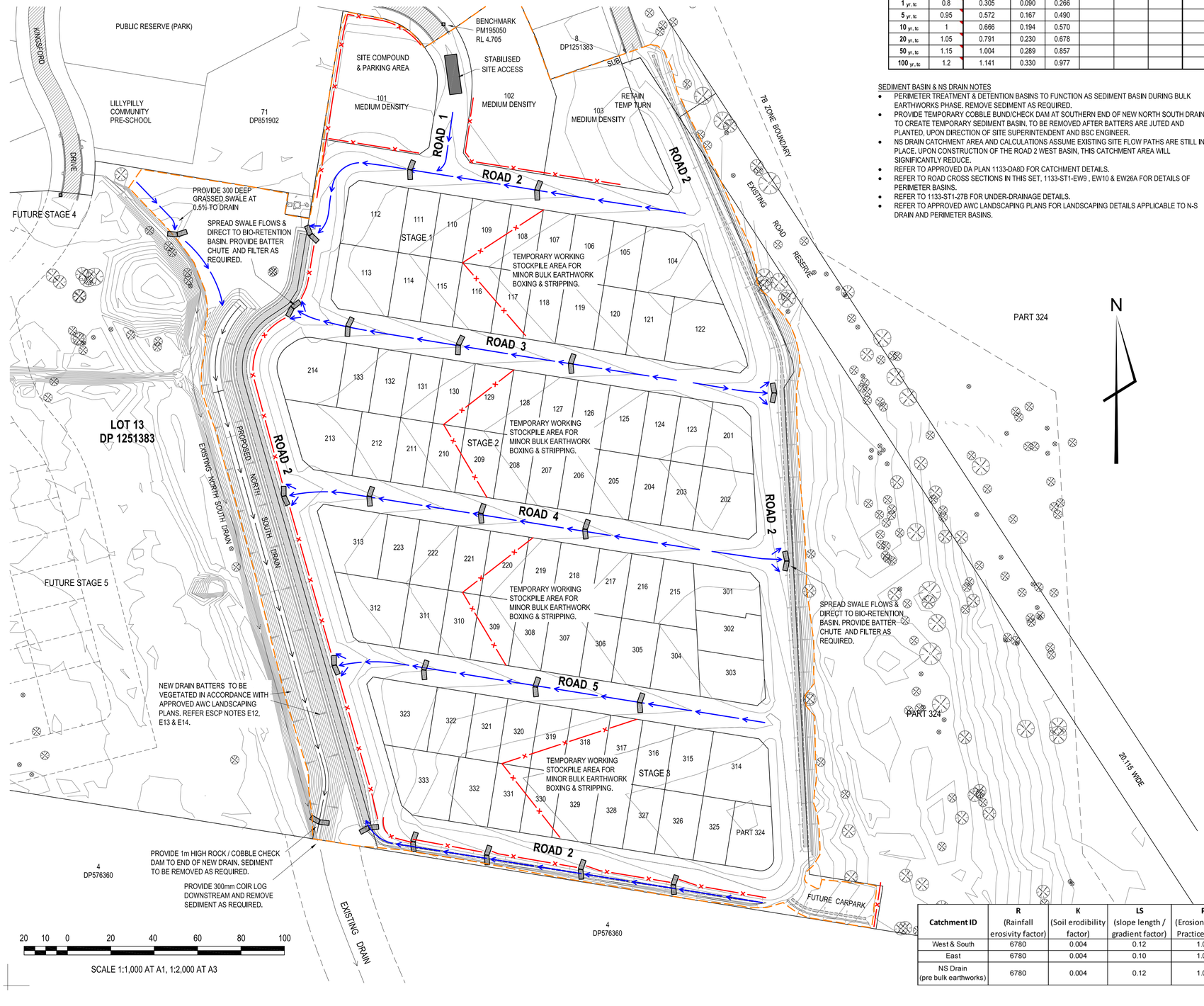
Site	A (ha)	tc (mins)	Rainfall intensity, I, mm/hr						C_{10}
			$1_{yr,tc}$	$5_{yr,tc}$	$10_{yr,tc}$	$20_{yr,tc}$	$50_{yr,tc}$	$100_{yr,tc}$	
West & South	6.61	16	83	131	145	164	190	207	0.25
East	1.55	9	105	163	180	203	233	255	0.25
NS Drain	5.5	15	87	135	149	169	195	213	0.25
-	0	0							
-	0	0							
-	0	0							

Peak flow calculations, 2

ARI yrs	Frequency factor (F_y)	Peak flows						Comment
		West & South (m^3/s)	East (m^3/s)	NS Drain (m^3/s)	- (m^3/s)	- (m^3/s)	- (m3/s)	
$1_{yr,tc}$	0.8	0.305	0.090	0.266				
$5_{yr,tc}$	0.95	0.572	0.167	0.490				
$10_{yr,tc}$	1	0.666	0.194	0.570				
$20_{yr,tc}$	1.05	0.791	0.230	0.678				
$50_{yr,tc}$	1.15	1.004	0.289	0.857				
$100_{yr,tc}$	1.2	1.141	0.330	0.977				

SEDIMENT BASIN & NS DRAIN NOTES

- PERIMETER TREATMENT & DETENTION BASINS TO FUNCTION AS SEDIMENT BASIN DURING BULK EARTHWORKS PHASE. REMOVE SEDIMENT AS REQUIRED.
- PROVIDE TEMPORARY COBBLE BUND/CHECK DAM AT SOUTHERN END OF NEW NORTH SOUTH DRAIN TO CREATE TEMPORARY SEDIMENT BASIN. TO BE REMOVED AFTER BATTERS ARE JUTED AND PLANTED, UPON DIRECTION OF SITE SUPERINTENDENT AND BSC ENGINEER.
- NS DRAIN CATCHMENT AREA AND CALCULATIONS ASSUME EXISTING SITE FLOW PATHS ARE STILL IN PLACE. UPON CONSTRUCTION OF THE ROAD 2 WEST BASIN, THIS CATCHMENT AREA WILL SIGNIFICANTLY REDUCE.
- REFER TO APPROVED DA PLAN 1133-DA8D FOR CATCHMENT DETAILS.
- REFER TO ROAD CROSS SECTIONS IN THIS SET, 1133-ST1-EW9 , EW10 & EW26A FOR DETAILS OF PERIMETER BASINS.
- REFER TO 1133-ST1-27B FOR UNDER-DRAINAGE DETAILS.
- REFER TO APPROVED AWC LANDSCAPING PLANS FOR LANDSCAPING DETAILS APPLICABLE TO N-S DRAIN AND PERIMETER BASINS.



EROSION CONTROL:

WORKS ON THE SITE SHALL BE CARRIED OUT IN THE FOLLOWING SEQUENCE:

- INSTALL BARRIER AND SILT FENCES
- STRIP AND STOCKPILE TOPSOIL
- UNDERTAKE APPROVED BULK EARTHWORKS
- REHABILITATE SITE, CLEANUP & REMOVE RUBBISH DEBRIS
- MAINTAIN TEMPORARY SOIL AND WATER MANAGEMENT WORKS FOR PHASE 2 CIVIL WORKS.

E1. THE PURPOSE OF THE SOIL AND WATER MANAGEMENT PLAN IS TO PROTECT THE DEVELOPMENT AREA AND THE SURROUNDING AREA FROM SOIL EROSION AND SUBSEQUENT POLLUTION AND SEDIMENTATION OF WATERWAYS.

E2. THE PRINCIPAL STRATEGY IS TO PROVIDE "SILT" FENCES, STRAW BALE FENCES OR SOIL BERMS DOWNSLOPE OF ALL UNPROTECTED DISTURBED AREAS TO CAPTURE ANY SEDIMENT PASSING FROM THE SITE.

E3. ALL WORKS TO BE IMPLEMENTED AND INSTALLED IN ACCORDANCE WITH LANDCOM & HOUSING NSW'S "BLUE BOOK", *MANAGING URBAN STORM WATER, SOILS AND CONSTRUCTION* AND ANY SPECIFIC DIRECTIONS OF COUNCIL.

E4. THIS PLAN IS TO BE READ IN CONJUNCTION WITH THE OTHER ENGINEERING PLANS AND ANY WRITTEN INSTRUCTIONS THAT MAY BE ISSUED. REFER TO THE EROSION AND SEDIMENT CONTROL PLAN FOR DETAILS.

E5. LAND DISTURBANCE SHALL BE LIMITED TO THAT NECESSARY FOR IMPLEMENTATION OF THE PLANS OF WORKS. BUFFER ZONES AND LANDS NOT TO BE DISTURBED SHALL BE CLEARLY MARKED WITH BARRIER FENCES. "SILT" FENCES OR STRAW BALE SEDIMENT TRAPS SHALL BE PLACED IMMEDIATELY DOWNSLOPE OF ALL UNPROTECTED DISTURBED LANDS.

E6. TEMPORARY REHABILITATION SHALL BE UNDERTAKEN ON DISTURBED AREAS WHERE WORKS HAVE STOPPED AND SOILS ARE EXPECTED TO REMAIN EXPOSED FOR MORE THAN ONE MONTH.

E7. THE CONTRACTOR SHALL MAINTAIN DAILY ALL WATER AND SOIL MANAGEMENT DEVICES.

E8. ALL VEGETATION SHALL BE RETAINED BEYOND LIMIT OF WORKS.

E9. VEHICULAR ACCESS POINTS ONTO CONSTRUCTION SITE TO INCLUDE A GRAVEL PAD/STABILISED ACCESS.

E10. THE SITES COURSE SAND DOES NOT REQUIRE SPECIFIC WIND EROSION DEVICES. WATER TRUCKS SHOULD BE USED AS REQUIRED OR DIRECTED DURING EXTENDED DRY AND WINDY PERIODS.

E11. CONDITION 30R - STRIPPING AND STOCKPILING STRIPPING AND STOCKPILING OF EXISTING TOPSOIL ON SITE, PRIOR TO COMMENCEMENT OF EARTHWORKS, AND THE SUBSEQUENT RE-SPREADING OF THIS MATERIAL TOGETHER WITH A SUFFICIENT QUANTITY OF IMPORTED TOPSOIL SO AS TO PROVIDE A MINIMUM THICKNESS OF 80mm OVER THE ALLOTMENTS AND FOOTPATHS AND PUBLIC RESERVES, UPON COMPLETION OF THE DEVELOPMENT WORKS.

E12. EARTHWORKS EXCAVATION OF PROPOSED NORTH-SOUTH DRAIN TO COMMENCE IN SUITABLE WEATHER CONDITIONS, AT SOUTHERN END AND PROCEED NORTH. PRIOR TO COMPLETION OF EACH DAYS WORKS, NEWLY EXCAVATED BATTERS ARE TO BE STABILISED AND PROTECTED BY INSTALLATION OF JUTE MESH IN ACCORDANCE WITH APPROVED AWC PLANS AND MANUFACTURERS GUIDELINES.

E13. PRIOR TO CONSTRUCTION OF NORTH SOUTH DRAIN CONCRETE INVERT, 200mm COIR LOGS MAY BE INSTALLED IF REQUESTED BY SITE SUPERINTENDENT OR BSC ENGINEER.

E14. UPON COMPLETION OF NEW NORTH-SOUTH DRAIN & INVERT, BATTERS ARE TO BE LANDSCAPED AS SOON AS PRACTICAL IN ACCORDANCE WITH APPROVED LANDSCAPING PLANS BY AWC.

E15. ROAD RESERVES TO BE FREE OF VEGETATION AND GRASS FOR ROAD CONSTRUCTION AND SERVICES INSTALLATION DURING CIVIL STAGES.

E16. LOTS TO BE WATERED BY WATER TRUCK DURING EXTENDED DRY PERIODS FOR DUST CONTROL.

E17. STOCKPILES AND EARTHWORK AREAS ARE TO BE STABILISED WITHIN 10 DAYS OF COMPLETION OF WORKS IN ACCORDANCE WITH THE CEMP, LANDSCAPING PLAN & ESCP.

E18. THE CIVIL CONTRACTOR IS TO DAILY REVIEW THE WEATHER FORECAST & IMPLEMENT ADDITIONAL ESC AS REQUIRED PRIOR TO ANY FORECAST HEAVY RAIN.

Wade Fletcher

ESCP CERTIFIED BY WADE FLETCHER

Civil Engineer
BEng Civil, MIEAust CPEng NER, RPEQ
EA ID: 2954545

ESCP LEGEND

- PROPOSED SUBDIVISION BOUNDARY
- EXTENT OF STAGE 1, 2 & 3 EARTHWORKS AREA
- SEDIMENT CONTROL FENCE OR TOPSOIL BUND (SEE SD6-7 ON EW25)
- STABILISED SITE ACCESS (SEE SD5-7 ON EW25)
- ROCK CHECK DAM OR 200mm COIR LOGS (SEE SD5-4 ON EW25)
- CATCH SWALE (SEE SD5-5 ON EW25)
- TREE TO BE PROTECTED & RETAINED IN STAGE 1-3. REFER 1133-SW1-EW26

REFER TO EW25 FOR EROSION AND SEDIMENT CONTROL DETAILS.

EXACT REQUIREMENTS FOR EROSION CONTROL TO BE DETERMINED ON SITE IN CONSULTATION WITH BYRON SHIRE COUNCIL STAFF.

RUSLE SOIL LOSS CALCULATIONS

Catchment ID	R (Rainfall erosivity factor)	K (Soil erodibility factor)	LS (slope length / gradient factor)	P (Erosion Control Practice Factor)	C (Cover factor)	A (Annual soil loss tonnes per hectare per year)	Catchment Area (hectares)	Annual Soil Loss (tonnes)
West & South	6780	0.004	0.12	1.00	0.95	3.09	6.61	20.4
East	6780	0.004	0.10	1.00	0.95	2.58	1.55	4.0
NS Drain (pre bulk earthworks)	6780	0.004	0.12	1.00	0.10	0.33	5.5	1.8

Iss	Description	Des	Drw	Date	Appd
C	BSC RE-SUBMISSION	WF	WF	04.11.2023	
A	FOR SUBMISSION	WF	WF	20.06.2023	

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WALLUM ESTATE
SUBDIVISION WORKS CERTIFICATE PLANS
EARLY STAGE 2 - BULK EARTHWORKS
15 TORAKINA ROAD, BRUNSWICK HEADS

EROSION & SEDIMENT CONTROL PLAN
0.2m FINISHED CONTOURS

Scale: 1:1,000 at A1 CAD file: 1133-ST1-EW5C.dwg
Datum: AHD CivilCAD file: 1133-ENG

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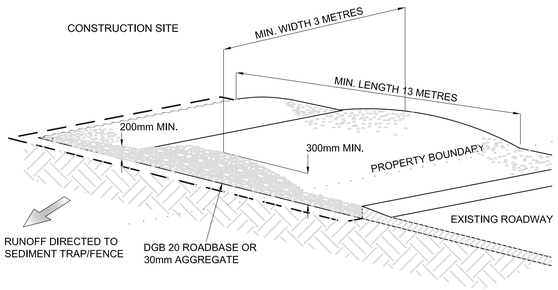
1133-ST1-EW5 **C**

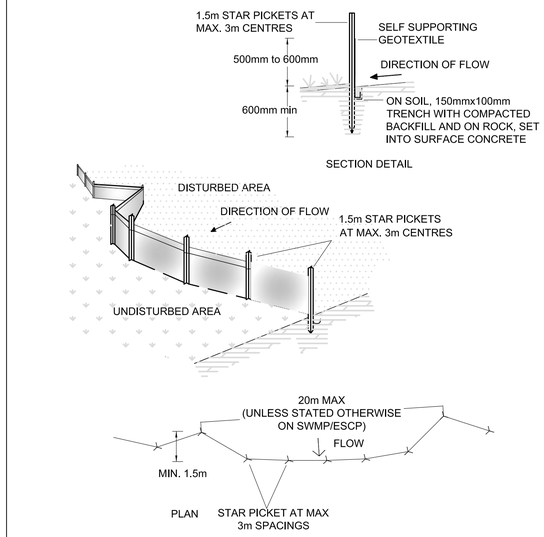


GEOTEXTILE FABRIC DESIGNED TO PREVENT INTERMIXING OF SUBGRADE AND BASE MATERIALS AND TO MAINTAIN GOOD PROPERTIES OF THE SUB-BASE LAYERS. GEOTEXTILE MAY BE WOVEN OR NEEDLE PUNCHED PRODUCT WITH MINIMUM CBR BURST STRENGTH (AS3706.4-90) OF 2500 N.

CONSTRUCTION NOTES

1. STRIP TOPSOIL AND LEVEL SITE.
2. COMPACT SUBGRADE.
3. COVER AREA WITH NEEDLE PUNCHED GEOTEXTILE.
4. CONSTRUCT 200mm THICK PAD OVER GEOTEXTILE USING ROADBASE OR 30mm AGGREGATE. MINIMUM LENGTH 15 METRES OR TO BUILDING ALIGNMENT. MINIMUM WIDTH 3 METRES.
5. CONSTRUCT HUMP IMMEDIATELY WITHIN BOUNDARY TO DIVERT WATER TO SEDIMENT FENCE OR OTHER SEDIMENT TRAP.

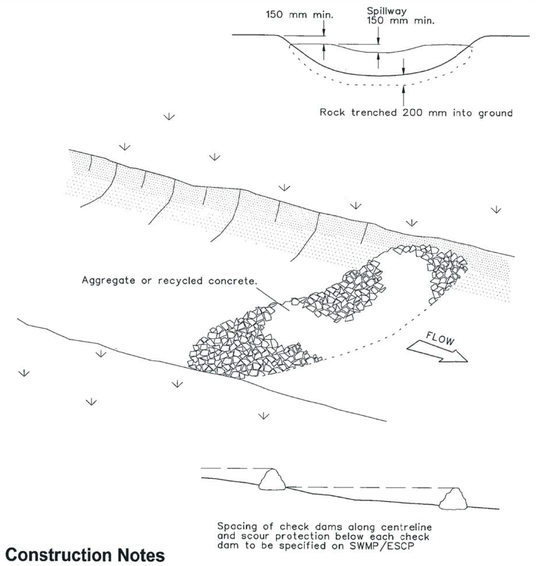
STABILISED SITE ACCESS SD 5-7



CONSTRUCTION NOTES

1. CONSTRUCT SEDIMENT FENCE AS CLOSE AS POSSIBLE TO PARALLEL TO THE CONTOURS OF THE SITE.
2. DRIVE 1.5 METRE LONG STAR PICKETS INTO GROUND 3 METRES APART.
3. DIG A 150mm DEEP TRENCH ALONG THE UPSLOPE LINE OF THE FENCE FOR THE BOTTOM OF THE FABRIC TO BE ENTRENCHED.
4. BACKFILL TRENCH OVER BASE OF FABRIC.
5. FIX SELF SUPPORTING GEOTEXTILE TO UPSLOPE SIDE OF POSTS WITH WIRE TIES OR AS RECOMMENDED BY GEOTEXTILE MANUFACTURER.
6. JOIN SECTIONS OF FABRIC AT A SUPPORT POST WITH A 150mm OVERLAP.

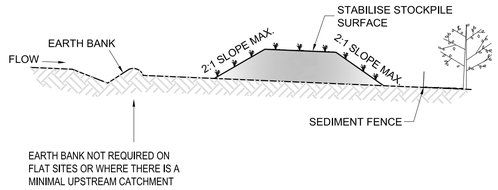
SEDIMENT FENCE SD 6-7



Construction Notes

1. Check dams can be built with various materials, including rocks, logs, sandbags and straw bales. The maintenance program should ensure their integrity is retained, especially where constructed with straw bales. In the case of bales, this might require their replacement each two to four months.
2. Trench the check dam 200 mm into the ground across its whole width. Where rock is used, fill the trenches to at least 100 mm above the ground surface to reduce the risk of undercutting.
3. Normally, their maximum height should not exceed 600 mm above the gully floor. The centre should act as a spillway, being at least 150 mm lower than the outer edges.
4. Space the dams so the toe of the upstream dam is level with the spillway of the next downstream dam.

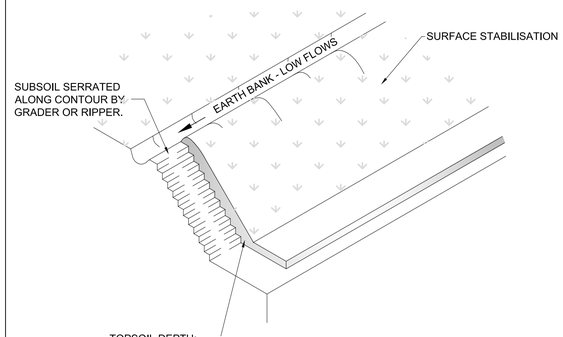
ROCK CHECK DAM SD 5-4



CONSTRUCTION NOTES

1. PLACE STOCKPILES MORE THAN 2 (PREFERABLY 5) METRES FROM EXISTING VEGETATION, CONCENTRATED WATER FLOW, ROADS AND HAZARD AREAS.
2. CONSTRUCT ON CONTOUR AS LOW, FLAT, ELONGATED MOUNDS.
3. WHERE THERE IS SUFFICIENT AREA, TOPSOIL STOCKPILES SHALL BE LESS THAN 3 METRES IN HEIGHT.
4. WHERE THEY ARE TO BE IN PLACE FOR MORE THAN 10 DAYS, STABILISE FOLLOWING THE APPROVED ESCP OR SWMP TO REDUCE THE C-FACTOR TO LESS THAN 0.10.
5. CONSTRUCT EARTH BANKS (SD 5-5) ON THE UPSLOPE SIDE TO DIVERT WATER AROUND STOCKPILES AND SEDIMENT FENCES (SD 6-8) 1 TO 2 METRES DOWNSLOPE.
6. STABILISE STOCKPILES AS REQUIRED WITHIN 10 DAYS OF COMPLETION OF WORKS.

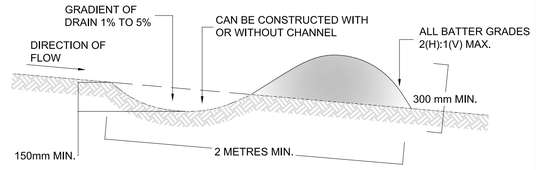
STOCKPILES SD 4-1



CONSTRUCTION NOTES

1. SCARIFY GROUND SURFACE ALONG THE LINE OF THE CONTOUR TO A DEPTH OF 50mm TO 100mm TO BREAK UP ANY HARDSETTING SURFACES AND TO PROVIDE A GOOD BOND BETWEEN THE RESPREAD MATERIAL AND SUBSOIL.
2. ADD SOIL AMELIORATES AS REQUIRED BY THE ESCP OR SWMP.
3. RIP TO A DEPTH OF 300mm IF COMPACTED LAYERS OCCUR.
4. WHERE POSSIBLE, REPLACE TOPSOIL TO A DEPTH OF 40 TO 60mm ON LANDS WHERE THE SLOPE EXCEEDS 4(H):1(V) AND TO AT LEAST 75mm ON LOWER GRADIENTS.

REPLACING TOPSOIL SD 4-2



NOTE: ONLY TO BE USED AS TEMPORARY BANK WHERE MAXIMUM UPSLOPE LENGTH IS 80 METRES.

CONSTRUCTION NOTES

1. BUILD WITH GRADIENTS BETWEEN 1 PER CENT TO 5 PERCENT.
2. AVOID REMOVING TREES AND SHRUBS IF POSSIBLE - WORK AROUND THEM.
3. ENSURE THE STRUCTURES ARE FREE OF PROJECTIONS OR OTHER IRREGULARITIES THAT COULD IMPEDE WATER FLOW.
4. BUILD THE DRAINS WITH CIRCULAR, PARABOLIC OR TRAPEZOIDAL CROSS SECTIONS. NOT "V" SHAPED.
5. ENSURE THE BANKS ARE PROPERLY COMPACTED TO PREVENT FAILURE.
6. COMPLETE PERMANENT OR TEMPORARY STABILISATION WITHIN 10 DAYS OF CONSTRUCTION.

EARTH BANK (LOW FLOW) SD 5-5

Iss	Description	Des	Drw	Date	Appd
B	BSC RE-SUBMISSION	WF	WF	27.10.2023	
A	FOR SUBMISSION	WF	WF	20.06.2023	

WALLUM ESTATE

SUBDIVISION WORKS CERTIFICATE PLANS
EARLY STAGE 2 - BULK EARTHWORKS
15 TORAKINA ROAD, BRUNSWICK HEADS

EROSION & SEDIMENT CONTROL STANDARD DRAWINGS

Scale: - CAD file: 1133-ST1-EW25B.dwg
Datum: - CivilCAD file: 1133-ENG

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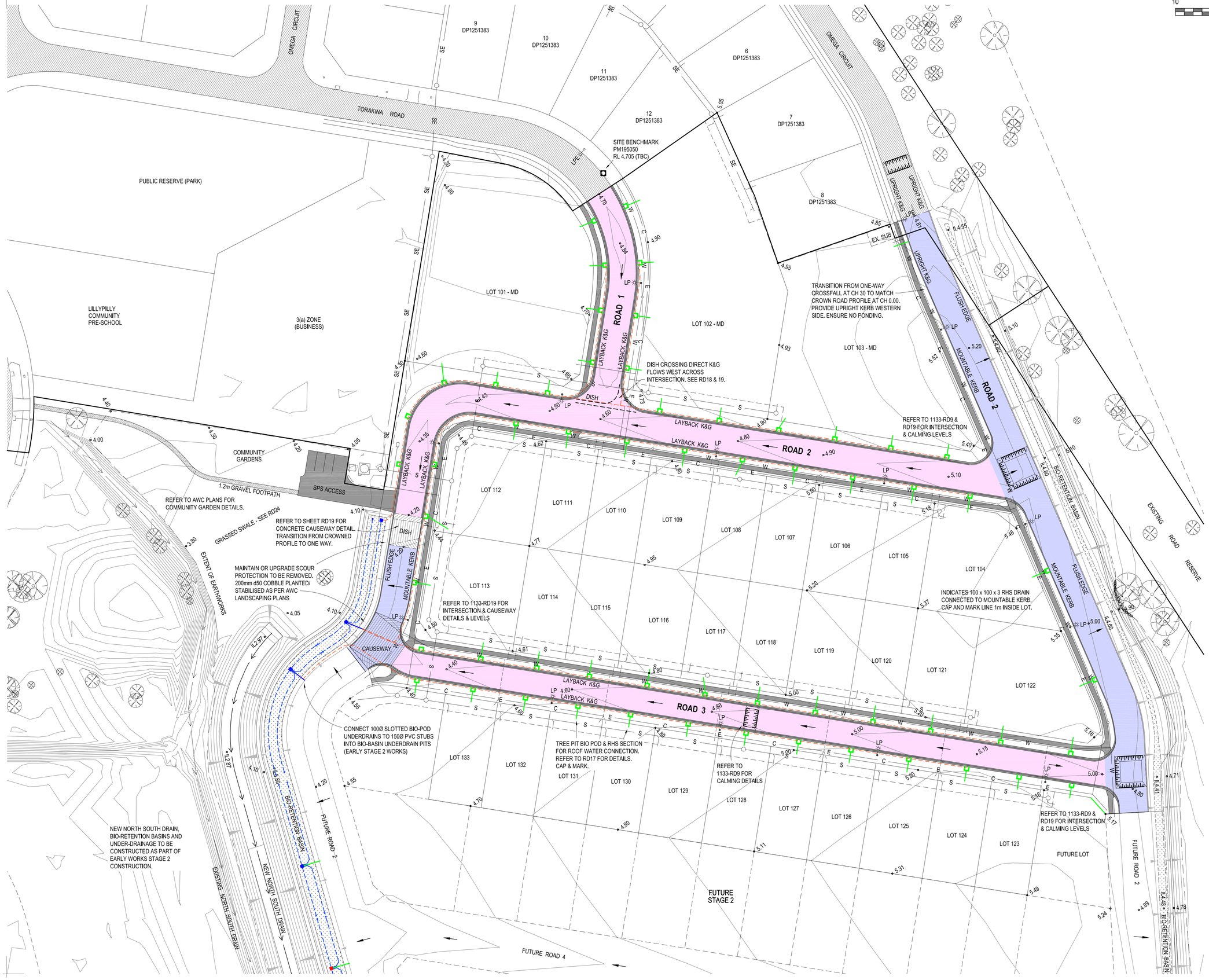
Appendix E

Sediment and Erosion Control Check List

Wallum Estate Sediment & Erosion Control Monitoring Checklist				
Inspection frequency (circle applicable):	>10mm rain predicted / post rainfall / daily/ weekly	Date of visit:		
		Site visit by:		
Requirement		Action required?	Action Responsibility	Signed-off
Sediment and erosion control structures in place				
Sediment, erosion and drainage control structures functional and undamaged				
Remove built up sediment and place in soil mound/ stockpile				
Check construction areas for signs of erosion/ scour				
Consultation with professional required to manage significant erosion, scour or excessive deposition of sediment?				
Weather forecast monitored for significant rainfall (i.e, >10mm)				
Comments / notes				

Appendix F

Stormwater Drainage Plan (Sourced Civil Tech)



10 0 10 20 30 40 50

SCALE 1:500 AT A1, 1:1,000 AT A3

N

LEGEND

- SUBJECT SITE BOUNDARY
- EXISTING NORTH SOUTH DRAIN INVERT
- REALIGNED NORTH SOUTH DRAIN
- EXTENT OF EARLY STAGE 2 EARTHWORKS
- EXISTING DRY ROCK WALL
- 100 YEAR ARI FLOW PATH
- 5.40 FINISHED SURFACE LEVEL (EARTHWORKS PART OF EARLY STAGE 2)
- CROWNED ROAD WITH KERB & GUTTER
- ROAD WITH ONE-WAY CROSSFALL OUT TO BIO-RETENTION SWALE
- BIO-RETENTION BASIN. DRAINAGE (PART OF EARLY STAGE 2 WORKS)
- TREE PIT BIO POD WITH FLUSHING POINTS (REFER DETAILS ON SHEET RD17)
- 100 x 100 x 3 RHS DRAIN TO BIO POD (EXTEND 1m INTO LOT, CAP AND MARK)
- 100mm SLOTTED UNDER-DRAIN BETWEEN BIO-PODS, EACH WITH FLUSHING POINTS. DISCHARGE TO BASIN UNDERDRAIN.
- BIO-RETENTION BASIN UNDER-DRAINAGE (PART OF EARLY STAGE 2 WORKS)
- 1.2m CONCRETE PEDESTRIAN FOOTPATH
- 1.2m GRAVEL PATH (REFER AWC PLANS)
- TREE TO BE PROTECTED & RETAINED IN STAGES 1 TO 3.

NO STORMWATER PIPES OR PIT NETWORKS TO BE CONSTRUCTED. ALL SURFACE STORMWATER FLOWS WILL DRAIN TO PERIMETER BIO-RETENTION SWALES VIA KERB & GUTTERS, DISH DRAINS & ONE-WAY CROSSFALL ROADS.

Iss	Description	Des	Drw	Date	Appd
A	FOR SUBMISSION	WF	WF	12.09.2023	

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WALLUM ESTATE

SUBDIVISION WORKS CERTIFICATE PLANS
CIVIL STAGE 1 - ROADS & DRAINAGE
15 TORAKINA ROAD, BRUNSWICK HEADS

STORMWATER DRAINAGE STAGE 1

0.2m FINISHED CONTOURS

Scale: 1:500 at A1 CAD file: 1133-ST1-RD6A.dwg

Datum: AHD CivilCAD file: 1133-ENG

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Appendix G

Bioretention & Bio-pod Checklist

Bioretention Maintenance Checklist			
Asset I.D.			
Date			
Location:			
Site Visit by:			
Inspection Items	**Y**	**N**	**Maintenance Work**
Sediment accumulation at inflow points? (record depth, remove if > 50%)			
Litter within inlet or macrophyte zones?			
Erosion at inlet or other key structures?			
Traffic damage present?			
Evidence of dumping (building waste)?			
Vegetation condition satisfactory (density, weeds etc)? - Density > 90% coverage of macrophyte zone - >1 species in macrophyte zone - ≥5 plants/m^2 - No weeds			
Watering of vegetation required?			
Weed removal required?			
Mowing/slashing required?			
Pruning and/ or removal of dead or diseased vegetation required?			
Replanting required?			
Damage/vandalism to structures present?			
Evidence of ponding?			
Evidence of scour and/or preferential flow path through basin floor?			
Are outlet structures free from silt or debris? Is cleaning required?			
Resetting of system required?			
Comments			

Appendix H

Unexpected Finds Protocol

Unexpected Find Recording Sheet

Unexpected Find No.: _____

Date:_____

Location:_____ GPS coordinates: _____

Unexpected Find Category: Contamination ☐ Aboriginal Heritage ☐ Other (describe below) ☐

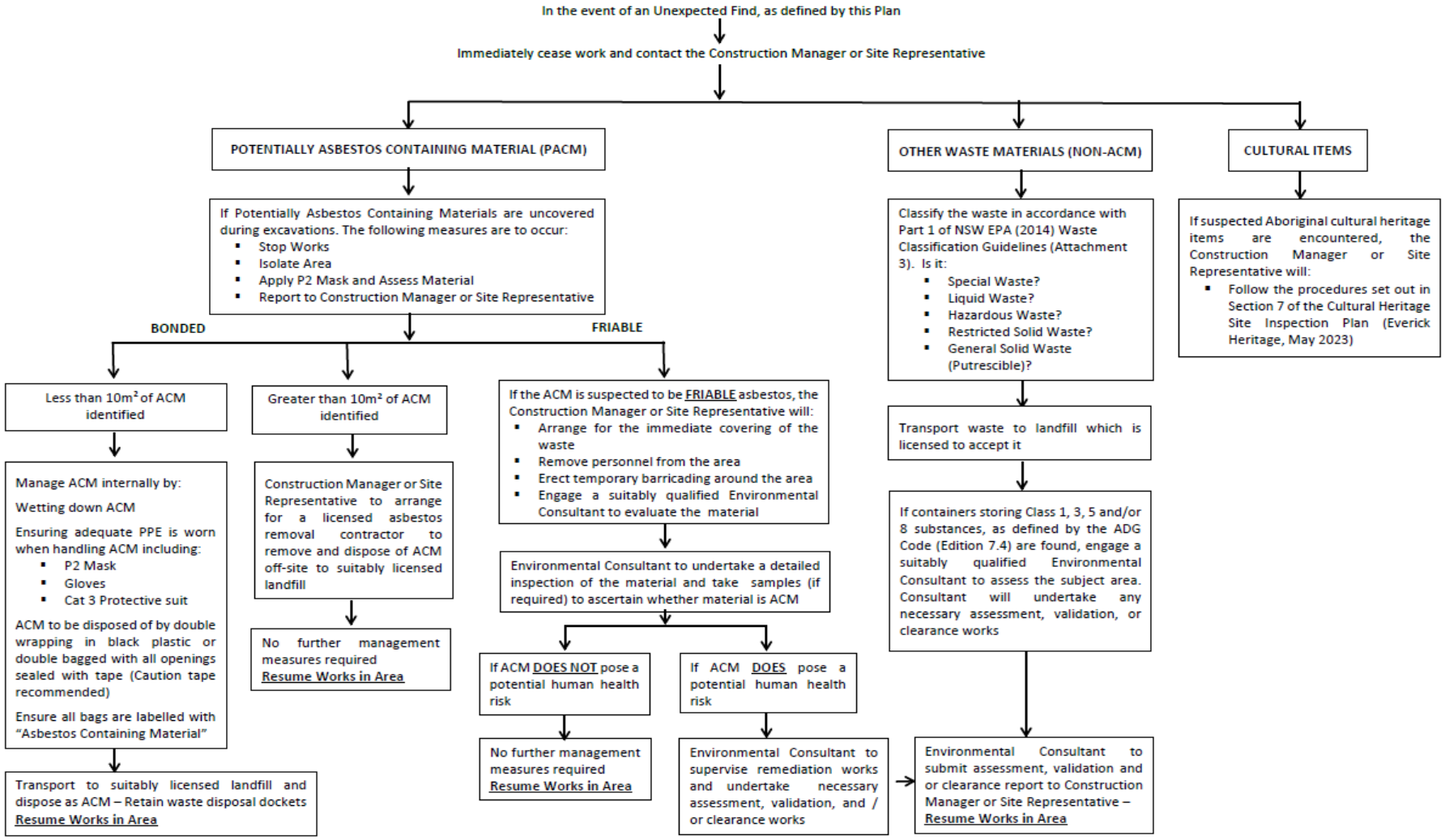
Item	Actions	Responsibility
Unexpected find encountered	1. Affected area closed off and signs erected as required (if suspected ACM)	Contractor
	2. Notify the Site Foreman	Contractor
	3. Notify the Project Manager	Site Foreman
	4. Notify/ commission Environmental Consultant/ Occupational Hygienist and provide description of find	Project Manager

Description of the Unexpected Find:

Does the Unexpected Find potentially involve asbestos? Yes ☐ No ☐

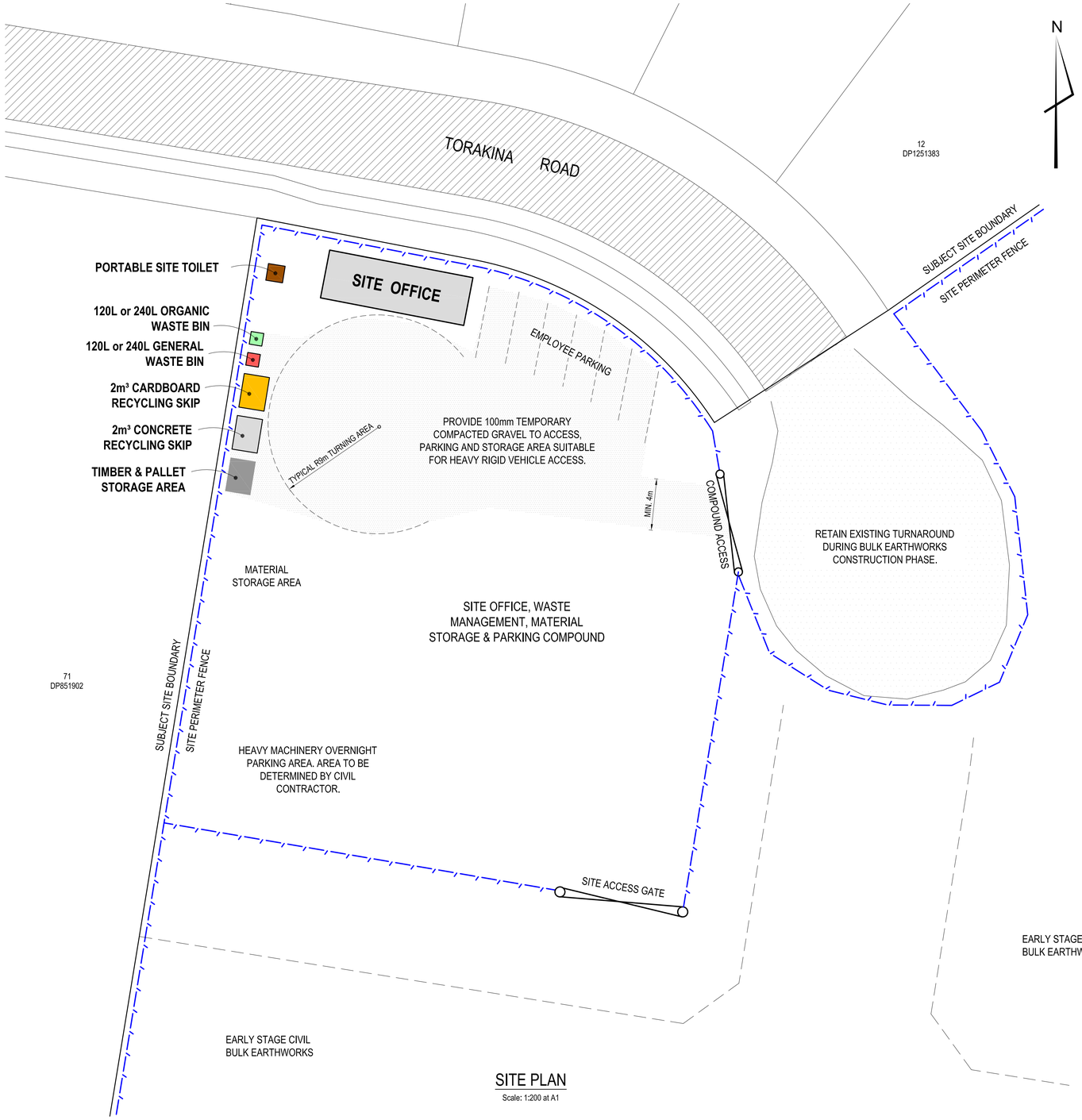
Appendix I

Unexpected Finds Flow Chart (Sourced ENVSolutions)


In the event of an Unexpected Find, as defined by this Plan
Immediately cease work and contact the Construction Manager or Site Representative
POTENTIALLY ASBESTOS CONTAINING MATERIAL (PACM)
If Potentially Asbestos Containing Materials are uncovered during excavations. The following measures are to occur:
Stop Works
Isolate Area
Apply P2 Mask and Assess Material
Report to Construction Manager or Site Representative
BONDED
FRIABLE
Less than 10m² of ACM identified
Manage ACM internally by:
Wetting down ACM
Ensuring adequate PPE is worn when handling ACM including:
P2 Mask
Gloves
Cat 3 Protective suit
ACM to be disposed of by double wrapping in black plastic or double bagged with all openings sealed with tape (Caution tape recommended)
Ensure all bags are labelled with "Asbestos Containing Material"
Transport to suitably licensed landfill and dispose as ACM – Retain waste disposal dockets
Resume Works in Area
Greater than 10m² of ACM identified
Construction Manager or Site Representative to arrange for a licensed asbestos removal contractor to remove and dispose of ACM off-site to suitably licensed landfill
No further management measures required
Resume Works in Area
If the ACM is suspected to be FRIABLE asbestos, the Construction Manager or Site Representative will:
Arrange for the immediate covering of the waste
Remove personnel from the area
Erect temporary barricading around the area
Engage a suitably qualified Environmental Consultant to evaluate the material
Environmental Consultant to undertake a detailed inspection of the material and take samples (if required) to ascertain whether material is ACM
If ACM DOES NOT pose a potential human health risk
No further management measures required
Resume Works in Area
If ACM DOES pose a potential human health risk
Environmental Consultant to supervise remediation works and undertake necessary assessment, validation, and / or clearance works
OTHER WASTE MATERIALS (NON-ACM)
Classify the waste in accordance with Part 1 of NSW EPA (2014) Waste Classification Guidelines (Attachment 3). Is it:
Special Waste?
Liquid Waste?
Hazardous Waste?
Restricted Solid Waste?
General Solid Waste (Putrescible)?
Transport waste to landfill which is licensed to accept it
If containers storing Class 1, 3, 5 and/or 8 substances, as defined by the ADG Code (Edition 7.4) are found, engage a suitably qualified Environmental Consultant to assess the subject area. Consultant will undertake any necessary assessment, validation, or clearance works
Environmental Consultant to submit assessment, validation and or clearance report to Construction Manager or Site Representative –
Resume Works in Area
CULTURAL ITEMS
If suspected Aboriginal cultural heritage items are encountered, the Construction Manager or Site Representative will:
Follow the procedures set out in Section 7 of the Cultural Heritage Site Inspection Plan (Everick Heritage, May 2023)

Appendix J

SWMMP- Wallum Estate Civil Works- Subdivision Construction Works



SITE PLAN

Scale: 1:200 at A1

SITE WASTE MINIMISATION & MANAGEMENT SCHEDULE

	REUSE	RECYCLING	DISPOSAL	
Type of waste generated	***Estimate Volume (m³) or Weight (t)***	***Estimate Volume (m³) or Weight (t)***	***Estimate Volume (m³) or Weight (t)***	***Specify method of onsite reuse, recycling centre or waste disposal depot to be used***
Excavation material	ALL	NIL	NIL	Earthworks
Timber (specify type)	ALL	NIL	NIL	Forming material.
Concrete	200 kg	200 kg	NIL	Crush & use as drainage material.
Bricks	N/A	N/A	NIL	N/A
Tiles	N/A	N/A	NIL	N/A
Metal (steel)	N/A	N/A	NIL	N/A
Glass	N/A	N/A	NIL	N/A
Bitumen hotmix	N/A	N/A	NIL	N/A
Fixtures and fittings	N/A	N/A	NIL	N/A
Floor coverings	N/A	N/A	NIL	N/A
Packaging (pallets / wrap)	100 kg	90kg	10 kg	Return pallets for reuse and wrap to waste disposal
Garden organics	N/A	N/A	NIL	N/A
Containers (cans, plastic, glass)	5 kg	90 kg	5 kg	Reuse where possible, recycle and dispose where necessary.
Paper / cardboard	10 kg	90 kg	NIL	To BSC recycling centre
General waste	NIL	NIL	50 kg	To BSC waste facility
Hazardous/special waste (specify)	N/A	N/A	NIL	.
Green / organic waste	NIL	50 kg	NIL	To BSC green waste compost.

Note: N/A means not applicable on this development project or phase

SITE WASTE MINIMISATION & MANAGEMENT PLAN NOTES

- PROVIDE SIGNAGE CLEARLY LABELING ALL BINS AND SKIPS
- GREEN WASTE WHEELIE BIN TO BE EMPTIED AT LEAST WEEKLY OR AS REQUIRED.
- GENERAL WASTE WHEELIE BIN TO BE EMPTIED AT LEAST FORTNIGHTLY OR AS REQUIRED.
- RECYCLING AND OTHER SKIPS TO BE EMPTIED AS REQUIRED.
- PORTABLE TOILET TO BE EMPTIED AT LEAST WEEKLY, SUBJECT TO NUMBER OF EMPLOYEES.
- NOMINATED CONTRACTOR MAY DAILY REMOVE WASTE AND DISPOSE IN SKIPS AT THEIR MAIN OFFICE. RECYCLING SKIPS NOT REQUIRED ON SITE IN THIS CASE.
- ALL WASTE TO BE DISPOSED/RECYCLES IN ACCORDANCE WITH THE SCHEDULE ABOVE AT APPROVED FACILITIES.
- CHANGES TO SWMMP LAYOUT OR OPERATION TO BE CONFIRMED WITH SITE SUPERINTENDENT & BSC ENGINEER.
- ADDITIONAL SKIPS TO BE ADDED IN FUTURE CIVIL STAGES AS REQUIRED.
- PROVIDE CCTV SECURITY SYSTEM TO COMPOUND AND SITE OFFICE AREA.
- VEHICLES AND MATERIALS TO BE STORED INSIDE LOCKED COMPOUND AREA OVERNIGHT.
- NO RESIDENTIAL WASTE TO BE DISPOSED OF IN BINS OR SKIPS.
- REFER TO EROSION & SEDIMENT CONTROL PLAN FOR STOCKPILE LOCATIONS AND APPLICABLE ESC.

LEGEND

SUBJECT SITE BOUNDARY

SITE & COMPOUND FENCING

4 2 0 5 10 15 20

SCALE 1:200 AT A1

Iss	Description	Des	Drw	Date	Appd
A	FOR SUBMISSION	WF	WF	27.10.2023	

WALLUM ESTATE

SUBDIVISION WORKS CERTIFICATE PLANS
EARLY STAGE 2 - BULK EARTHWORKS
15 TORAKINA ROAD, BRUNSWICK HEADS

SITE WASTE MINIMISATION & MANAGEMENT - SITE PLAN

Scale: 1:200 at A1
CAD file: 1133-ST1-SWMMP1A.dwg
Datum: AHD
CivilCAD file: 1133-ENG

CivilTech Consulting Engineers
Subdivision Design • Civil Engineering • Town Planning • Project Management

CivilTech Consulting Engineers
Ph. 0431 065 645
PO BOX 4285
Goonellabah NSW 2480
www.civiltech.net.au

Sheet No.
1 of 1

Dwg. No. Issue
1133-ST1-SWMMP1 A

Appendix K

ASS Amelioration record and checklist (Wallum Estate)

Acid Sulfate Soil (Batch) Amelioration Record – Wallum Estate	
Environmental Manager to fill the fields, keep a record on file and provide a copy to Byron Shire Council	
Construction Stage	Environmental Manager
Batch Code	Preliminary assessment by whom?
Original Soil Location: (Attach detailed map of spatial extents	
Date of excavation: GPS Coordinates: Depth of excavation: Area of excavation: Volume of batch: Contractor name/company:	Notes:
ASS analysis results: (attached results sheets)	
Liming rate: (Calculated or provided?) (m^3 or tonne)	
Amelioration Record	
Lime incorporation methods:	Notes:
Date:	
Which ASS treatment pad?	
Volume and details of lime used: (manufacturer, other details, bag number)	
Validation testing results: (attach results sheets)	
Contractor name/company:	
Any acid leachate generated? Volume: Original pH value: Ameliorated pH value: Date of discharge: Method and locations of discharge:	Notes:
Placement of ameliorated ASS - record	
Usage type: Location description: (attach detailed map showing extents) GPS Coordinates: Volume: Depth of placement: pH value: Approvals: Permission:	Notes:

Appendix L

Internal Environmental Control Audit Site WHS Corrective Action Form

Wallum Estate Internal Environmental Monitoring Audit					
Inspection frequency:	Prior to construction activity / weekly	Date of audit:			
		Audit by:			
Control	Requirement	Effective? Yes/ No/ Partial	Action required?	Action Responsibility	Signed-off
Site induction	All personnel onsite completed environmental induction				
Hygiene	Hygiene Protocols implemented as per the CEMP ' Arrive Clean, Leave Clean'				
Vegetation	Has vegetation been managed as per the CEMP				
Fauna	Has fauna been managed as per the CEMP				
	Spotter catcher to inspect vegetation prior to removal				
Sediment & Erosion control	Stockpiles adequately protected and managed				
	Unfinished earthworks & stockpiles temporarily stabilised as required				
	Sediment & erosion monitoring and maintenance undertaken and check list completed				
Cultural heritage	Monitoring and inspection undertaken as required				
	Unexpected find protocol implemented				
	Cultural heritage induction completed by workers				
Acid Sulfate Soils	Has routine monitoring been carried out as per the CEMP				
	Has routine monitoring indicated ASS disturbance				
Dust and Air Quality	Has dust been minimised using appropriate controls				
	Has machinery exhaust not impacting receptors				
	No waste materials burnt on site				
Chemical storage	Are dangerous goods stored correctly as per the MSDS				

	Fuel and chemicals stored correctly as per the MSDS				
	Machinery refueling >30m from creek bank				
Noise	Noise minimised where possible				
	Has construction occurred during standard/ approved hours				
Dust & Air quality	Dust minimised using appropriate controls				
	Machinery exhaust not impacting receptors				
	No waste materials burnt on site				
Waste	Waste management plan implemented				
	Reduce, reuse, recycle hierarchy adopted				
Unexpected finds	Unexpected finds protocol implemented if required				
	Have asbestos containing materials managed as per remediation plan				
Vehicle Movements	Have vehicle movements been reduced and managed appropriately with access points and correct signage				
	Have vehicles kept speed limits to below 30km/hr within residential areas				
GW Bores	Are monitoring bored adequately identified with para webbing and signage				
General Comments					

Appendix M

Site WHS Corrective Action Form

Site WHS Corrective Action Form											
Worker/Notifier to Complete					Manager/Supervisor to Complete						
Date Dd/mm/yyyy	Issue Notified by Name of notifier & method eg Hazard Form	Issue/ Hazard Details	Direct Reported	Corrective Action (CA) Required	Risk (L, M, H)	Actioned by who	Date to be Action By	Dated Completed	Feedback provided to notifier	Work completion verification Signature (other than actioned by who)	Review of implemented CA Name and Signature
									☐ Yes ☐ No		
									☐ Yes ☐ No		
									☐ Yes ☐ No		
									☐ Yes ☐ No		
									☐ Yes ☐ No		
									☐ Yes ☐ No		

Appendix N

Resumes of Damian McCann, nominated Environmental Manager and Jesse Munro, Senior Scientist

Damian McCann

Director

Capabilities

› Water Sensitive Urban Design

› Expert Witness for environmental stormwater issues

› Pollutant modelling

› Urban stormwater management

› Design or large-scale water quality systems in agricultural landscapes

› Technical training on the design construction and management of stormwater infrastructure

› Wetland, terrestrial and landscape ecology

› Ecological Design and Rehabilitation

› Stream management and rehabilitation

Qualifications, Training and Accreditations

› B App Sci – Social Ecology

› B Sci Hons – Ecology

› Riverstyles Geomorphic Assessment Framework

› Graduate Certificate in River Restoration and Management

› Masters of Environmental Management

› Certified Biodiversity Assessor (BAM) (BAAS19080)

› Certified Environmental Practitioner (CEnvP) (CEnvP)

Professional Experience

Damian has over 20 years experience in the environment and stormwater fields with specialist expertise in stormwater management, catchment and water cycle management ecological restoration, geomorphology, environmental assessment.

Damian has held management positions with Australian Wetlands for over 20 years, and a Director or Australian Wetlands Consulting since 2009.

He has led multi-disciplinary teams on a wide array of projects throughout Australia, including the preparation of industry best practice guidelines, catchment management plans and design and construction supervision on Federally funded infrastructure projects.

Damian is member of the SQIDEP Technical Review Panel Established by Stormwater Australia.

Damian is unique in his ability to identify environmental solutions which are pragmatic and workable, drawing upon principles of ecology and bio-engineering.

Selected Projects

› Stormwater Quality Strategy for the West Byron Estate including consideration of pollutant loading limits of the Belongil Estuary

› Bennelong Pond Stormwater Improvement Works, Review of Environmental Factors and Construction Supervision, Sydney Olympic Park

› Astrolabe Park Wetland Design and Construction Supervision for EnviroPacific and Sydney Water

› Babinda Creek Wetland Design - 10 ha constructed wetland and 45 ha floodplain restoration. Integrated water quality improvement and ecological restoration works as part of protecting the Great Barrier Reef

› Springfield Lakes Estate - retained advisor from 2009 to 2019 on WSUD, creek lines, wetlands and lakes for 10,000 lot estate

› Nerang River Estuary Study - leading a multi-disciplinary team to carry out an in depth investigation of water quality, riparian vegetation, geomorphology and aquatic ecology along 20km of waterway and over 400ha of lakes and canals.

› Stormwater Quality Strategy for Shoal Point Estate, Mackay, including consideration of pollutant loading limits of tidal wetlands

› Preparation of the Tweed Urban Stormwater Management Plan

› Tallebudgera Catchment Creek Catchment and Estuary Management Plan

› Expert Witness in Aquatic Ecology for Gold Coast City Council.

› Expert Witness in Ecology for Byron Shire Council.

Conferences and Training

› At least 1 paper and presentation at each conference:

› Stormwater Industry Association National Conference 2018 - Nominated for Best Integrated Stormwater Design

› NSW Stormwater Industry Association State Conference - Awarded Excellence in Integrated Stormwater Design (2017)

› Advanced plant identification training – 5 days, University of NSW (2017)

› 8th Australian Stream Conference, (2016)

› Wetland Design and Management Seminars, Sydney, Albany, Brisbane, Townsville (Presenter) (2016, 2017, 2019, 2020, 2021)

› International WSUD Conference, Sydney (2015)

› International WSUD Conference, Gold Coast (2013)

› QLD Stormwater Industry Association State Conference (2009, 2012, 2014, 2017)

› Riverstyles Geomorphic Assessment Framework, Macquarie University, (2013)

› International Society for Wetland Scientists / River Symposium – Brisbane (2011)

› Biodiversity Assessment Method (BAM) training (2018)

Jesse Munro

Senior Environmental Consultant

jesse@awconsult.com.au | 0437 012 014

Capabilities

› Stream health assessments incorporating aquatic macroinvertebrates (AUSRIVAS) as biological indicators

› Water Sensitive Urban Design and Urban stormwater management

› Sediment and Erosion Control Plans

> Oversee construction and establishment of stormwater treatment systems

› Facilitate vegetated stormwater treatment asset handover to local council

› Treatment of agricultural and industrial runoff using natural treatment systems

› Design of On-site wastewater management systems

› MUSIC modelling

› Vegetation assessment and management strategies

› AutoCAD drafting

› Site investigations and assessments with various focus

› Soil sampling

› Surface and groundwater monitoring

› Biosolids management

› Landfill leachate management

› MEDLI modelling

Qualifications / Training

› B App Sci – Natural Resource Management (Southern Cross University, 2010)

› Planning for Bushfire Protection Short Course (UTS, 2006)

› Associate Diploma Horticulture (UWS, 1994)

› Certificate II Bushland Regeneration (Ryde TAFE, 1998)

› MUSIC Modelling

› IECA - Erosion and Sedimentation Control

› AUSRIVAS Training - Accredited practitioner

Professional Experience

Jesse spent the formative years of his career working in the horticulture industry fields of landscape maintenance, wholesale production nurseries and bush regeneration.

In 2004 Jesse started the Bachelor of Applied Science course at Southern Cross University majoring in Natural Resource Management on a part time, predominantly external basis. During this time, study took him to the water science, catchment management and treatment technologies direction. His Integrated Project measured the performance of a constructed treatment wetland for urban stormwater.

In 2006 Jesse found employment with an Engineering company and worked under the Senior Environmental Officer. Skills gained include on-site wastewater management strategies and design, contaminated land assessments, acid sulfate soil assessments and other civil engineering duties and drafting along with a basic understanding of planning principles and industry workings.

Jesse joined AWC in April 2011 as the Graduate Environmental Scientist and has become an integral part of the team providing valuable assistance to others in the office such as the Senior Ecologist and the Senior Water Scientist. Jesse gained a range of skills and experience in the areas of water quality and stormwater treatment, sediment and erosion control, ecology, monitoring of environmental waters (groundwater and surfacewater), management of landfill facilities and leachate, STP biosolids management and stream health assessment and monitoring.

More recently, stream health assessments using biological indicators has been a focus of training. Completed certification and accredited AUSRIVAS practitioner.

Key Projects

Manage catchment health monitoring project, including water quality, macroinvertebrates, diatoms and vegetation for an LGA

Assistance with preliminary concept and detailed design of agricultural runoff treatment systems (SEQ and FNQ).

Design of multiple water quality monitoring projects

Ongoing organisation of documentation and works from multiple companies in order to complete the requirements of an LGA to accept stormwater management devices as part of a large subdivision in South East Queensland.

Ongoing water quality, hydrology, vegetation and estuary health monitoring as part of the management of the artificial opening of the Belongil Estuary and the Tallow Creek Estuary.

Maintenance and use of water level and water quality loggers and data collection, interpretation and presentation for multiple projects.

Construction Environmental Management Plan (CEMP) and subsidiary reports for a ~1000 hectare solar farm in South Australia.

Hydrological monitoring and assessments of a proposed saltmarsh rehabilitation area in SEQ.

Phosphorus study in STP polishing wetlands to determine the remaining sorption capacity and other removal pathways

Assessments of dysfunctional stormwater treatment wetlands and bioretention basins to provide a diagnosis and rectification strategy.

Design and undertake vegetation monitoring and assessment framework at a property hosting a large annual music festival.

Design of On-site wastewater treatment and disposal systems at schools in north eastern NSW and the associated Review of Environmental Factors.

Assist in the assessment and development of the Ballina Bypass compensatory habitat area for SEPP 14 wetland offsets.

Review of Environmental Factors of Biosolids application for beneficial agricultural use.

Water quality monitoring and baseline data collection to assess for compliance with water quality objectives during pre-construction phase of a rail link in SE Qld. Water quality data collection, presentation, interpretation and reporting.

Collaboration in landfill leachate management projects. Review data to determine leachate quality and quantity trends. Assistance in the treatment system design and modelling. Undertake various modelling (eg. MEDLI) to determine sustainability and size requirements of irrigation area for disposal of treated leachate.

Design a garbage truck washdown collection, treatment and disposal system for a municipal landfill facility. Stormwater management plans for municipal landfill facilities.

Groundwater monitoring for biosolids application to land areas and STP reuse scheme in northern NSW. Assistance in preparation of lake management plans for urban water bodies.

Collaboration in design for a trial STP treatment wetland including preparation of design drawings, treatment modelling and review of existing effluent quality and quantity data.

Contaminated Land Assessment for a 15 hectare urban subdivision.

Water quality monitoring in constructed urban lakes to establish baseline data prior to floating reedbed establishment.

Appendix O

Online Waste Tracking Application Form

Online waste tracking application form

The online waste tracking system is a secure system. To obtain a username and password, please complete and sign the form.

If you need assistance or have questions, contact Environment Line on 131 555.

Company details (name and address of your company. For large companies, provide the head office address)		
Company name:		
Street address or PO box:		
Suburb:	State:	Postcode:
Company ABN (this is important as it links your account to the system):		

User details (provide the phone number and email address where you can be most easily reached)	
First name:	Last name:
Phone or mobile number:	
Email:	

Please complete site details and required access level for each site you need access to on the next page.

Forms for three sites are provided. If you need access to additional sites, please copy and paste the blank forms.

Note that:

- you must specify which jobs you will be performing in waste tracking for each site
- you can act in more than one job
- you can act in different jobs at different sites if appropriate.

If you are a transporter or receiving facility, ensure you provide your NSW Environment Protection Licence number or interstate equivalent.

Site details (location of the site where waste is transported to or from. If you are a transporter, provide the location of where your vehicle is normally garaged)		
Site name:		
Street address or PO box:		
Suburb:	State:	Postcode:
NSW Environment Protection Licence number (or interstate equivalent) if you are a transporter or receiving facility:		

Job	**Required access level (tick as appropriate)** **TC** = transport certificate, **CA** = consignment authorisation			
☐ Producer	☐ View only	☐ Create and update TC		
☐ Agent	☐ View only	☐ Create and update TC		
☐ Transporter*	☐ View only	☐ Create and update TC		
☐ Receiving facility*	☐ View only	☐ Create and update TC	☐ Create and update TC and CA	☐ Create and update liquid waste levy

*For transporter and receiving facility, please ensure the NSW Environment Protection Licence number (or interstate equivalent) has been provided.

Site details (location of the site where waste is transported to or from. If you are a transporter, provide the location of where your vehicle is normally garaged)		
Site name:		
Street address or PO box:		
Suburb:	State:	Postcode:
NSW Environment Protection Licence number (or interstate equivalent) if you are a transporter or receiving facility:		

Job	**Required access level (tick as appropriate)** **TC** = transport certificate, **CA** = consignment authorisation			
☐ Producer	☐ View only	☐ Create and update TC		
☐ Agent	☐ View only	☐ Create and update TC		
☐ Transporter*	☐ View only	☐ Create and update TC		
☐ Receiving facility*	☐ View only	☐ Create and update TC	☐ Create and update TC and CA	☐ Create and update liquid waste levy

*For transporter and receiving facility, please ensure the NSW Environment Protection Licence number (or interstate equivalent) has been provided.

Site details (location of the site where waste is transported to or from. If you are a transporter, provide the location of where your vehicle is normally garaged)		
Site name:		
Street address or PO box:		
Suburb:	State:	Postcode:
NSW Environment Protection Licence number (or interstate equivalent) if you are a transporter or receiving facility:		

Job	**Required access level (tick as appropriate)** **TC** = transport certificate, **CA** = consignment authorisation			
☐ Producer	☐ View only	☐ Create and update TC		
☐ Agent	☐ View only	☐ Create and update TC		
☐ Transporter*	☐ View only	☐ Create and update TC		
☐ Receiving facility*	☐ View only	☐ Create and update TC	☐ Create and update TC and CA	☐ Create and update liquid waste levy

*For transporter and receiving facility, please ensure the NSW Environment Protection Licence number (or interstate equivalent) has been provided.

I wish to apply for access to the online waste tracking system. I understand that the EPA may, at any time, cancel my access to the system. I confirm that the details provided above are, to the best of my knowledge, correct.

Signed:		**Date:**	

Send the completed form by:

Email to Hazardous.Materials@epa.nsw.gov.au

Post to Manager, Hazardous Materials
Hazardous Materials, Chemicals and Radiation Unit
Environment Protection Authority
PO Box A290
SYDNEY SOUTH NSW 1232

Bangalow

25 Leslie Street
Bangalow NSW 2479
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