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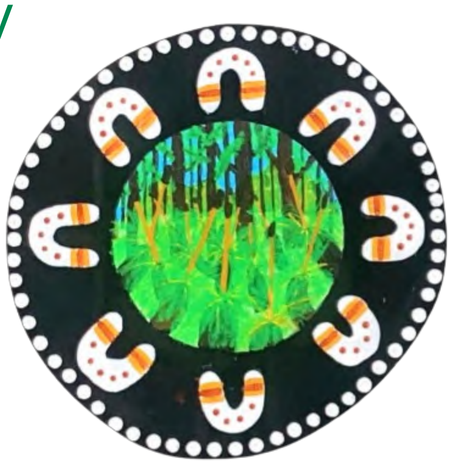
VEGETATION MANAGEMENT PLAN FOR 120 CARRS DRIVE, YAMBA

February 2024

CLIFTON YAMBA LAND PTY LTD

Acknowledgement of Country



Ecosure acknowledge the Traditional Custodians of the lands and waters where we work. We pay deep respect to Elders past and present who hold the Songlines and Dreaming of this Country. We honour and support the continuation of educational, cultural and spiritual customs of First Nations peoples.

Glossary, acronyms and abbreviations

APZ	Asset protection zone
BC Act	*Biodiversity Conservation Act 2016* (NSW)
CAA	Controlled activity approval
CEMP	Construction environmental management plan
CVC	Clarence Valley Council (Council)
DCCEEW	Department of Climate Change, Energy, the Environment and Water (Commonwealth)
DCP	Development control plan
DPE	Department of Planning and Environment
DPI	Department of Primary Industry
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth)
ESCP	Erosion and Sediment Control Plan
FM Act	*Fisheries Management Act 1994* (NSW)
HBT	Hollow-bearing tree
HTW	High threat weed
KFT	Koala food tree
LEP	Clarence Valley Council Local Environment Plan 2011
LGA	Local Government Area
MDE	Manage-Design-Engineer Pty Ltd
MHTW	Manageable High Threat Weed
MNES	Matters of National Environmental Significance
MSES	Matters of State Environmental Significance
NRAR	Natural Resources Access Regulator
PCT	Plant Community Type
ROTAP	Rare or Threatened Australian Plants
SLI	Statement of Landscape Intent
SMP	Stormwater Management Plan
TEC	Threatened Ecological Community
TPZ	Tree Protection Zone
VMP	Vegetation Management Plan
VMZ	Vegetation Management Zones
VRZ	Vegetated Riparian Zone
WM Act	*Water Management Act 2000* (NSW)
WSUD	Water Sensitive Urban Design

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1 Introduction

Ecosure has prepared this Vegetation Management Plan (VMP) on behalf of Clifton Yamba Land Pty Ltd in support of Development Application 2023/0241 (the DA). The DA has been submitted to Clarence Valley Council (CVC) and proposes subdivision for a 216-lot manufactured housing estate. This VMP has been prepared to guide the management and restoration of vegetation and riparian function at 110-120 Carrs Drive, Yamba 2464 (Figure 1).

This VMP addresses the New South Wales (NSW) Natural Resources Access Regulator (NRAR) recommendation for a Vegetated Riparian Zone (VRZ) for developments affecting waterfront land (DPE 2022a). This plan also draws upon information provided in Part 4 of Schedule X1 of the CVC Residential Zones Development Control Plan 2011 (the DCP) as well as the Australian Standard AS 4970 - 2009 (Protection of trees on development sites).

1.1 Site description

The site is located east of Oyster Channel, a tributary of the Clarence River, in the North Coast NSW Interim Biogeographic Regionalisation for Australia (IBRA) subregion, with egress to Carrs Drive to the west. The site is approximately 17.7 ha. Regrowth native vegetation dominates the eastern portion of the site, while mature remnant swamp sclerophyll occupies the western portion of the site (Figure 2). A 2nd order stream enters the site from Carrs Drive and runs inside the southern boundary to Oyster Channel beyond the western boundary, from which tidal influence extends upstream (Figure 3).

The development footprint will be predominantly contained within the eastern portion of the site, which is dominated by regrowth native vegetation, bearing evidence of historical clearing and subsequent thickening of regrowth vegetation following cessation of prior land use activities in recent years. The central and western portions of the site are occupied by mature, intact swamp sclerophyll, swamp oak and saltmarsh vegetation communities.

Areas of native vegetation adjoins the site to the north and south, including swamp sclerophyll and swamp oak communities, and an area of saltmarsh adjacent to the southern boundary. A narrow channel of mangroves, lines the tidal extent of the 2nd order stream, fanning out at its estuarine outlet.

1.2 Project description

The eastern portion of the subject site is proposed to be cleared and filled to allow construction of 216 residential lots and associated dwellings, roads, service infrastructure, community areas and bioretention basins (Figure 3). A residential development of similar proportions is currently under construction to the immediate north of the site and is subject to an existing Vegetation and Weed Management Plan (Geolink 2021).

The site is within the CVC Local Government Area (LGA), where it is zoned R1 – General

Residential (10.2 ha), C3 – Environmental Management (1.4 ha) and C2 – Environmental Conservation (6.1 ha) within the Clarence Valley Local Environment Plan 2011(the LEP) as shown on Figure 3. The area of impact resulting from the development footprint is contained within land in the R1 zoning. The R1 zone consists of a small area of mature vegetation and isolated paddock trees surrounded by cleared or previously cleared land containing native regrowth in varying condition. The C3 and C2 zones contain mature forested vegetation with no infrastructure and minimal evidence of recent disturbance.

The development proposal does not incorporate an Asset Protection Zone (APZ) however, an average separation of 15 m will be maintained between dwellings and the Vegetated Buffer Zone, which is contiguous with the retained vegetation.

All impacts associated with the development have been addressed in a Biodiversity Assessment Report (Ecosure 2024) accompanying the development application.

1.3 Background

This VMP aims to respond to items 1, 2, and 4 of the ID 2023-10327 - Request for additional information issued by the Department of Planning and Environment - Water. In addition, it addresses mitigation measures proposed within the BDAR (Ecosure 2023) detailing how indirect impacts to avoided vegetation adjacent to the development will be monitored for and addressed if required. This VMP is to be read in conjunction with the following plans and reports pursuant to DA2023/0241:

- Statement of Landscape Intent prepared by Zone Landscape Architecture (ZLA)
- Construction Environmental Management Plan prepared by Manage-Design-Engineer Pty Ltd (MDE)
- Erosion and Sediment Control Plan prepared by MDE
- Stormwater Management Plan prepared by MDE.
- Carrs Dr In Channel Works Aquatic Assessment prepared by Aquatic Science and Management

The VMP has been developed with reference to the following information and guidelines:

- Controlled activities – Guidelines for riparian corridors on waterfront land (NSW DPE 2022)
- Plant database, Water by Design: an Initiative of Healthy Land and Water (Water by Design 2020)
- Guide to monitoring ecological restoration projects (NSW OEH 2015)
- Part 4 of Schedule X1 of the CVC Residential Zones Development Control Plan
- Australian Standard AS 4970 - 2009 (Protection of trees on development sites).

1.4 Aims and objectives

As per the objectives of the DCP, the aim of the VMP is to plan, develop, rehabilitate and revegetate native communities and areas of biodiversity significance and enhance their preservation. The Department of Planning and Environment (DPE) requested further justification to support the issue of a controlled activity approval (CAA) in their RFI dated 26 July 2023. In contribution to fulfilling this request, the VMP addresses the requirements of a controlled activity approval as prescribed by the NRAR and in accordance with guidelines issued by NSW Office of Water (2022). A controlled activity approval applies to works on waterfront land, as defined under the NSW *Water Management Act* 2000 (WM Act), including removal of vegetation, construction works, deposition of material, and any other activity affecting the quantity or flow of water in a water source. The following objectives are outlined for the protection, restoration, and management of retained vegetation and watercourse at the site:

- prevent damage to retained vegetation
  - communicate tree protection and retention plans to site personnel
  - outline requirements for physical barriers to prevent impacts to retained vegetation during clearing and construction
  - manage recreational incursion into retained vegetation during the operational phase, through the provision of fencing, signage activation points and access points
- protect the three Commonwealth-listed Threatened Ecological Communities (TECs) known to occur, one of which is also listed at the State level. These TECs have been flagged to be retained adjacent to the development footprint through the management of a vegetated buffer zone at the interface of the built environment and retained vegetation, and through the restoration, stabilisation and management of a naturalised riparian channel within the development footprint
- enhance the condition of retained vegetation through the control of existing weed infestations and the prevention of further pest plant introductions associated with the development, and the monitoring of vegetation condition for a period of 5 years
- restore vegetation along the 2nd order stream occurring along the southern boundary of the site
- ensure an effective and resilient restoration outcome that approximates the native vegetation present on site
- to protect and enhance the connectivity of the retained vegetation for the benefit of fauna.

This VMP is to be applied in conjunction with the Statement of Landscape Intent prepared by Zone Landscape Architecture (2024), and the Stormwater Management Plan prepared by MDE (2024).

1.5 Staging

This VMP outlines management actions covering a period of five years, at which stage a compliance assessment will be scheduled with the approval authority.

Measures to protect, restore, manage and/ or monitor vegetation are outlined as they relate to the preconstruction phase, construction phase and post-construction phase of the proposal (Section 6).

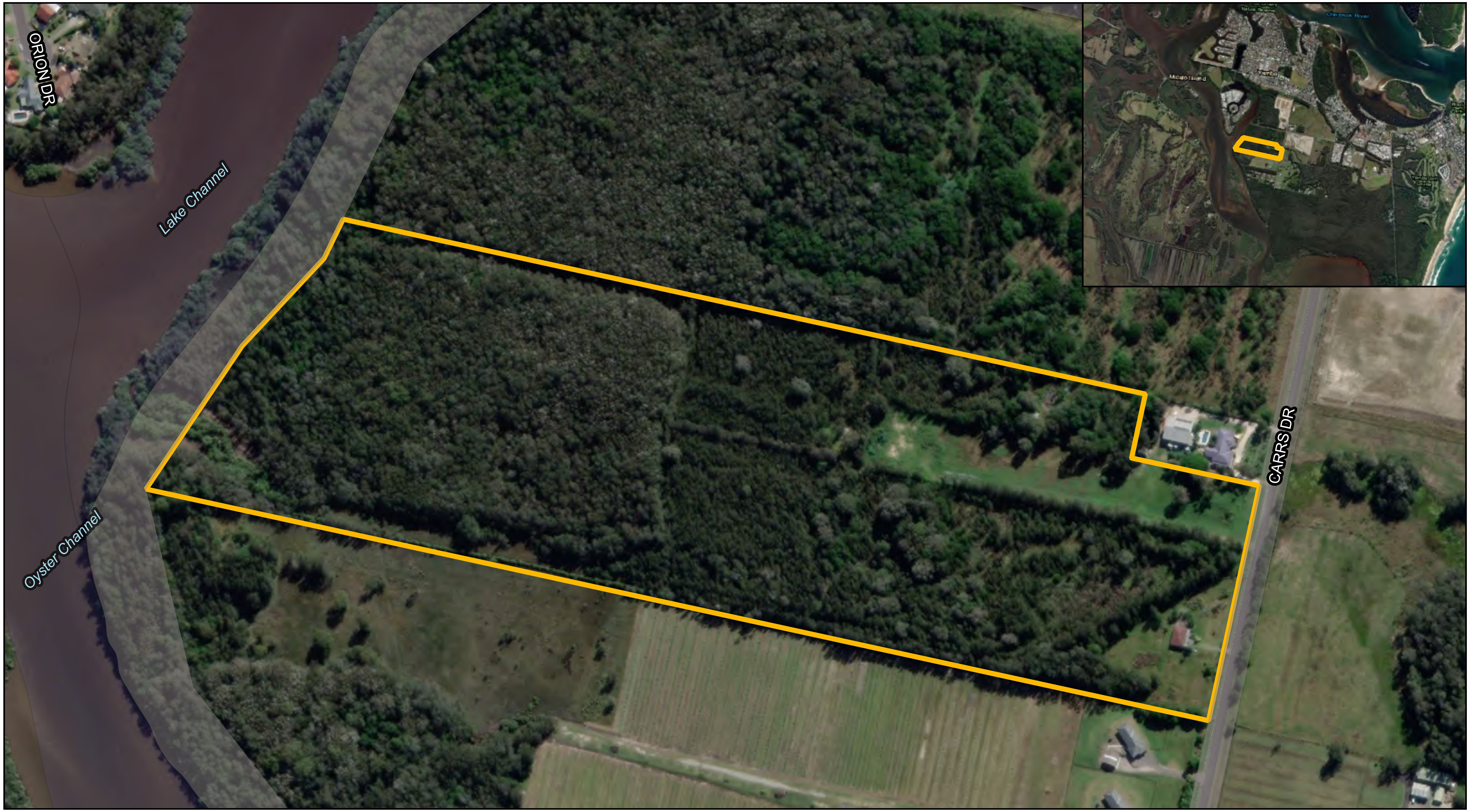

Figure 1: Site location

Clifton Yamba Land

Carrs Drive VMP

Site boundary
Road corridor
Water corridor

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Job number: PR8060
Revision: 0
Author: SR
Date: 05/10/2023

0 25 50 75 100 m

GDA 1994 MGA Zone 56
Projection: Transverse Mercator
Datum: GDA 1994
Units: Meter

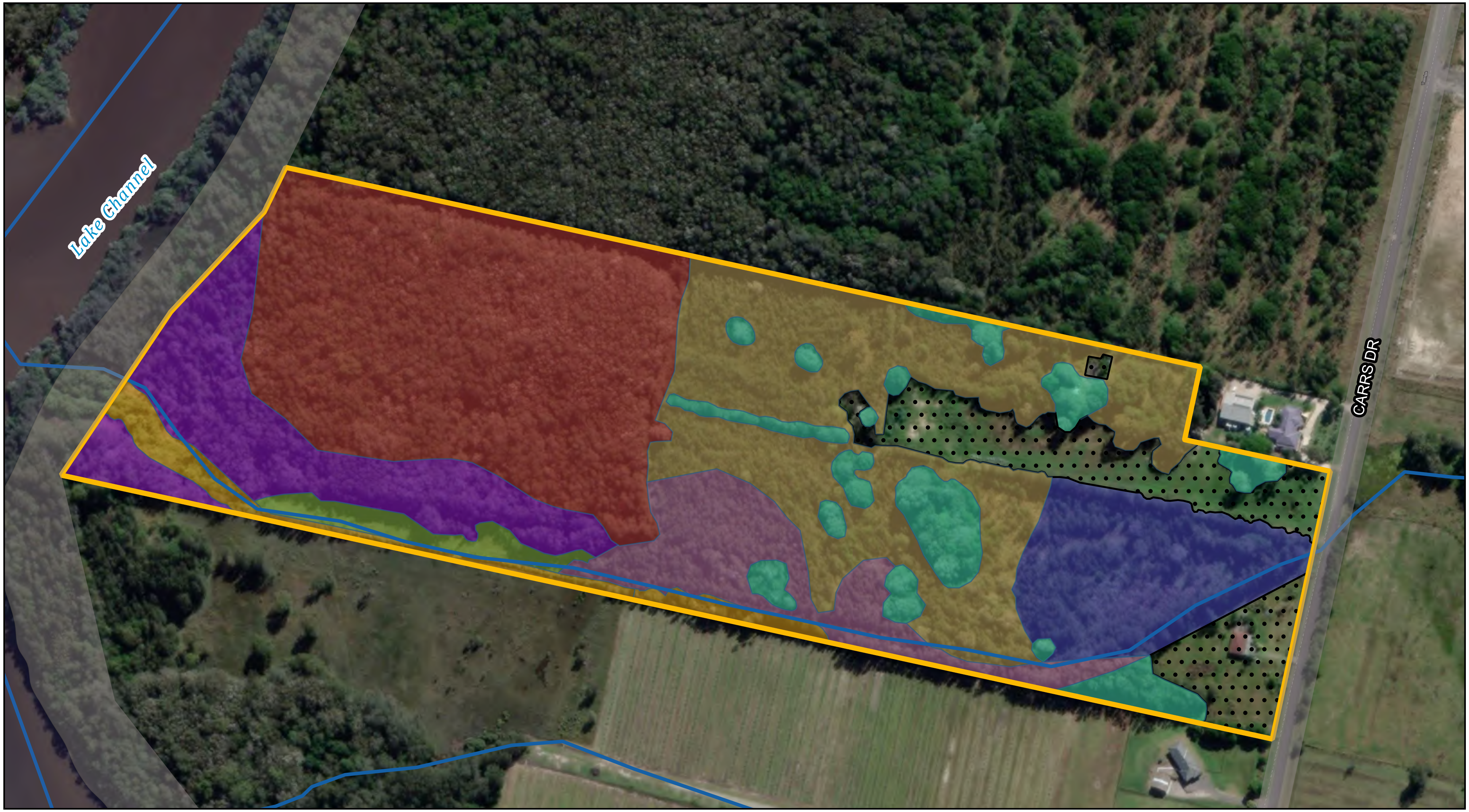

Figure 2: Existing vegetation

Clifton Yamba Land

Vegetation Management Plan, 110-120 Carrs Drive Yamba

Site boundary

Vegetation zones

- Regrowth - Swamp oak dominated with high weed cover
- Regrowth - Broad-leaved paperbark dominated
- Mature regrowth - broad-leaved paperbark dominated
- Mature regrowth - swamp oak dominated
- Remnant broad-leaved paperbark swamp forest
- Remnant swamp oak forest
- Saltmarsh
- Mangroves
- Cleared

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Job number: PR8060
Revision: 0
Author: JT
Date: 10/11/2023

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GDA 1994 MGA Zone 56
Projection: Transverse Mercator
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Units: Meter

2 Management context

2.1 Site biodiversity values

Three TECs listed under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) are present within the vegetation to be retained on site, comprising:

- Coastal Swamp Sclerophyll Forest of New South Wales and South East Queensland – Endangered
- Coastal Swamp Oak (*Casuarina glauca*) Forest of New South Wales and South East Queensland ecological community – Endangered
- Subtropical and Temperate Coastal Saltmarsh – Vulnerable.

In addition, a patch of vegetation consistent with Plant Community Type (PCT) 4091 – Grey Mangrove-River Mangrove Forest occurs in the southwestern corner of the site and a narrow fringe of grey mangrove (*Avicennia marina*) lines the lower reaches of a 2nd order stream, reflecting tidal influence extending from the stream's outlet at Oyster Channel estuary. The protection, management and/or restoration of these vegetation communities are the subject of this VMP. Each PCT is listed along with its respective vegetation class and associated TEC in Table 1 and displayed in Figure 2.

Table 1 Plant Community Types recorded on site and associated Threatened Ecological Communities

PCT ID	Plant Community Type	Vegetation Class	Associated EPBC Act listed TEC
3987	Far North Floodplain Paperbark-Swamp Oak Forest	Coastal Swamp Forest	Coastal swamp sclerophyll forest of New South Wales and south east Queensland
			Coastal swamp oak (*Casuarina glauca*) of New South Wales and south east Queensland
4103	*Sporobolus virginicus* Saltmarsh	Saltmarshes	Subtropical and Temperate Coastal Saltmarsh
4091	Grey Mangrove-River Mangrove Forest	Mangrove swamps	None

The vegetation to be retained on site is confirmed habitat for native fauna including nine species of frogs, 28 species of birds and 17 species of mammals, including nine species of microbat and two species of flying fox (Ecosure 2024). Among those are two threatened species; the squirrel glider *Petaurus norfolcensis*, listed as Vulnerable in NSW, and the grey-headed flying fox *Pteropus poliocephalus*, listed as Vulnerable under NSW and Commonwealth legislation.

2.2 Riparian features

A 2nd order stream enters the site from the east at Carrs Drive and runs along the southern boundary of the site towards the western perimeter, where it empties to the Oyster Channel estuary. The stream has been subject to historical modification, having been diverted, channelised and straightened to facilitate drainage of the site for agricultural purposes (Piper and Robins 2011).

Tidal influence extends approximately 700 m from the site's western boundary, with a narrow line of mangrove vegetation fringing the riparian zone, and saltmarsh vegetation fanning out from the riparian zone in the lower catchment, indicative of periodic tidal inundation. Upstream, at the site's southeastern extent, the riparian vegetation is indicative of greater freshwater influence, being comprised predominantly of broad-leaved paperbark (*Melaleuca quinquenervia*).

2.3 Weeds and pest animals

A cumulative record of exotic flora species was documented during ecological assessments carried out in September and November 2021, January and February 2022, June and December 2023 and January 2024.

Weed species encountered on site, along with the respective status of each under local, State and Commonwealth legislation or policy frameworks, are listed in Table 2. Notably, the Clarence Valley Council LGA is identified under the NSW *Biosecurity Act 2015* as an exclusion zone for groundsel bush (*Baccharis halimifolia*), imposing a duty for landholders to notify a control authority of its presence, eradicate the plant from the land and keep land free of the plant, mitigate the risk of reintroduction of the plant onto their land and refrain from selling, moving, carrying or releasing the plant into the environment (LLS 2022).

Two other species, ground asparagus (*Asparagus aethiopicus*) and lantana (*Lantana camara*) are both listed as priority weeds on the North Coast (LLS 2022) and as weeds of national significance (WoNS).

Weeds can also be indicators of altered hydrological regimes within the dominant vegetation community on site. Wetter regimes can result in increased success of weeds like water hyacinth (*Eichhornia crassipes*), while drier reconditions may facilitate invasion of prickly pear (*Opuntia* spp.) (DAWE 2021). Monitoring of weeds may therefore demonstrate the stability of hydrological conditions, in accordance with development approval conditions.

Table 2 Weed species recorded on site

Scientific name	Common name	North Coast Regional Strategic Weed Management Plan 2023-2027 Goal	BC Act	WONS
Ardisia crenata	coral berry	Asset protection – Additional species of concern	Exotic	-
Asparagus aethiopicus	ground asparagus	Containment and Asset Protection	HTW	Yes
Baccharis halimifolia	groundsel bush	Containment - Exclusion (eradication) zone	HTW	-
Cinnamomum camphora	camphor laurel	Asset protection – Additional species of concern	MHTW	-
Cuphea carthagenensis	Colombian waxweed	-	Exotic	-
Ficus pumila	climbing fig	-	Exotic	-
Ipomoea cairica	coastal morning glory	-	Exotic	-
Lantana camara	lantana	Containment and Asset Protection	MHTW	Yes
Macroptilium atropurpureum	siratro	-	Exotic	-
Ochna serrulata	ochna	-	HTW	-
Opuntia spp.	prickly pear	Containment and Asset Protection	MHTW	-
Paspalum mandiocanum	broad-leaf paspalum	-	HTW	-
Paspalum urvillei	vasey grass	-	Exotic	-
Passiflora edulis	common passionfruit	-	Exotic	-
Passiflora suberosa	corky passionfruit	-	HTW	-
Senna pendula	Easter cassia	-	MHTW	-
Setaria sphacelata	setaria	-	Exotic	-
Sphagneticola trilobata	Singapore daisy	-	Exotic	-

Biodiversity Conservation Act 2015 (NSW) Status: HTW - High Threat Weed – not manageable; MHTW - Manageable High Threat Weed

WONS: Weed of National Significance

3 Preconstruction phase

3.1 Erosion and sediment control

Erosion and sediment control devices will be installed and maintained for the duration of works, in accordance with an approved Erosion and Sediment Control Plan (ESCP).

Stockpiles will be:

- placed at least 5 m from existing vegetation, concentrated water flow, roads and hazard areas
- constructed as low, flat, elongated mounds aligned with the contour
- less than 2 m in height, where space allows
- stabilised to achieve a C-factor of less than 0.10 if intended to be retained for more than 10 days
- earth banks will be constructed 1 to 2 metres upslope of stockpiles to divert water around stockpiles and sediment fences (MDE 2023).

Sediment fencing will be:

- constructed as close to the alignment as possible with the contours of the site, with small, intermittent returns as shown in the ESCP to limit the catchment burden on any one section
- constructed with catchment areas small enough to limit water flow if concentrated at one point to 50 L per second in a 10-year storm event
- constructed with the bottom of the fabric to be entrenched within a 150-mm deep trench along the upslope line of the fence
- supported with 1.5 m long, safety-capped star pickets driven into ground at 2.5 m intervals (max) at the downslope edge of the trench
- fixed with self-supporting geotextile specifically manufactured for sediment fencing, to the upslope side of the posts, reaching to the base of the trench and fixed wire ties or as recommended by the manufacturer.
- arranged so that geotextile fabric sections overlap by 150 mm at a support post
- backfilled with compacted soil within the upslope trench to cover the base of the geotextile fabric (MDE 2023).

Further details, construction notes and design drawings are provided in the ESCP prepared by MDE (Appendix 1).

3.2 Tree retention and protection measures

The development proposes to clear 10.07 ha of vegetation, carrying out bulk earthworks to achieve a developable landform above flood levels.

A designated vegetated buffer zone extending 30 m from the western extent of the proposed development footprint will be subject to provisions outlined in Section 4 to mitigate, monitor and manage the impacts of edge effects, such as weed invasion, on retained native vegetation.

Prior to any machinery arriving at site, a vegetation protection barrier will be installed along the outer edge of the tree protection zone (TPZ) of trees forming the perimeter of the vegetation community to be retained adjacent to the development footprint.

As vegetation communities are being retained, the fencing can be along the boundary of the community rather than each single tree. It is recommended that a suitably qualified arborist supervises the installation of tree protection zones to advise on the necessity of any specific measures to prevent incidental damage resulting from dislodgement of unstable limbs, compaction of root zones or other disturbance to individual trees.

The tree protection fencing can be either:

- high visibility mesh/para webbing installed with 1500 mm stakes at 3 m intervals; OR
- rope flagging installed with 1500 mm stakes at 3 m centres.

Signs will be installed intermittently (at high visibility locations) stating that the fenced area is a TPZ, with no unauthorised access.

Once installed, fencing is not to be removed or altered until works with machinery have ceased, or access is required for rehabilitation purposes. In accordance with Australian Standard (AS) 4970 – 2009 (Protection of trees on development sites), the following activities are not permitted within the fenced off tree protection area:

- trenching or excavation
- placing of fill or sediment
- installation of sediment fencing
- cultivation activities, or parking of vehicles or plant
- storage of items
- mixing, storage or preparation of chemicals
- machine or equipment wash-downs or cleaning
- damage to vegetation
- washdown of vehicles
- any other activity detrimental to the ongoing health of the tree or vegetation to be retained.

The TPZ is calculated at 12 x diameter at breast height (DBH), in accordance with AS 4970-2009.

All personnel are to be briefed at the site induction on the tree protection locations and notified that fencing is not to be removed. Fencing inspections are to be included on the supervisor's daily inspection sheet and maintained as required. Trees to be removed are to be felled away from any TPZ.

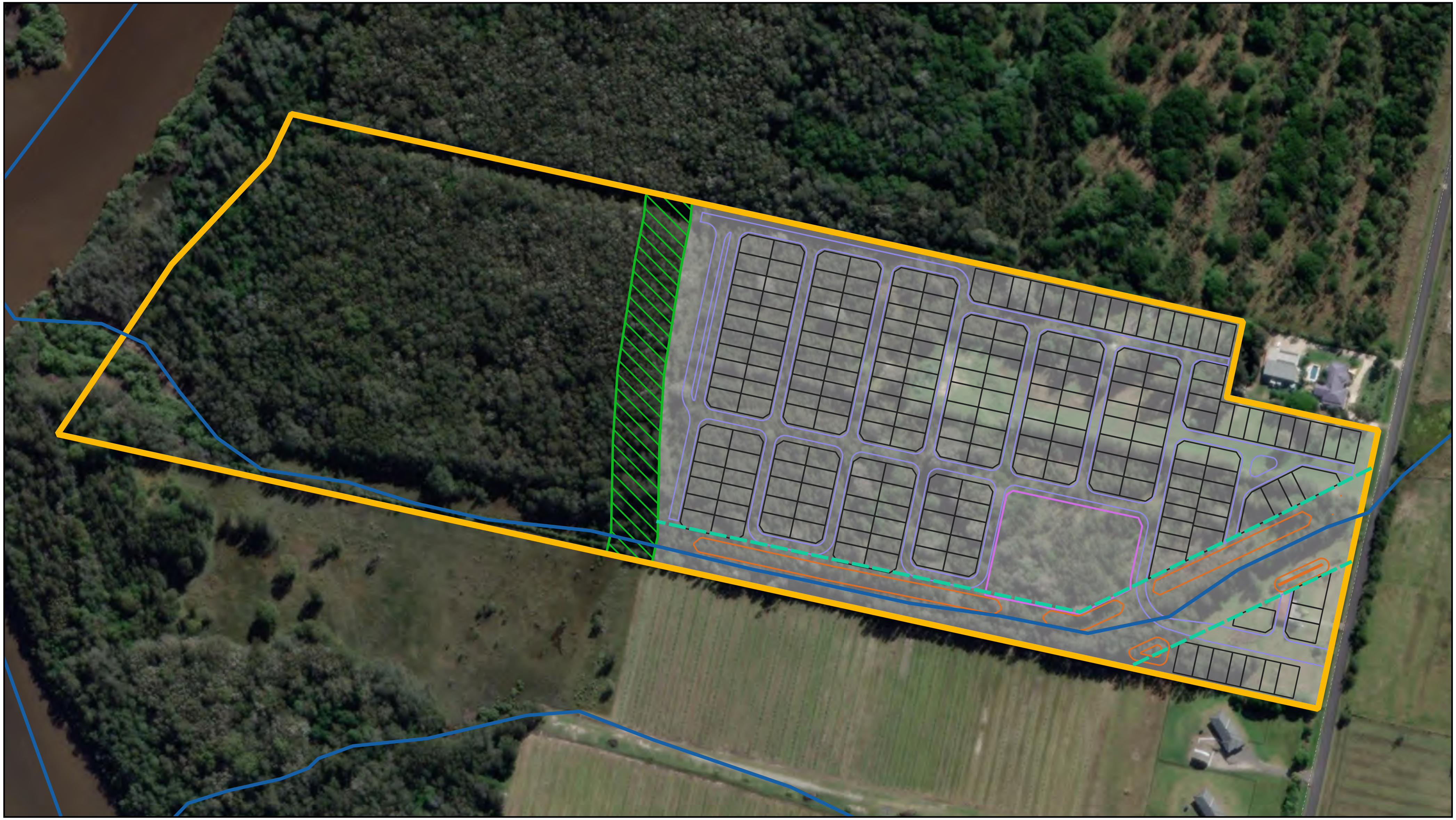

Figure 3: Proposed development layout

Clifton Yamba Land

Vegetation Management Plan, 110-120 Carrs Drive Yamba

Site boundary

Watercourse

30 m vegetated buffer

20 m riparian set-back

Disturbance footprint

Design plan

Proposed lots

Proposed community centre

Bio retention zones

Roads

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Job number: PR8060
Revision: 0
Author: SR
Date: 30/01/2024

0 25 50 75 100 m

GDA 1994 MGA Zone 56
Projection: Transverse Mercator
Datum: GDA 1994
Units: Meter

3.3 Signage and notification

A copy of this VMP, with relevant conditions imposed by regulators, will be displayed in the site office for site personnel and machinery operators to review. Signage will be installed at strategic, visible points along TPZ advising site personnel of purpose and restricting unauthorised persons from tampering with its alignment (Section 3.2).

3.4 Weed and pathogen hygiene

Weed hygiene procedures (Appendix 2) will be implemented prior to the commencement of construction and maintained for the duration of site works, to mitigate the spread of weed seeds by vehicles and personnel accessing the site. Weed washdowns are to be conducted at nearby commercial car wash facilities until the on-site washdown facility planned to be constructed as part of the proposed development becomes operational.

Coastal swamp sclerophyll forest of New South Wales and South East Queensland TEC is susceptible to dieback caused by the root-rot fungus (*Phytophthora cinnamomi*), which is spread via the transfer of soil, water and organic matter from infected sites to uninfected sites. There is no evidence that the pathogen occurs on the site; therefore, measures to maintain biosecurity will be implemented through the application of Introduction and Spread of Weed and Pathogens Procedure (Appendix 3) which will include a washdown protocol to remove potentially infected organic matter from vehicles, machinery and bush regeneration tools.

The promotion of biosecurity hygiene will be communicated to site personnel and machinery operators by way of messaging endorsed by the Australian Government's Threat Abatement Plan (DCCEEW 2018), e.g., 'Arrive clean, leave clean' and 'Check, Clean, Disinfect, Dry' messaging displayed in the site office.

4 Construction phase

4.1 Vegetation removal

Vegetation will be cleared to facilitate earthworks within a 10.07 ha area of the site (Figure 3).

The following clearing protocols are outlined to avoid direct injury to wildlife during clearing:

- pre-clearing fauna surveys will be carried out to identify any active fauna breeding places or fauna to be relocated (presence of threatened species will result in a stop-works)
- clearing works will be timed to avoid critical life cycle events such as general breeding activity during late winter/ spring
- clearing will be undertaken under the supervision of an experienced fauna spotter / catcher operating under a NSW Biodiversity Conservation Licence
- clearing will be carried out sequentially from the Carrs Drive frontage towards the western extent of the clearing footprint, to allow wildlife the opportunity to evacuate to adjacent vegetation.

Felled vegetation will be mulched and stored offsite in an approved facility/location, for reuse in landscaping and restoration works in accordance with AS 4454-2012.

Habitat features such as hollow logs will be set aside to be relocated from the impacted area into adjacent retained vegetation or restoration areas where suitable, by suitably qualified restoration practitioners.

4.2 Earthworks

4.2.1 Landform establishment

Earthworks will raise the site's elevation above flood levels, requiring significant import of clean fill and compaction prior to construction.

Prior to earthworks, remediation of contamination identified during the design phase is required. This will involve the excavation and off-site disposal of impacted soil in the vicinity of an oil drum and concrete slab associated with a former dwelling, in accordance with the NSW EPA waste framework, including:

- an excavation of approximately 2 m x 2 m x 0.4 m depth, based on site investigations
- validation sampling following the removal of impacted soil to confirm the soil is suitable for residential land use
- removal of debris associated with the site's former use for residential and agricultural purposes.

Further details of remediation works are addressed in the CEMP (Appendix 4). The CEMP will incorporate protocols for acid sulphate soils management, dust suppression and water quality monitoring during the construction phase (Appendix 4).

Topsoil will be stripped to a stockpile, from which landscaping and restoration works may source material as required in accordance with AS 4419-2003.

Filling the site will involve:

- introduction of fill from an approved source or quarry
- trucking of fill material on to site via Carrs Drive
- batters to be located 10 to 15 m from the edge of retained vegetation along Oyster Channel (Appendix 5)
- a total area of 10.07 ha to be subject to earthworks on site.

Detailed technical drawings are provided in the Earthworks Plan prepared by MDE (Appendix 5).

Topsoil will be salvaged and stored onsite or disposed of offsite in an approved facility in accordance with AS 4419—2003.

Erosion and sediment control procedures will be overseen in accordance with an approved ESCP (Appendix 1).

4.2.2 Riparian works

A CAA under the *Water Management Act 2000* (WM Act) will be required to permit works within the 2nd order stream, a condition of which is the provision of this VMP.

The Guidelines for Development on Waterfront Land stipulate the requirement for a VRZ of 20 m either side of a 2nd order stream, with allowances for variability providing that the average 20m buffer width is maintained along the stream's length.

The proposed VRZ is measured from the top of bank of either side of the watercourse in accordance with NSW Guidelines for Development on Waterfront Land requiring:

- vegetation restoration works and scour protection within the outer 50 % of the riparian buffer of the existing 2nd order stream
- construction of stormwater quality and quantity management devices to mitigate stormwater runoff during the construction phase and subsequent operational phase, in accordance with an approved Stormwater Management Plan (SMP) (MDE 2024)
- stormwater drainage works will be carried out in accordance with an approved SMP, incorporating piped drainage of development flows.

4.3 Works schedule

A schedule for the works prescribed in this VMP is provided (Appendix 6), and may commence following approval by the relevant authorities including:

- CVC
- NRAR
- Department of Planning and Environment – Water (DPE-Water)
- Department of Climate Change, Energy, the Environment and Water (DCCEEW).

The broad steps outlined in the schedule of works include the following:

- civil works
  - install construction fencing
  - install sediment fencing
  - install information signage
- revegetation
  - seed collection from local provenance, cleaning and storage during growth
  - site preparation
  - installation of jute matt and mulch
  - tube stock supply from local provenance
  - tube stock installation
  - replacement tube stock as required
  - irrigation
- weed control
  - primary and secondary control
  - maintenance
  - other works
- monitoring and reporting.

5 Restoration phase

5.1 Restoration strategy

The goal of the VMP is to mitigate impacts of the proposal through the improvement and ongoing management of the retained vegetation within the site. The VMP has also been prepared to detail the requirements for the restoration of riparian vegetation within the 20m riparian zone either side of the 2^{nd} order stream running through the site to satisfy DPE Water requirements for development on waterfront land (DPE 2022).

5.1.1 Reference ecosystems

Planting palettes are selected to reflect the extant native vegetation on site and are guided by the recommendations of the Water by Design plant database (Water by Design 2020). Recommendations also reflect likely changes to the soil profile and other features of physiography such as drainage and aspect resulting from major earthworks.

5.1.2 Vegetation Management Zones

As the project undergoes refinement there is an opportunity to review the locations and areas of management zones based on the final landscape plan and stormwater management designs.

The total area covered by this VMP is 9.23 ha of vegetation covering 3 Vegetation Management Zones (VMZ) for this VMP (Figure 5):

- Zone 1 (Vegetation buffer) – Regeneration
- Zone 2 (Retained vegetation) – Regeneration
- Zone 3 (Riparian corridor VRZ) – Revegetation.

5.1.2.1 Zone 1: Regeneration

Zone 1 is the vegetated buffer zone of 30 m from the western extent of the proposed development footprint covering 0.71 ha. The objectives of this zone are to mitigate, monitor and manage the impacts of edge effects, such as weed invasion and changes in hydrology, on retained native vegetation should they occur.

Weed management works in this zone will include the cut, scrape and paint treatment of all woody weeds and spot spraying exotic vines and grasses using a non-selective herbicide (e.g. Roundup Biactive®). This will likely require a minimum of at least two spray treatments. Weed control maintenance will also likely be required to manage further weed germination.

Two photo and two quadrat-based vegetation monitoring points will be established within this zone to allow for adaptive management where required.

For more information on specific weed control techniques, see Appendix 2.

5.1.2.2 Zone 2: Regeneration

This zone encompasses the remainder of the vegetation to be retained within the site covering an area of 6.9 ha.

This area is predominantly the PCT 3987 Far North Floodplain Paperbark-Swamp Oak Forest with small areas of PCT 4091 – Grey Mangrove-River Mangrove Forest and PCT 4103 *Sporobolus virginicus* Saltmarsh.

The vegetation within this zone is in relatively good condition with only scattered weeds. No planting is required within this zone. Two photo monitoring points will be established within this zone.

Weed management works in this zone will include the cut, scrape and paint control of all woody weeds using a nonselective herbicide (e.g. Roundup Biactive®).

5.1.2.3 Zone 3: VRZ - Revegetation

Zone 3 is where the works proposed to be undertaken under a WM Act CAA will occur and covers an area of 1.62 ha.

All of this zone except the stream bed and bank will be cleared to allow for the construction of earthworks, fill embankments, and stormwater quality and quantity management devices to mitigate stormwater runoff according to approved plans as a result of the development.

Following earthworks, it is expected that all of Zone 3 except for the stream bed will require revegetation with trees, shrubs and groundcovers to reinstate PCT 3987 Far North Floodplain Paperbark-Swamp Oak Forest throughout all vegetation strata with species identified in Table 3, and revegetation densities as identified in Table 4.

All plantings need to be local provenance species; a complete list of flora species recorded on the site can be found in Appendix 7. This zone will be where landscaping (Appendix 8), the SMP and the vegetation management plan all integrate (Figure 4).

Figure 4 Excerpt from Statement of Landscape depicting an example of integration of stormwater management devices with revegetation zones (Zone Landscape Architecture 2024)

Two photo, and two quadrat-based vegetation monitoring points will be established within this zone to allow for adaptive management where required as per the Guidelines for vegetation management plans on waterfront land (NSW DPE 2022).

Figure 5: Vegetation management zones

Clifton Yamba Land

Vegetation Management Plan, 110-120 Carrs Drive Yamba

Watercourse
Road corridor
Site boundary
Disturbance footprint

Vegetation management zone

Zone 1 (Rehabilitation) - Vegetated buffer
Zone 2 (Rehabilitation) - Retained vegetation
Zone 3 (Revegetation) - Riparian corridor VRZ

ecosure
improving ecosystems

Job number: PR8060
Revision: 0
Author: SR
Date: 31/01/2024

0 25 50 75 100 m

GDA 1994 MGA Zone 56
Projection: Transverse Mercator
Datum: GDA 1994
Units: Meter

5.1.3 Planting palettes, densities and schedules

All plantings are to be sourced from local provenance stock, wherever possible, as per the Florabank guidelines (Mortlock, 1999). If a prescribed species (Table 3) is not available, quantities may be supplemented with one or more substitute species from the species list in Appendix 7 and from the equivalent stratum (e.g., trees, shrubs, groundcovers).

Trees should be planted with sufficient spacing to allow for formation of lateral branches in trees and to allow enough light through for native grasses, shrubs and ferns to thrive.

For further technical information on stormwater infrastructure, refer to engineering plans prepared by MDE (Appendix 9).

Table 3 Planting palettes

VMZ	Description	Reference community	Primary objective	Planting palette
Zone 1	Vegetated buffer, including scour outlets	· PCT 3987 Far North Floodplain Paperbark-Swamp Oak Forest · Reference sites	· Mitigate edge effects through intensively managing vegetation at the interface with the development footprint. · Weed management and in-fill planting where necessary. Monitor vegetation condition at reference sites	· Infill planting to select from Zone 3 palette
Zone 2	Environmental management zone	· PCT 3987 Far North Floodplain Paperbark-Swamp Oak Forest · Reference sites	· Monitor vegetation to identify and manage weeds · Monitor vegetation condition at reference sites	· Infill planting only to be implemented as required in instances where manual weed control results in areas of disturbance > 5 m2. · Otherwise, natural regeneration from adjacent mature vegetation to be supported. · Infill planting to select from Zone 3 palette
Zone 3	Riparian corridor (incorporating VRZ & Stormwater Devices)	· PCT 3987 Far North Floodplain Paperbark-Swamp Oak Forest	· Revegetate and apply adaptive management	**Upper Stream Banks/Riparian Zone** **Ground cover** *Carex appressa* *Ficinia nodosa* *Lepidosperma laterale* *Lomandra hystrix* *Lomandra longifolia*

VMZ	Description	Reference community	Primary objective	Planting palette
				Myoporum insulare *Juncus usitatus* *Dianella longifolia* **Shrubs** *Leptospermum liversidgei* *Melaleuca sieberi* *Melaleuca thymifolia* *Banksia robur* *Pittosporum undulatum* **Trees** *Casuarina glauca* *Glochidion ferdinandi var. ferdinandi* *Cupaniopsis anacardioides* *Lophostemon suaveolens* *Melaleuca bracteata* *Melaleuca quinquenervia*
				Areas of Inundation *Machaerina rubiginosa* *Fimbristylis ferruginea* *Schoenoplectus validus* *Phragmites australis* *Philydrum lanuginosum*

5.1.4 Revegetation

Revegetation works are required within Zone 3 (Figure 5). It is assumed that natural recruitment will occur within Zone 1 and 2 following targeted weed treatment supported by ongoing weed control maintenance, with in-fill planting to be instigated where weed control results in bare ground exceeding $5m^2$.

Revegetation works will include planting of native groundcover, grass, shrub and canopy species using tube stock and Hiko / Viro cells. Mulch, where needed, is to be applied providing a depth of 100 mm. Mulch can be sourced from native vegetation earmarked for removal from the development area or externally sourced from certified weed free sources.

Jute matting is to be used instead of mulch in areas of high erosional potential along the riparian corridor. More information on revegetation and seed collection specifications is provided in Appendix 2.

Table 4 outlines indicative planting densities and tube stock requirements for each VMZ.

Table 4 Revegetation densities and tube stock requirements

VMZ	Description	Total Area ha)	Revegetation area (m2)	Planting densities (per m^2)				Total numbers			
				Tree	Shrub	Forbs	Graminoids	Tree	Shrub	Forbs	Graminoids
1	Rehabilitation	0.71	None proposed	-	-	-	-	-	-	-	-
2	Rehabilitation	6.9	None proposed	-	-	-	-	-	-	-	-
3	Revegetation	1.62	16,200	0.25	0.2	1	1	4050	3240	16200	16200
										Sub-Total	**76,180**

5.2 Weed management

5.2.1 Primary and secondary weed control

Primary weed control is to be undertaken in the establishment phase and includes the initial treatment of woody weeds, vines, and exotic grasses and groundcovers, specifically the control of *Lantana camara* (lantana), *Cinnamomum camphora* (camphor laurel*), Baccharis halimifolia* (groundsel bush), *Senna pendula* var. *glabrata* (Easter cassia / winter senna) and *Asparagus aethiopicus* (asparagus fern).

Woody weeds can be treated using cut, scrape and paint method. Woody weeds adjacent to the creek line are to be cut, treated and left in situ if close to the creek line to prevent localised erosion impacts. Chemical control techniques will be required for grasses and groundcovers with the exception being adjacent to the creek line, near waterways or drainage lines where no spraying should be undertaken to limit pollution. The treatment of exotic grass and groundcover in these sections should limited to hand weeding where practical, or chemical control using herbicides registered for use in and around watercourses, such as Weedmaster Duo Biactive ® or Roundup Biactive®.

Secondary weed control is also to be undertaken in the establishment period and includes follow up treatments of all weed seedling growth after initial weed treatment, as well as overlooked weeds. Chemical and mechanical control techniques will be required in follow up treatments. During these weed control activities, care must be taken to avoid damaging any natural regeneration of native species. For more information on specific weed control techniques, see Appendix 3.

5.2.2 Weed control measures

All material brought onto the site should be free of weeds and pathogens. Landscaping materials and plants must be sourced from accredited providers registered with the Nursery Industry Accreditation Scheme Australia to ensure compliance with Australian Standards such as *AS4454-2012 Composts, soil conditioners and mulches.*

Weed control measures are outlined in Table 5 with additional details in Appendix 3. All weed control must be in accordance with approved controls detailed in the *North Coast Regional Strategic Weed Management Plan 2023-2027.*

Table 5 Prescribed weed control measures

Weed type	Examples recorded on site	Prescribed control measures
Grasses and forbs	*Cuphea carthagenensis* *Paspalum* spp. *Setaria sphacelata* *Sphagneticola trilobata*	Foliar spray Hand-pulling (early infestations, small infestations, sensitive locations)
Exotic vines	*Ipomoea cairica* *Passiflora suberosa*	Cut, scrape and paint Hand-pulling (early infestations, small infestations)

Weed type	Examples recorded on site	Prescribed control measures
	Passiflora edulis	
Woody weeds	*Cinnamomum camphora* *Lantana camara* *Ochna serrulata* *Senna pendula* var. *glabrata*	Poison in situ by stem injection Hand-pulling, manual removal (early infestations, small infestations)

Handling and application of foliar sprays and other herbicides is to be carried out with care to avoid native woody vegetation and watercourse values. Only herbicides registered for use around waterways are to be applied to minimise impacts on water quality. Herbicides and other chemicals must only be used and stored according to the manufacturer's instructions, applied by a licensed practitioner, and fit for purpose according to the relevant herbicide information available at the Australian Pesticides and Veterinary Medicines Authority database, accessible at https://portal.apvma.gov.au/pubcris. Emergency spill kits will be made available at the site office.

Weed control must be completed by suitably certified bush regeneration practitioners. Contractors must be inducted into the site, including familiarisation with TEC adjacent to restoration areas and within the 2nd order watercourse.

Wastewater from the on-site facility will be directed into municipal sewerage services, contributing to ongoing weed hygiene for the retained vegetation for the duration of the site's operation. This will contribute to alignment with the Australian Weeds Strategy 2017-2027 during its construction phase (Invasive Plants and Animals Committee 2016b).

5.2.3 Maintenance

Following primary and secondary weed control, all areas will require ongoing maintenance for a period of five years to treat weed regrowth from the soil seed bank. The maintenance period will commence at the completion of all establishment period works. Maintenance work is to be undertaken by a qualified bush regeneration contractor(s) as per specifications provided in Appendix 1. Maintenance will be undertaken on a regular basis in the peak growing seasons (spring and summer), with less frequent visits in cooler periods (autumn and winter). Maintenance work will include actions to encourage native regeneration where it is not occurring naturally. These actions include techniques such as soil disturbance, niche seeding and transplanting.

5.3 Impact mitigation measures

Interpretive signage will be installed at strategic points to increase local awareness of the presence of biodiversity values under conservation and management.

Community awareness of the importance of woody debris as habitat features for some species, to discourage removal of plant material from the retained habitat.

Principles of Water Sensitive Urban Design (WSUD) to be incorporated into the riparian restoration will include:

- retention and restoration of the existing 2nd order stream
- dedicated vehicle washdown area
  - capture and re-use stormwater
  - minimise pollutants entering stormwater outlets and waterways
  - mitigate impacts to water quality
- utilisation of tree pits for street trees, incorporating flow direction ribs to improve in flow to:
  - enhance water infiltration
  - aid stormwater treatment
  - improve tree growth with less demand for maintenance watering
- bioretention basins in the outer 50% of the riparian zone to economically:
  - enhance water infiltration
  - aid stormwater treatment
  - provide hydrological benefit
- increased permeable surfaces through the use of perforated pavements, e.g. near riparian zones.

In addition, WSUD has informed the selection of planting palettes to buffer and revegetate the interface between residential and riparian areas, manage flows, provide for fauna habitat, source from local plant stock and minimise the inputs required to fertilise, water and maintain vegetation.

Overland flows from the development site will be directed to bioretention basins or detention basins and subsequently to the channel at the southern boundary of the site, where flows will be conveyed towards the Oyster Channel (Appendix 8). This will apply to all proposed stormwater outlets except for two scour valves directing stormwater flows to the west. The design responds to the CVC stormwater design standards of capturing and conveying via the proposed pit and pipe network all flows up to and including the 5-year Average Recurrence Interval (ARI) event. Volumes exceeding the 5-year ARI event will surcharge the system and travel via overland flow to the basins then into the existing channel. The basins are designed so as to not increase the discharge in the post developed scenario, i.e. pre and post stormwater discharge volumes will remain comparable.

Both the basins and buried infiltration tanks provide a stormwater treatment function through the provision of an extended detention zone. Stormwater runoff will be retained within this zone and then infiltrate down through filter layers and eventually into the naturally occurring sands and the water table. Basins will be vegetated with appropriate native groundcover species to aid in the removal of nutrients from runoff. Species to be used in basin revegetation will include *Carex appressa, Ficinia nodosa, Lepidosperma laterale, Lomandra spp.,* and *Myoporum insulare* (Table 3, Appendix 8 7).

5.4 Performance objectives and criteria

The Guidelines for Vegetation Management Plans on Waterfront Land (NSW Office of Water 2012a) nominate a performance objective of a minimum 80% survival rate for all plantings, with a maximum weed cover of 5%. With the goal to restore VZ 3 with species, composition, and structure consistent with existing relevant ecological communities a minimum of 40% of the benchmark levels for species diversity (Table 6) will be planted.

The performance criteria are detailed in Table 7. Failure to meet these performance criteria will mean that the maintenance period will be extended until they are achieved. Therefore, maintenance must continue until CVC agrees that the objectives and performance criteria have been met and the maintenance period has concluded. A qualified and experienced person must prepare a statement certifying the compliance of the performance criteria at the end of the five-year maintenance period.

If monitoring indicates that the VMP tasks are not resulting in achievement of the performance criteria, the task program will be revised. The project manager and the bush regeneration contractor, in consultation with the CVC, can adapt these criteria as required in response to the success of rehabilitation works.

Table 6 Benchmark values for revegetation within the VMP area

PCT-ID	PCT common name	Species richness			Cover %		
		Tree	Shrub	Groundcover #	Canopy	Shrub	Groundcover #
3987	Far North Floodplain Paperbark-Swamp Oak Forest	7	6	19	39	10	90

 # Includes grasses, forbs and ferns

Table 7 Performance criteria

Management Zone	Year 1	Year 2	Year 3	Year 4	Year 5
All zones	Commencement of all tasks outlined in the VMP or evidence of planning for their implementation *Civil construction works*: · all construction and sediment fencing installed · information signage installed · all earthworks completed under the supervision of an ecologist or bush regenerator · soil preparation works completed to specifications in section 5.2 · all rubbish and debris removed. *Vegetation management works:* · revegetation is to be undertaken with a minimum of 40% of the benchmark levels for species diversity provided in Table 6 · maintenance replanting is to replace plants by the same species, or where that species is not available, with the same growth form (i.e. tree for tree, etc.) and must not decrease species diversity. any new species must be from the community being emulated and of local provenance · treatment of any new weed infestations · no woody weeds present which are capable of producing seeds · no erosion or sedimentation beyond the boundary of the development lot · monitoring and reporting undertaken in accordance with Section 6.				
All zones	· Treat 100% of priority weeds · Treat 95% of other weeds · Treatment of new weed breakouts · Shrub and groundcover no less than 40% of their benchmark levels provided in Table 6.	· Treatment of new weed outbreaks · Shrub and groundcover no less than 40% of their benchmark levels provided in Table 6.	· Treatment of new weed outbreaks · Shrub and groundcover no less than 40% of their benchmark levels provided in Table 6.	· Treatment of new weed outbreaks · Shrub and groundcover no less than 40% of their benchmark levels provided in Table 6.	· Treatment of new weed outbreaks · Shrub and groundcover no less than 40% of their benchmark levels provided in Table 6.
Zones 1 and 2	· No greater than 30% cover by priority weeds	· No greater than 20% cover by priority weeds	· No greater than 15% cover by priority weeds	· No greater than 5% cover by priority weeds	· No greater than 2% cover by priority weeds

Management Zone	Year 1	Year 2	Year 3	Year 4	Year 5
(Rehabilitation)	· No greater than 40% cover by other environmental weeds.	· No greater than 30% cover by other environmental weeds.	· No greater than 20% cover by other environmental weeds.	· No greater than 10% cover by other environmental weeds.	· No greater than 4% cover by other environmental weeds.
Zone 3 (Revegetation)	· Native vegetation cover no less than 50% · 85% survival rate of plantings, replacement plantings where required · Suppression of all weeds during revegetation · No greater than 20% cover by priority weeds · No greater than 30% cover by other weeds.	· Native vegetation cover no less than 60% · 85% survival rate of plantings, replacement plantings where required · No greater than 15% cover by priority weeds · No greater than 25% cover by other weeds.	· Native vegetation cover no less than 70% · 85% survival rate of plantings, replacement plantings where required · No greater than 10% cover by priority weeds · No greater than 20% cover by other weeds.	· Native vegetation cover no less than 80% · 85% survival rate of plantings, replacement plantings where required · No greater than 5% cover by priority weeds · No greater than 10% cover by other weeds.	· Native vegetation cover no less than 90% · 85% survival rate of plantings, replacement plantings where required · No greater than 2% cover by priority weeds · No greater than 4% cover by other weeds.

6 Monitoring and Reporting

The bush regeneration contractor and the land manager will monitor the vegetation for changes over time. Information gained through the monitoring and reporting process will identify works that have and have not been successful, and the reasons for their success or failure.

The aim of monitoring is to measure the effectiveness of the control actions being undertaken to achieve the desired outcome. It will identify non-conformance and provide the land manager with the ability to implement corrective actions. Information derived from the results of monitoring will also be used in adaptive management (i.e., learning from past experience to inform future priorities and work plans). For example, as annual grass weeds are removed, herbaceous and perennial weeds may establish.

Finally, monitoring and reporting will help determine and quantify the costs related to weed management and the cost effectiveness of the VMP.

6.1 Monitoring

Monitoring will be undertaken by photo monitoring and vegetation surveys. Monitoring will need to be implemented prior to works commencing to establish a benchmark for performance, and to occur on an annual basis until the completion of the project. Monitoring results will be included in the progress report.

6.1.1 Photo monitoring

Photo monitoring points should be set-up using a permanent reference point to provide a visual reference of changes in the vegetation. Photo monitoring to include:

- set up a minimum of eight photo monitoring points within the VMP area
- place two six-foot star pickets 10 m apart
- record the location (eastings and northings) of the first star picket with a GPS
- record the bearing to the second star picket
- take a digital photo from the first star picket looking towards the second star picket, showing the entire length of first star picket.

Label each digital image with a unique reference number that indicates where the photo was taken (i.e. the photo monitoring point) and the date it was taken (e.g. 01_240330 for a photo taken at the first photo monitoring point on the 30th March 2024).

6.1.2 Vegetation surveys

Quadrat based vegetation monitoring points will be completed within the VMP area to monitor changes in the vegetation through time. A minimum of four quadrat based monitoring points are to be set up within the VMP area. The quadrat data forms the baseline for monitoring against the performance criteria for the first five years of the duration of the VMP. Floristic plot data is to be collected including species richness, cover and abundance in a 10 m x 10 m quadrat.

6.2 Progress reports

A baseline report is to be prepared prior to works being undertaken to establish a benchmark for performance of works over time. Progress reports are then to be provided at the completion of the establishment period, on an annual basis throughout the maintenance period of the VMP.

This reporting includes the implementation of the monitoring actions specified in Section 6.1 and a description of the works that have been undertaken. These reports will be submitted to the CVC. Reports will include at a minimum:

- the time period the report relates to
- qualifications and experience of contractors
- certification of seed and local provenance stock
- a summary of works carried out within the period including:
  - date and time of site visits
  - works completed on the site at each visit
  - a table detailing total person hours for each task carried out on site
  - methods of weeding undertaken and details of herbicide use
  - numbers of tubestock planted if applicable
  - any methods implemented for Assisted Natural Regeneration
- photo monitoring results to date
- a description of any problems encountered in implementing the works outlined in this VMP, including stochastic events such as flood, bushfire or chemical spill, and how they were overcome
- any observations made, including new plant species recorded (native and weed species), comments on rates of regeneration and any problems which impact on the implementation of the VMP
- if applicable, the results of the implementation works in relation to the relevant performance criteria.

7 Costing

The cost of implementation for five-year period will be approximately $468,408.00 exclusive of GST and CPI. An indicative annual costing timeline is provided in Table 8. Rates and costs are based on typical commercial rates. Assumptions that have been made regarding the estimation of costs have been outlined below.

7.1 Construction and preparation works

Civil construction activities have not been costed within the VMP Table 8.

7.2 Vegetation management works

7.2.1 Site preparation techniques

Costings have assumed that truck access will be possible for the installation of jute matting in Management Zone 3. If truck access is not available, then this may be an additional cost. If additional mulch or jute matting is required due to changes in the resilience of the site, this may be an additional cost.

7.2.2 Weed control techniques

Bush regeneration contractors will implement the weed control treatments identified in this VMP. These works have been estimated to cost $1,750 for a team of three bush regenerators, including a supervisor, per day. The cost of bush regeneration works includes the costs of herbicide, vehicles and equipment which are required to implement the VMP.

7.2.3 Revegetation treatments

Bush regeneration contractors will implement the revegetation treatments identified in this VMP. Tubestock costs have been budgeted at an estimated $3.59 per tree and shrub including, planting, water crystals, fertiliser and initial watering, and an estimated $3.27 per grass, sedge and groundcover including planting, water crystals and initial watering.

A total of approximately 76,180 plants will be required to achieve the densities identified in the VMP. The total estimated cost of revegetation is approximately $132,150 for tubestock installation, including a 10% rate for replacement plantings to be installed throughout the remainder of the VMP period after initial revegetation works.

7.2.4 Seed collection

Budget for the collection of seed has been included as a separate task. This is an indicative figure and does not take into account the risks from climatic variables. If further seed collection works are required, this may be an additional cost.

7.2.5 Monitoring and reporting

Bush regeneration contractors or ecologists will undertake the monitoring and reporting identified in this VMP. This includes:

- initial setup of the photo points and conducting the baseline surveys
- preparing a yearly report, including photo points and vegetation surveying until the completion of the project.

Table 8 Indicative annual costing timeline

Treatment	Establishment	Maintenance				Total Year 1 – 5
	Year 1	Year 2	Year 3	Year 4	Year 5	
Revegetation						
Site preparation	NA					TBA
Jute matting / mulch	$123,120.00					$123,120.00
Tubestock, supply and install	$132,150.00					$132,150.00
Replacement tubestock, supply and install		$7,938.00				$7,938.00
Watering	$74,800.00					$74,800.00
Weed control						
Primary	$26,100.00					$26,100.00
Secondary	$13,920.00					$13,920.00
Maintenance	$5,120.00	$20,880.00	$20,880.00	$13,920.00	$13,920.00	$74,720.00
Associated costs						
Monitoring and reporting	$7,120.00	$2,135.00	$2,135.00	$2,135.00	$2,135.00	$15,660
Grand total	**$382,330.00**	**$30,953.00**	**$23,015.00**	**$16,055.00**	**$16,055.00**	**$468,408.00**

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Appendix 1 Erosion and Sediment Control Plan

EROSION & SEDIMENTATION CONTROL PLAN

SCALE 1:600

Horizontal Scale 1:600 (A1)
1:1200 (A3)

LEGEND

- GEOTEXTILE INLET FILTER FOR FIELD INLET PIT
- SEDIMENT FENCE - REFER TO SED 6-8 & 01.01 DETAILS SHEET D42
- HAY BALE SEDIMENT TRAP
- TOPSOIL WINDROW & DESIGN SWALE
- FLOW DIRECTION
- SUGGESTED STOCKPILE SITE - REFER TO SED 4-1 ON DETAILS SHEET D42
- STABILISED SITE ACCESS - REFER TO SED 09.01 ON DETAILS SHEET D42
- TEMPORARY SEDIMENT BASIN

LEGEND

- INTERNAL LOT BOUNDARY
- BIO - BASIN TOP
- CHANNEL TOP OF BANK
- CHANNEL CENTRE LINE
- PROPOSED STORMWATER DRAINAGE
- RETAINING WALL
- NATURAL SURFACE CONTOURS
- STORMWATER DRAINAGE PIT
- HEADWALL
- VISITOR AND RECREATIONAL VEHICLE PARKING
- NEW INTERNAL CONCRETE ROAD PAVEMENT
- NEW INTERNAL CONCRETE INTERSECTION TREATMENTS & DRIVEWAYS
- NEW 2.5m WIDE SHARED PATH WITHIN SITE BOUNDARY
- MHE BOUNDARY SETBACK 3m WIDE 'NO BUILD ZONE'
- MHE BOUNDARY SETBACK 10m WIDE 'NO BUILD ZONE'

EROSION & SEDIMENT CONTROL NOTES:

1. SOIL STOCKPILES TO BE NO HIGHER THAN 2.0 METRES (1.0m PREFERABLE) IN LOCATIONS DIRECTED BY THE SUPERINTENDENT.
2. CONSTRUCT SEDIMENT FENCE AT LOCATIONS SHOWN AND AS DIRECTED BY SITE SUPERINTENDENT. SEDIMENT FENCE OR EQUIVALENT TO BE CONSTRUCTED AND MAINTAINED IN ACCORDANCE WITH COUNCILS ENGINEERING REQUIREMENTS.
3. UPON COMPLETION OF FINAL EARTHWORKS OR AFTER WRITTEN DIRECTION OF COUNCIL, IMMEDIATE SOIL CONSERVATION TREATMENTS SHALL BE APPLIED SO AS TO RENDER AREAS THAT HAVE BEEN DISTURBED, EROSION PROOF IN 14 DAYS.
4. ALL PERIMETER AND SILTATION CONTROL MEASURES ARE TO BE THE FIRST STEP IN CLEARING OR EARTHWORKS.
6. TEMPORARY SEDIMENTATION BASIN TO BE FLOCCULATED AND PUMPED OUT AFTER EVERY STORM EVENT. ALL FLOCCULATED SEDIMENT TO BE REMOVED FROM THE BASIN AT THE CONCLUSION OF THE CONTRACT PERIOD.
7. ALL TEMPORARY EARTH BERMS AND DIVERSION BANKS ARE TO BE TRACK ROLLED AND SEEDED OR MULCHED FOR TEMPORARY VEGETATION COVER AS SOON AS THEY HAVE BEEN FORMED.
8. PROVIDE FILTER SAUSAGE KERB INLET SEDIMENT TRAPS OR EQUIVALENT (TO THE SATISFACTION OF THE SUPERINTENDENT) TO ALL CONSTRUCTED INLET PITS AND STORMWATER PIPING.
9. ALL TOPSOIL IS TO BE STOCKPILED ON SITE FOR RE-USE (AWAY FROM TREES AND DRAINAGE LINES). MEASURES SHALL BE APPLIED TO PREVENT EROSION FROM THE STOCKPILES.
10. SOIL/GRASS - TOPSOIL, 100mm THICK SHALL BE APPLIED TO ALL DISTURBED AREAS. ALL REMAINING EXPOSED TOPSOIL SHALL BE SEEDED IMMEDIATELY UPON COMPLETION OF THE SOIL SPREADING OPERATION.

ISSUE	DESCRIPTION	DATE
1	ISSUED FOR DEVELOPMENT APPLICATION - AMENDED SITE FORMATION HEIGHTS	23.01.2024
0	ISSUED FOR DEVELOPMENT APPLICATION	08.09.2022

DESIGNED:	T.RYDEN	DATE:	JAN 2024
DRAWN:	A.SCHMID	SCALE:	AS SHOWN
SURVEYING:	MACRO SURVEYING	SHEET SIZE:	A1

ISSUED FOR DEVELOPMENT APPROVAL
NOT FOR CONSTRUCTION

MDE Manage Design Engineer

CLIENT
CLIFTON YAMBA LAND PTY LTD

TITLE
110 & 120 CARRS DRIVE, YAMBA
DEVELOPMENT APPLICATION CIVIL WORKS PLANS

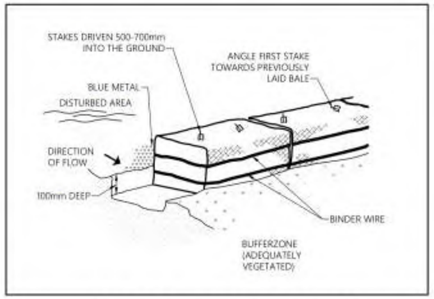
CLIFTON YAMBA

PROJECT
PROPOSED MHE DEVELOPMENT
110 & 120 CARRS DRIVE
YAMBA, NSW 2464
LOT 2 DP733507 & LOT 32 DP128863

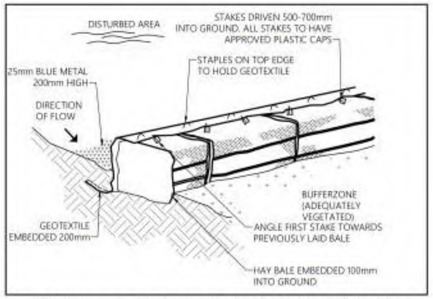
DA CIVIL DRAWING

DRAWING TITLE:
EROSION & SEDIMENTATION CONTROL PLAN

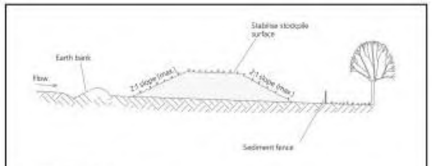
DWG No: D41 | SHEET: 41 OF 43 | REV: 1



SED_02.01: HAY BALE BARRIERS



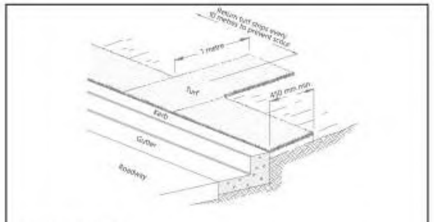
SED_02.02: HAY BALE & GEOTEXTILE FENCE



CONSTRUCTION NOTES:

1. Place stockpiles more than 2 (preferably 5) metres from existing vegetation, concentrated water flow, roads and hazard areas.
2. Construct on the contour as low, flat, elongated mounds.
3. Where there is sufficient area, topsoil stockpiles shall be less than 2 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 (Standard Drawing 5-5) on the upslope side to divert water around stockpiles and sediment fences (Standard Drawing 6-8) 1 to 2 metres downslope.

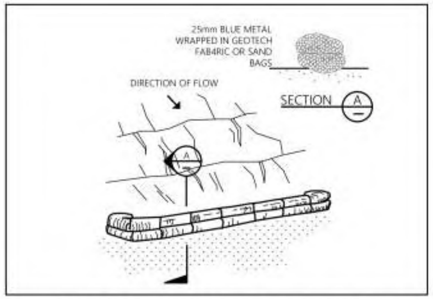
SED_4-1 STOCKPILES



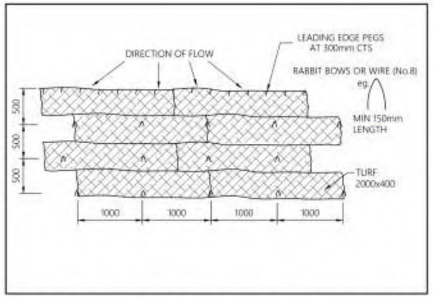
CONSTRUCTION NOTES:

1. Install a 450 mm minimum wide roll of turf on the footpath next to the kerb and at the same level as the top of the kerb.
2. Lay 1.4 metre long turf strips normal to the kerb every 10 metres.
3. Rehabilitate disturbed soil behind the turf strip following the ESCP/SWMP.

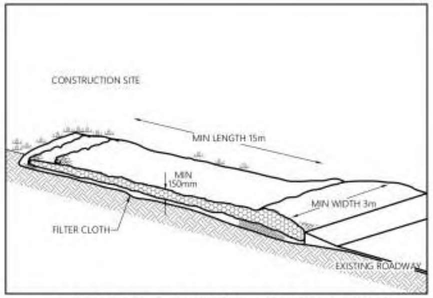
SED_6-13 KERBSIDE TURF STRIP



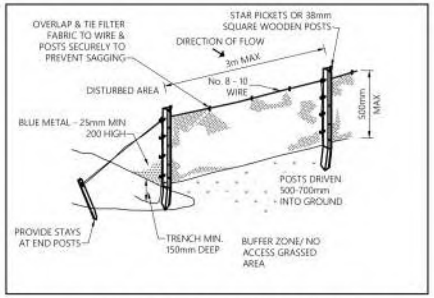
SED_03.01: ROCK GROYNE OR SAUSAGE



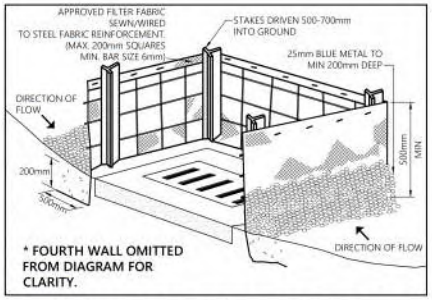
SED_07.02: TURF LAYING CONFIGURATION



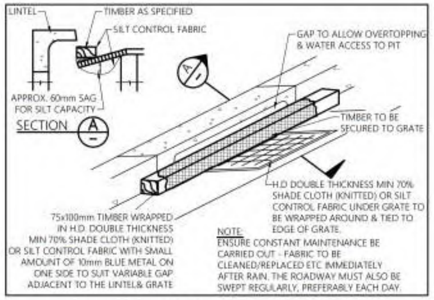
SED_09.01: STABILISED CONSTRUCTION ENTRANCE DETAILS



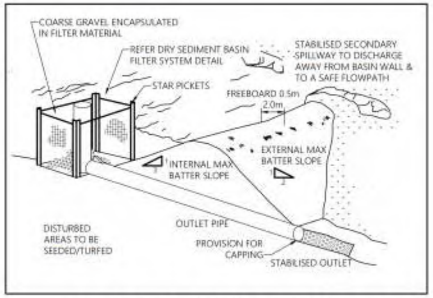
SED_01.01: SILT FENCE - TYPE 1



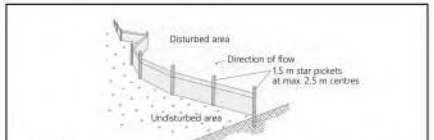
SED_11.05: STORM INLET SEDIMENT TRAP



SED_11.03: KERB INLET CONTROL



SED_10.01: SEDIMENT BASIN OUTLET



CONSTRUCTION NOTES:

1. Construct sediment fences as close as possible to being parallel to the contours of the site, but with small returns as shown in the drawing to limit the catchment area of any one section. The catchment area should be small enough to limit water flow if concentrated at one point to 50 litres per second in the design storm event, usually the 10-year event.
2. Cut a 150-mm deep trench along the upslope line of the fence for the bottom of the fabric to be entrenched.
3. Drive 1.5 metre long star pickets into ground at 2.5 metre intervals (max) at the downslope edge of the trench. Ensure any star pickets are fitted with safety caps.
4. Fix self-supporting geotextile to the upslope side of the posts ensuring it goes to the base of the trench. Fix the geotextile with wire ties or as recommended by the manufacturer. Only use geotextile specifically produced for sediment fencing. The use of shade cloth for this purpose is not satisfactory.
5. Join sections of fabric at a support post with a 150-mm overlap.
6. Backfill the trench over the base of the fabric and compact it thoroughly over the geotextile.

SED_6-8 SEDIMENT FENCE NOTES

ISSUE	DESCRIPTION	DATE
1	ISSUED FOR DEVELOPMENT APPLICATION - AMENDED SITE FORMATION HEIGHTS	23.01.2024
0	ISSUED FOR DEVELOPMENT APPLICATION	08.09.2022

DESIGNED:	T.RYDEN	DATE:	JAN 2024
DRAWN:	A.SCHMID	SCALE:	AS SHOWN
SURVEYING:	MACRO SURVEYING	SHEET SIZE:	A1

ISSUED FOR DEVELOPMENT APPROVAL
NOT FOR CONSTRUCTION

MDE
Manage Design Engineer

CLIENT: CLIFTON YAMBA LAND PTY LTD

TITLE: 110 & 120 CARRS DRIVE, YAMBA
DEVELOPMENT APPLICATION CIVIL WORKS PLANS

CLIFTON YAMBA

PROJECT: PROPOSED MHE DEVELOPMENT
110 & 120 CARRS DRIVE
YAMBA, NSW 2464
LOT 2 DP733507 & LOT 32 DP128863

DA CIVIL DRAWING

DRAWING TITLE: EROSION & SEDIMENTATION CONTROL DETAIL

DWG No: D42 | SHEET: 42 OF 43 | REV: 1

Appendix 2 Techniques and specifications

Weed control

Weed control involves a combination of mechanical, physical and chemical techniques to control weeds and manage regrowth. Weed control will be undertaken across the entire site. A selection of the best suited weed control method within the site depends on a number of factors including:

- the species or combination of weeds being targeted
- the density of the weeds
- resources available (time, labour, equipment and finances)
- weather conditions of the day.

Weed control techniques

Details of specific weed control techniques to be used such as cut and paint, scrape and paint, herbicide spraying and hand weeding are given in Brodie (1999). The principles of bush regeneration and techniques to trigger natural regeneration are to be in accordance with the Bradley Method and other techniques described in Buchanan (2000). Management techniques for different types of weeds are provided below.

Annual grasses

Annual grasses should be hand removed or spot sprayed where isolated or in low concentrations. Larger patches of annual grasses may be slashed/brush cut in late spring to early summer, after flowering, but prior to seed set. For most species, slashing/brush cutting prior to late spring through to early summer will promote vigorous growth and should not occur. However, some annual grasses can grow and produce seed at any time of the year dependent on climatic conditions such as high rainfall and warm temperatures. Monitoring of annual species should be undertaken and if new growth occurs, the same treatment will be applied to the new growth to prevent seed production. Individual plants should be hand removed, bagged and disposed of appropriately offsite.

Perennial grasses

Perennial grasses, such as *Paspalum mandiocanum* (broad-leaf paspalum) will be hand removed where isolated or in low concentrations. Larger patches may be slashed prior to seed production in spring or summer (depending on the growth cycle of the species) and the regrowth spot-sprayed 2-3 weeks later when it is actively growing and approximately 10 cm in length. Monitoring of these species will occur and if new seed production occurs, the same treatment will be applied again as required. However, slashing will not reduce the presence of exotic grasses on its own and must always be combined with targeted control to reduce densities and allow for native regeneration. Individual plants should be hand removed, bagged and disposed of appropriately offsite.

Woody weeds

Follow up treatment of woody weeds, including *Cinnamomum camphora* (camphor laurel) and *Lantana camara* (Lantana) will be controlled by the cut and paint or drill and fill method using a non-selective herbicide. The most appropriate method to be used depends on the size of the individual to be removed and will be determined by the bush regeneration contractor. Primary weed control should use techniques that will not encourage flushes of secondary weed growth. All seedlings of woody weeds will be hand pulled or spot-sprayed with a non-selective herbicide.

Creepers and climbers

The control of creepers, including *Passiflora suberosa* (corky passionfruit), varies depending on the species. For the most part, seedlings will be hand pulled, while mature plants can be controlled by the stem-scrape method or spot spraying using a non-selective herbicide. The precise method to be used will be determined by the bush regeneration contractor depending on the species, size and reproductive status of the individual. All vegetative material removed should be bagged, removed from site and disposed of appropriately.

Herbaceous weeds

Where individual plants of herbaceous weeds, e.g., *Senecio madagascariensis* (fireweed) are found, they will be hand pulled prior to flowering. Where large swaths of these species occur, they will be sprayed using a non-selective herbicide. If high densities of mature stands occur, weeds may be slashed first using a brush cutter and any subsequent regrowth sprayed. Regular monitoring of these species will be required to prevent seed production. All vegetative material that is pulled out and has the potential to regrow if deposited on ground will be bagged and removed from site.

Management of weed waste

All weed propagules, especially priority weeds, will be bagged and disposed of as directed by legislation at facility licensed to receive green waste. All weed waste without propagules will be composted onsite in small unobtrusive piles.

Herbicide use

The use of herbicide to control weeds should be carefully considered. Herbicide must only be used for the purpose described on the product label, as per the NSW *Pesticides Act 1999*. Herbicide use should assess potential long-term impacts of the technique, including whether the proposed works address the source of the weed infestation. However, herbicide application forms an important and useful component of an integrated weed management approach and can be the most appropriate method for the control and eventual eradications of some weed species.

Herbicide use should occur during the active growing season for plants to encourage the chemical uptake into the plant. The selection of herbicides should also consider the type of weed and the location. Where non-selective herbicides are required for use, glyphosate is the most suitable. A glyphosate-based herbicide, formulated for use near waterways, will be used if works require herbicide application near waterways, a (e.g. Roundup Biactive®).

Broad-leaf selective herbicide may be used as per the NSW Weed Control Handbook (DPI 2018). However, this type of herbicide is extremely toxic to aquatic life and must not be used in, or adjacent to, waterways.

Registration and records must be kept in accordance with the NSW Pesticides Regulation 2017.

Revegetation works

Revegetation has the dual aim of both re-establishing the original native vegetation community at the site and reducing erosion along the length of the riparian corridor, which will carry greatly increased peak flows due to the increased run-off from the hard surfaces created by the associated residential development. Any plantings should consist of local provenance stock.

Planting of Hiko for trees and shrub species and Hiko or Viro cells for grasses and other groundcover species is the preferred method. Planting should be done via a low impact method such as hand digging or hand auger. The holes dug for each plant should be at least 1.5x the width and 2x the depth of the root ball. Fertiliser should be added to each hole dug as per the label specifications. Water crystals or wetting agents should be added to each plant hole. This will increase the water holding capacity of the soil and reduce watering schedules. Initial irrigation of the plantings is essential to ensure that the soil forms around the root ball and air pockets are removed. This will be required unless sufficient rainfall (approx. 10mm) occurs on the day of planting.

Tree guards will need to be installed on each tree or shrub to protect seedlings from extreme weather (frosts and heat), herbivorous grazing and herbicide drift during maintenance works. Bio-degradable tree guards are recommended to protect the seedlings. Following the revegetation works, irrigation is required for at least 8 weeks following planting to ensure the establishment of the plants. The level of irrigation will be determined by rainfall and temperature experienced at the planting site.

A temporary irrigation system should be installed to assist in the establishment of vegetation. Timing of the planting of these areas will need to take into consideration surrounding civil works and erosion/sediment control requirements, these areas will not be planted until earthworks have been completed. A maximum rate of attrition of 15% is to be tolerated, with any plant loss above this rate to be replaced at the contractor's expense.

Mulch can be derived from vegetation removed from the development area, if available. Alternately, mulch should be comprised of un-composted wood (preferably wood waste), with a particle size of 15 mm to 40 mm, with no fines, and good air-filled porosity. Mulch should not contain any weed seeds, nor be derived from diseased trees or from any part of the tree lower than 1 m above the ground. Mulch, where required, should be installed to a depth of 100 mm. Jute matting, where required, must be comprised of 100 % biodegradable jute fibres with a minimum weight of 680 g/m^2 (~6 mm thickness). Jute must be pegged with at least 3 x 150 mm pins per m^2 and each roll overlapped by 100 mm.

Seed collection

For the growth of the plants used in the revegetation works, seed must be collected from local provenance species. Groundcovers, shrubs and trees should be collected as within close proximity (i.e. < 20 km) to the site. However, soil type, climate and aspect of the collection site(s) should also be considered. Native grasses typically have much larger dispersal mechanisms and are to be collected from within the wider locality.

Only wild native species are to be used. Plants are not to be substituted with horticultural varieties under any circumstances.

Record keeping of seed collection and planting locations are to follow the Florabank guidelines (Mortlock, 2000). A Section 132C licence under the NSW National Parks and Wildlife Act 1974 will be required to undertake seed collection works. The bush regeneration contractor is responsible for recording this information and providing it to CVC.

Bush regeneration contractors

All vegetation management works in the establishment phase will be undertaken by suitably qualified and experienced bush regeneration contractors who are members of the Australian Association of Bush Regenerators (AABR) or fulfil the membership criteria. Additionally, team leaders should have, as a minimum, a Certificate III in Conservation & Land Management or equivalent. The contractor will need to carry out best practice bush regeneration techniques as described by Buchanan (2009). A flexible approach to this site is recommended since techniques may need to be changed or modified to suit site conditions. This approach is consistent with adaptive management and allows the contractor to develop and build on site knowledge whilst implementing this VMP. Monitoring will assist in the development of the VMP actions in subsequent years.

Hygiene protocols

To avoid introducing soil pathogens / diseases in particular *Phytophthora cinnamomi* (root rot disease) onto site a hygiene protocol should be undertaken as per the guidelines developed by the Royal Botanic Gardens in *'Best Practice Management Guidelines for Phytophthora cinnamomi with the Sydney Metropolitan Catchment Management Authority'*. For Bush Regenerators all tools and boots should be washed down and thoroughly cleaned of soil / mud using a solution of water and disinfectants prior to undertaking works onsite. All machinery should be thoroughly cleaned of all soil / mud / debris prior to working within the VMP area. Further details of hygiene management protocol are addressed in Appendix 3.

Appendix 3 Weed and Pathogens Procedure

Construction works on development sites have the potential to introduce and promote the spread of weed species. This procedure is intended to prevent or minimise the spread of priority weed species. During construction, the Project Manager and Site Supervisor should adhere to best practice methods for weed management, which includes:

- Mow or slash areas infested with weeds before they seed. This may reduce the propagation of new plants.
- Program works from least to most weed infested areas.
- Clean machinery, vehicles and footwear before moving to a new location.
- Securely cover loads of weed-contaminated material to prevent weed plant material falling or blowing off vehicles.
- Dispose of weed-contaminated soil at an appropriate waste management facility.
- Remove weeds immediately onto suitable trucks and dispose of without stockpiling.

Pathogens

Pathogens are agents such as bacterium, virus or fungus that cause disease in flora and fauna, which are be spread on footwear, vehicles or machinery. The four most common pathogens found in NSW include:

- Phytophthora (*Phytophthora cinnamomi*): A soil-borne fungus that attacks the roots of native plant species, causing them to rot and eventually die.
- chytrid fungus (*Batrachochytrium dendrobatidis*): A waterborne fungus that affects native frog species.
- myrtle rust (*Uredo rangelii*): An introduced fungus that attacks young leaves, shoot tips and stems of Myrtaceous plants (such as Bottle Brush, Tea Tree, Lilly Pilly and Turpentine), eventually killing the plant.

If the occurrence of pathogens is known within the locality, a test for presence through soil or water tests should fire be undertaken. If pathogens are present, during construction, the Project Manager and Site Supervisor should adhere to best practice methods for pathogens Table 9.

Table 9 Best practice methods for pathogens

Pathogen	Best practice hygiene protocols
Phytophthora	· Minimise work during excessively wet or muddy conditions. · Programming of works should always move from uninfected areas to infected areas. · Set up exclusion zones with fencing and signage to restrict access into contaminated areas. · All personnel (including visitors) to be inducted on Phytophthora management measures for the site. Provide vehicle wash down facility. · Restrict vehicles to designated tracks, trails and parking areas. · Provide parking and turn-around points on hard, well-drained surfaces. · Provide a boot wash down facility. · Restrict personnel to designated tracks and trails. · Use a certified supply of plants and soil that is disease-free. · Retain all potentially affected materials within the contaminated area. · Ensure stockpiles of mulch, topsoil and fill material are separated to avoid potential contamination and spread.
chytrid fungus	· Minimise work during excessively wet or muddy conditions. · Programming of works should always move from uninfected areas to infected areas. · Set up exclusion zones with fencing and signage to restrict access into contaminated areas. · All personnel (including visitors) to be inducted on chytrid management measures for the site. · Provide a vehicle wash down facility. · Restrict vehicles to designated tracks, trails and parking areas. · Provide parking and turn-around points on hard, well-drained surfaces. · Provide boot wash down facility. · Disinfect with cleaning products containing benzalkonium chloride or 70% methylated spirits in 30% water. · Disinfect hands or change gloves between the handling of individual frogs and between each site. · Only handle frogs when necessary. Use the 'one bag-one frog' approach. · To avoid cross contamination, generally avoid transferring water between two or more separate waterbodies.
myrtle rust	· To determine if myrtle rust is known within the locality of the development site, the following should be undertaken: o Use The Department of Primary Industry (DPI) Myrtle Rust Management Zone map (http://www.dpi.nsw.gov.au/__data/assets/pdf_file/0008/374633/myrtle-rust-nswmgt-zones.pdf). o Consult with DPE for additional rust records and risk assessments. o Photograph potentially infected plants and send to: biosecurity@industry.nsw.gov.au for confirmation. · Programming of works should always move from uninfected areas to infected areas. · Set up exclusion zones with fencing and signage to restrict access into contaminated areas. · All personnel (including visitors) to be inducted on myrtle rust management measures for the site. · Provide a vehicle wash down facility. · All vehicles and machinery to be washed with Truckwash® (or equivalent).

Pathogen	Best practice hygiene protocols
	· Restrict vehicles to designated tracks, trails and parking areas. · For medium-long term projects, install a concrete wash down bay which will capture the water in a trench or bunded area. · Water used for wash downs must not be used for dust control. · Personnel working in an infected site should shower and launder clothes (especially hats) before moving to another bushland site. · Provide a boot wash down facility. · Footwear and equipment is to be cleaned of soil/mud then sprayed with 70% methylated spirits in 30% water. · Use a certified supply of plants and soil that is disease-free (Nursery & Garden Industry 2011) provides best practice myrtle rust management that is to be expected from suppliers). · Plant material should be buried on site if possible. · Do not dispose of waste at another bushland site. · Buried material sites must be mapped to prevent re-exposure, especially if located near utility easements. · If material cannot be buried advice should be sought from DPI.

Appendix 4 Construction Environmental Management Plan

Construction Environmental Management Plan

Manufactured Housing Estate – Clifton Yamba

at 110-120 Carrs Drive Yamba NSW 2464

Lot 2 DP733507

And

Lot 32 DP1280863

Prepared by Manage-Design-Engineer Pty Ltd

For Clifton Yamba Land Pty Ltd ATF Yamba Land Trust

Manage-Design-Engineer DOCUMENT CONTROL

PROJECT: Clifton Yamba MHE Development

CLIENT: Clifton Yamba Land Pty Ltd ATF Yamba Land Trust

AUTHOR: Andrew Smith

REVISION HISTORY

REVISION	DATE	CHECKED BY	
		NAME	SIGNATURE
1	22/05/2023	Troy Ryden	

Table of Contents

INTRODUCTION

The purpose of this Construction Environmental Management Plan (CEMP) is to provide a framework for the construction phases of the Manufactured Home Estate (MHE) at 110-120 Carrs Drive Yamba NSW.

The Civil Construction of the MHE development will consist of vegetation clearing works, site filling, stormwater drainage, sewer reticulations, electrical, communications and road pavement works. The construction of dwellings will follow the completion of each stage of civil construction works.

The ultimate MHE estate at Clifton Yamba will provide contemporary housing for active over 55s in a resort style setting.

The CEMP incorporates the following areas.

- Pavement Damage and Restoration
- Construction works
- Traffic and Pedestrian Management
- Noise and Vibration Management
- Materials Storage and Waste Management
- Soil and Water Management
- Dewatering & Acid Sulphate Soil Management
- Flora and Fauna Management

1. SITE IDENTIFICATION DETAILS

1.1 Ownership & Contact Details

Site Owner:	Clifton Yamba Land Pty Ltd ATF Yamba Land Trust
Address of Property:	110-120 Carrs Drive Yamba NSW 2464
Construction Managers:	Manage-Design-Engineer Pty Ltd (MDE) 1/64 Ballina Street Lennox Head NSW 2478
Contact Name:	Andrew Smith (MDE - Director)
Telephone Number:	0473160191
Email Address:	andrew@mde.au
Real Property Description:	Lot 2 DP733507 & Lot 32 DP 1280863

Clifton Yamba Site Location

1.2 Land Use

The site is located within the West Yamba Urban Release Area (WYURA). The proposed Manufactured Home Estate will be contained to the Residential R1 zoned portion of the site which covers an area of approximately 10Ha. The balance of the site, located to the west of the proposed development area, is zoned C2 and C3. There is no development proposed within these areas and they are proposed to be retained and managed under a Vegetation Management Plan.

The development will provide a maximum 216 house sites for the placement of manufactured homes and includes communal facilities in the form of:

- Club house
- Gymnasium
- Swimming Pool
- Lawn Bowling Green
- Croquet Green

Once a resident occupies a site with a home purchased from the developer, they become responsible for the ongoing management and maintenance of the home and site. The communal facilities are managed/maintained by the Site Manager and available for the use of residents and their guests.

Adjoining land uses are;

- Existing Over 55's estate to the North
- Rural residential to the South
- Existing vegetation to the west backing onto Oyster channel.
- Rural farm land and a proposed residential estate to the East

2. CONSTRUCTION MANAGEMENT ISSUES

2.1 Site Compound and Ancillary Facilities

A temporary site compound and ancillary facilities will be required to support construction of the project.
The site compound will accommodate the majority of site management, engineering, specialist and administrative personnel. Typically these facilities

include:

- Office accommodation
- Staff amenities
- Light vehicle parking
- Material and chemical storage compound
- Equipment and materials storage areas

The location and arrangement of the site compound will comply with the following:

- Site facilities to will be located more than 12m from the trafficked way
- All facilities and storage areas to be established outside of areas of environmental value
- Stockpile locations to be within the previously cleared area, on a stable surface and an adequate distance from drainage lines and canopy drip lines, with adequate protection from erosion.

2.2 Pavement Damage and Restoration

The existing road pavement on Carrs Drive will be assessed as part of a dilapidation survey report prior to the earthworks import operation. The Road pavement condition will be reviewed to determine any damage caused by truck movements into and out of the site, the Civil Contractor will make good to Council Standards and damage caused.

2.3 Hours of Construction

Monday to Friday – 7:00am to 6:00pm
Saturday – 8:00am to 1:00pm
No Construction work which will adversely impact on the amenity of the local area is to take place outside of the above hours, including Public Holidays

2.4 Access and Parking

The main access to the site will be off Carrs Drive during Construction through a temporary entry that will be constructed by the Earthworks contractor.

Parking for construction workers will be on site in a dedicated suitable area as defined by the Construction Manager and Civil Contractor.

2.5 Earthworks Operations

The site will require a large volume of imported material to enable the construction of the estate. Material is to be sourced from approved quarry sites by the appointed Civil Contractor and delivered to site with Truck & Trailer haulage operation.

The final quarry locations and material quality reports will be provided to Council for approval prior to import and once the successful civil contractor has finalised the quarry source and supply agreements. At this stage the quarry at Mororo controlled by Newmans is the most likely source of the fill material

Earthworks material import is likely to utilise the Pacific Highway then along Yamba Road, right into Carrs drive then right into the site access for placement by the civil contractor.

Prior to commencement of earthworks operations, the Earthworks contractor is required to implement Erosion and Sediment Control measures as outlined in the ESC plan included in Appendix A.

2.6 Cultural Heritage Management

An Aboriginal Cultural Heritage assessment has been completed for the proposed development by Everick Heritage Consultants in 2022.

The Cultural Heritage Assessment (copy provided in Appendix B) concluded that 'disturbing works … are unlikely to impact on Aboriginal objects and will not impact on any known places or sites of cultural significance to the Aboriginal Community'.

The report does however provide a number of recommendations relating to unexpected finds. These recommendations should be followed in the case of any suspected Aboriginal material of remains being uncovered on site during construction activities.

2.7 Dust and Vibration issues during Construction

Dust & Vibration issues may cause concerns with residents during construction operations. Management during construction will be via the following methods:

- Advise residents on potential for dust and vibration impact prior to construction and setup suitable communication methods for residents with concerns.
- Handle and investigate noise, dust and vibration complaints in an efficient and timely manner.
- On Site water truck to wet down earthworks areas on a regular basis during the hours of operation
- Application of Polymer Binders to areas that cannot be immediately re vegetated
- Undertake permanent stabiliation and revegetation of completed earthworks areas as soon as possible following completion of works

- Undertake works in a manner that will limit the generation of vibration that may affect nearby residents e.g. undertake static rather than vibratory rolling methods in close proximity to nearby dwellings, choose appropriately sized machinery for the task being undertaken etc
- Where concerns are raised and if deemed necessary, undertake vibration monitoring during filling compaction and plant movement operations. If vibration exceeds industry accepted limits then the use of Non-Vibratory compaction methods (Static Rolling) will be utilised.

2.8 Dewatering & Acid Sulphate Soils Management Plan

(a) Water Quality Monitoring During Construction

The site shall implement erosion and sediment control measures in accordance with the approved *Erosion* & Sediment Control Plans in the Bulk Earthworks CC drawings as approved for the development site. The principal standards to be met for stormwater runoff monitoring include:

(i) Suspended solids to be no greater than 50mg/Ltr
(ii) pH to be between 6.5 and 8.5
(iii) Monitoring of any controlled discharges
(iv) Assessment of water quality parameters for rainfall events greater than 25mm per 24hr period

(b) Acid Sulfate Soils Management Plan

An Acid Sulphate Soil (ASS) investigation was carried out by Precise Environmental and found that there was some ASS is the strip surface layer (Appendix C). The Acid Sulfate Management Plan recommend that a layer of Aglime shall be placed at a rate >5 kg/m^2 across the entirety of the stripped layer.

It is also noted that stockpiling of untreated ASS should be kept to a minimum and should follow the detailed earthworks strategy.

2.9 Procedure for Dealing with Noise Issues

The proposed estate shall require the construction of works within close proximity to existing dwellings along Carrs Drive.

The noise objectives of the site is to minimise noise levels so as to not exceed the LA90 noise level by more than 5dB(A). This is to be achieved by complying with AS2436: Guide To Noise Control on Construction, Maintenance and Demolition Sites to which the following guide is provided:

- All equipment to be fitted with compliant industry standard muffler systems
- Locate any continuous operating equipment (ie. generators or dewatering pumps) to have their exhaust manifolds facing a direction so as to maximise separation distance.
- Construction works must be withing the allowed timeframes setout out in item 4.2 of this report.
- At least 2 days prior to commencing works, notify local residences within a nominal 200m radius of the work area by pamphlet/flyer of works to be undertaken.
- Advise within pamphlet/flyer:
  (i) Contact details for any noise/vibration complaints or work enquires (ie. the Site Manager)
  (ii) Anticipated scope of works and its duration

A copy of any formal complaints shall be referred to Council together with details of proposed corrective actions should any be necessary. In the event that Council believes further investigation is required as to noise levels based upon the complaint, if an alternative and practical work method cannot be devised, a noise monitoring logger can be placed in a location as required by Council within a 24 hour period to further assess actual noise levels. Should it be found that construction noise impacts are of significance, work in the area of concern will be modified by the implementation of alternative work procedures to the approval of Council's Environmental Health officers.

2.10 Waste Management

The proposed development works will generate construction waste during the construction phase of the project. These waste materials include, but are not limited to, excavated road surface material, road base material, concrete, soil, PVC and Poly pile off cuts, formwork and general construction waste.

Contractors will be required to adopt a Waste Management hierarchy of avoidance, reuse, recycling, energy recovery and disposal of waste generated as a result of the works.

Construction activities are to be managed to minimize construction waste produced and manage waste streams effectively, including disposal options to prevent impact to the surrounding environment. The following waste management measures will apply to the site:

WASTE TYPE	REQUIREMENT
Food waste, litter and other general waste	Store in covered bins for collection and offsite disposal at approval landfill facility.
Sediment and silt collected through erosion and	Reuse sediment/silt on site for landscaping and rehabilitation purposes

sedimentation controls	
Waste Concrete	Minimise the generation of waste concrete through accurate estimation of required volumes. Reuse concrete where possible or return to supplier. Avoid concrete washouts on site, if washouts are required then perform washouts in contained areas where waste concrete can be collected, crushed and recycled.
Green Waste (cleared vegetation)	Dispose of weeds at a licensed facility. Native vegetation is to be mulched and re used on site for landscaping and erosion control.
Regulated Wastewater (Sewage)	If access to reticulated sewer system is not available then portable toilets are to be provided and regularly serviced by a licensed contractor and disposed of ay an appropriate facility.
Regulated Waste (Hazardous Waste not identified above)	All hazardous liquid wastes are to be stored in a bunded facility and flammable or combustible liquids are to be stored in a bund constructed in accordance with AS1940:2004.
Recyclables	Timber pallets and skids – the contractor will be responsible for returning timber skids and pallets to the supplier for recycling or re use. Metals, steel and aluminum scrap – to be sorted and collected by a licensed scrap metal recycler. Paper and Cardboard – to be stored in recycling bins for collection and recycling offsite Glass and plastics – to be stored in recycling bins for collection and recycling off site.

3. MONITORING RECORDING & REVIEWING

3.1 Monitoring/Complaints Register

In the event of a complaint being received, details of the complaint will be taken using the attached form. Complaints will be investigated and, where necessary, corrective action taken.

All complaints will be kept in a Complaints Register and will be available for viewing by Council Officers as necessary.

3.2 Complaints Register

Complaint Details

Date of complaint:	
Time of complaint:	
Nature of complaint:	
Method of complaint:	
Name of complainant:	
Complainant contact details:	

Investigation Details

Time when alleged issue occurred:	
Activities undertaken when alleged incident occurred:	
Cause of issue:	
Person responsible for investigation:	
Investigating method:	
Findings of investigation:	

Action Taken

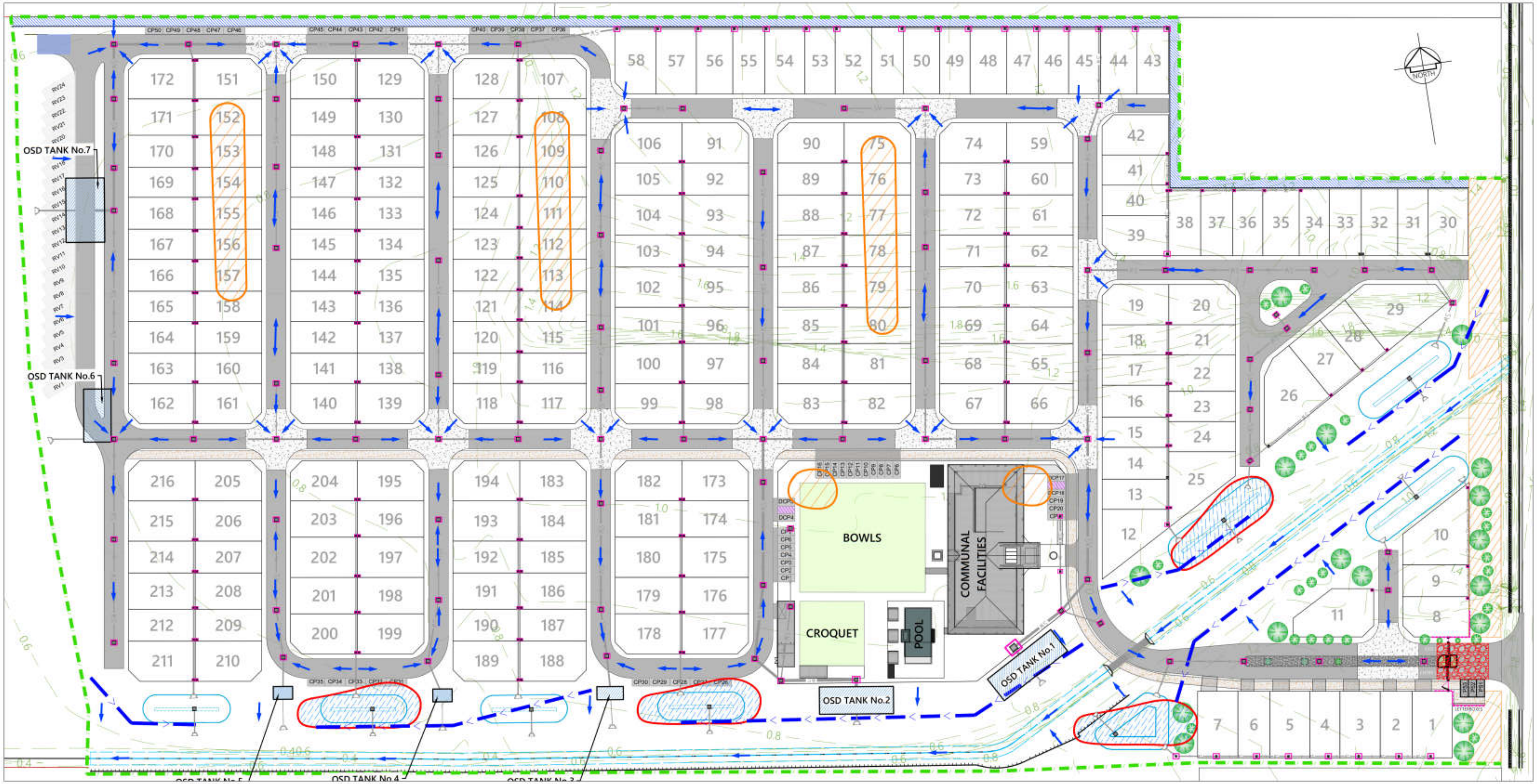
Corrective actions:	

Communications with complainant:	

3.3 Review

The Construction Management Plan will be reviewed on a regular basis and generally reviewed between construction stages as new work areas are commenced on the development site.

APPENDIX A – ESC PLAN



0 10 20 30 40
Horizontal Scale 1:600 (A1)
1:1200 (A3)

EROSION & SEDIMENTATION CONTROL PLAN

SCALE 1:600

LEGEND

- GEOTEXTILE INLET FILTER FOR FIELD INLET PIT
- SEDIMENT FENCE - REFER TO SED 6-8 & 01.01 DETAILS SHEET D45
- HAY BALE SEDIMENT TRAP
- TOPSOIL WINDROW & DESIGN SWALE
- FLOW DIRECTION
- SUGGESTED STOCKPILE SITE - REFER TO SED 4-1 ON DETAILS SHEET D45
- STABILISED SITE ACCESS - REFER TO SED 09.01 ON DETAILS SHEET D45
- TEMPORARY SEDIMENT BASIN

LEGEND

- INTERNAL LOT BOUNDARY
- BIO - BASIN TOP
- CHANNEL TOP OF BANK
- CHANNEL CENTRE LINE
- PROPOSED STORMWATER DRAINAGE
- RETAINING WALL
- NATURAL SURFACE CONTOURS
- STORMWATER DRAINAGE PIT
- HEADWALL
- VISITOR AND RECREATIONAL VEHICLE PARKING
- NEW INTERNAL CONCRETE ROAD PAVEMENT
- NEW INTERNAL CONCRETE INTERSECTION TREATMENTS & DRIVEWAYS
- NEW 2.5m WIDE SHARED PATH WITHIN SITE BOUNDARY
- MHE BOUNDARY SETBACK 3m WIDE 'NO BUILD ZONE'
- MHE BOUNDARY SETBACK 10m WIDE 'NO BUILD ZONE'

EROSION & SEDIMENT CONTROL NOTES:

1. SOIL STOCKPILES TO BE NO HIGHER THAN 2.0 METRES (1.0m PREFERABLE) IN LOCATIONS DIRECTED BY THE SUPERINTENDENT.
2. CONSTRUCT SEDIMENT FENCE AT LOCATIONS SHOWN AND AS DIRECTED BY SITE SUPERINTENDENT. SEDIMENT FENCE OR EQUIVALENT TO BE CONSTRUCTED AND MAINTAINED IN ACCORDANCE WITH COUNCILS ENGINEERING REQUIREMENTS.
3. UPON COMPLETION OF FINAL EARTHWORKS OR AFTER WRITTEN DIRECTION OF COUNCIL, IMMEDIATE SOIL CONSERVATION TREATMENTS SHALL BE APPLIED SO AS TO RENDER AREAS THAT HAVE BEEN DISTURBED, EROSION PROOF IN 14 DAYS.
4. ALL PERIMETER AND SILTATION CONTROL MEASURES ARE TO BE THE FIRST STEP IN CLEARING OR EARTHWORKS.
6. TEMPORARY SEDIMENTATION BASIN TO BE FLOCCULATED AND PUMPED OUT AFTER EVERY STORM EVENT. ALL FLOCCULATED SEDIMENT TO BE REMOVED FROM THE BASIN AT THE CONCLUSION OF THE CONTRACT PERIOD.
7. ALL TEMPORARY EARTH BERMS AND DIVERSION BANKS ARE TO BE TRACK ROLLED AND SEEDED OR MULCHED FOR TEMPORARY VEGETATION COVER AS SOON AS THEY HAVE BEEN FORMED.
8. PROVIDE FILTER SAUSAGE KERB INLET SEDIMENT TRAPS OR EQUIVALENT (TO THE SATISFACTION OF THE SUPERINTENDENT) TO ALL CONSTRUCTED INLET PITS AND STORMWATER PIPING.
9. ALL TOPSOIL IS TO BE STOCKPILED ON SITE FOR RE-USE (AWAY FROM TREES AND DRAINAGE LINES). MEASURES SHALL BE APPLIED TO PREVENT EROSION FROM THE STOCKPILES.
10. SOIL/GRASS - TOPSOIL, 100mm THICK SHALL BE APPLIED TO ALL DISTURBED AREAS. ALL REMAINING EXPOSED TOPSOIL SHALL BE SEEDED IMMEDIATELY UPON COMPLETION OF THE SOIL SPREADING OPERATION.

ISSUE	DESCRIPTION	DATE
0	ISSUED FOR DEVELOPMENT APPLICATION	08.09.2022

DESIGNED: T.RYDEN | DATE: SEPT 2022
DRAWN: A.SCHMID | SCALE: AS SHOWN
SURVEYING: | SHEET SIZE: A1

NOT FOR CONSTRUCTION

MDE Manage Design Engineer

CLIENT
CLIFTON YAMBA LAND PTY LTD

TITLE
110 & 120 CARRS DRIVE, YAMBA
DEVELOPMENT APPLICATION CIVIL WORKS PLANS

CLIFTON YAMBA

PROJECT
PROPOSED MHE DEVELOPMENT
110 & 120 CARRS DRIVE
YAMBA, NSW 2464
LOT 2 DP733507 & LOT 32 DP128863

DA CIVIL DRAWING

DRAWING TITLE: EROSION & SEDIMENTATION CONTROL PLAN

DWG No: D44 | SHEET: 44 OF 45 | REV: 0

APPENDIX B – CULTURAL HERITAGE ASSESSMENT

EVERICK HERITAGE

Manufactured Housing Estate Carrs Drive, Yamba, NSW

Aboriginal Cultural Heritage Assessment

Written for Clifton Yamba Land Pty Ltd

Everick Heritage Pty Ltd

Report Reference:

DRAFT Hill, T. and M. Finlayson 2022. *Manufactured Housing Estate, Carrs Drive, Yamba: ACHA.* Everick Heritage Pty Ltd unpublished report prepared for Clifton Yamba Land Pty Ltd.

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2	M. Finlayson	All	29.07.21	T. Robins
3	M. Finlayson	All	02.08.21	T. Robins
4	T. Hill	All	04.08.21	T. Robins
5	A Cameron	Figure 2	17.05.22	T. Robins

Executive Summary

The following is a report detailing the results of an Aboriginal Cultural Heritage Assessment ('ACHA') for the proposed Manufactured Housing Estate ('MHE') development at Yamba, NSW ('the Project'). The lands subject to assessment comprise Lot 2 DP 733507 and part Lot 3 DP 733507 at 104 & 120 Carrs Drive, Yamba, New South Wales ('NSW') (the 'Project Area'). It is understood the Project requires an Aboriginal cultural heritage assessment in support of a Development Application ('DA') to be submitted to Clarence Valley Council for approval.

The methods used for this assessment are in compliance with the Code of Practice for Archaeological Investigation of Aboriginal Objects in NSW (DECCW 2010) ('CoPAI') and all relevant legislation as described in Section 2 of this Report. The following are the broad requirements for compliance with the CoPAI;

a) consultation with the Yaegl Traditional Owners Aboriginal Corporation ('TOAC');

b) searches of applicable heritage registers;

c) review of ethnographic and historic resources relevant to the region;

d) review previous archaeological work and the landscape context;

e) summarise the local and regional character of Aboriginal land use and its material traces;

f) formulate a predictive model;

g) conduct an archaeological survey with representatives of Yaegl TOAC to identify the potential for harm to Aboriginal objects and appropriate management response; and

h) report on findings and recommended management strategies.

No Aboriginal sites were identified within the Project Area and the C2 midden is known to be located to the west of the environmental protection area.

The ACHA has been commissioned to support the proposed MHE residential development at 104 & 120 Carrs Drive, Yamba (the 'Proposed Works') (Figure 1). The subdivision layout involves the following components (see also Figure 2):

- 212 residential manufactured housing allotments of varying sizes;
- Bio-retention basins;
- Internal roads;
- Sub-surface electrical and sewerage amenities; and
- Landscaping.

As a result of the desktop study, field inspection and consultation with Yaegl TOAC the following can be concluded:

a) No Aboriginal sites were identified within the surveyed section of the Project Area.

b) The revised locations for the Yamba C1 and Yamba C2 middens (Everick 2011) report indicates both the C2 site is within or beside the environmental protection are to the west of the proposed footprint of the MHE development. The C1 site is further north along Oyster Channel.

c) Vegetation comprises predominantly juvenile Melaleuca spp. that has overgrown most of the area of the Proposed Works in the last 5 years. Few mature Melaleucas remain and none that were surveyed were noted to have cultural modification. South of the Lot 3 house pad, the vegetation comprises a more mixed variety of regrowth Casuarina and Oak with some remnant matures.

d) The cleared house pad / grassed area comprising 104 Carrs Drive (Lot 3) has been subject to the introduction of fill that has raised the ground surface above the original swampland surface level by approximately 1 m. It is inferred that the soil profile of this area would likely comprise fill overlying original swampy ground surfaces and topsoil deposits. This would be consistent with the findings of the Everick (2011) report which stated the West Yamba (Carrs Drive) area was, drained, cleared and filled by European settlers to overcome the coastal swampland conditions for farming.

e) It was generally agreed that midden material, if present would more likely be located within 80 metres of the Oyster Channel bank. However, Ken and Shane noted that midden material has been found further east of the Oyster Channel to the south of the Project Area and on Goldings Lane to the east. Low elevated aeolian sand dunes associated with the former coastline have the potential for midden material as these formed islands throughout the swampland.

f) Ken Laurie remembers the property as being predominantly used for cattle and believes vegetation would have been removed by bulldozer before fill was subsequently scattered to create a new surface.

g) Due to the level of ground-surface disturbance, lack of surveyable area and limited GSV, it was the conclusion of the Yaegl TOAC sites officers that Aboriginal spotters should be on-site during ground disturbing works for topsoil removal and installation of water retention basins. The objective of the monitoring program would be to identify any former mid-Holocene sand dunes that might occur through the area of the Proposed Works but have been levelled by historic agriculture.

h) Test excavations are not deemed to be required as per Section 3 of the *Code of Practice for Archaeological Investigation of Aboriginal Objects in NSW* (DECCW 2010) due to the level of disturbance and the lack of proximity of ground disturbing works to a previously recorded midden. This opinion is supported by the Yaegl TOAC representatives preferring on-site monitoring of any potential shell material that be encountered by development of the estate.

RECOMMENDATIONS

The assessment has concluded that ground disturbing works, being the MHE allotments, bio-retention basins, underground services and interior roads are unlikely to impact on Aboriginal objects and will not impact on any known places or sites of cultural significance to the Aboriginal community. As such additional consultation and archaeological investigation is not required. However, the following recommendations are provided as a precautionary measure to mitigate impacts to potential Aboriginal heritage values.

Recommendation 1: Aboriginal Objects Find Procedure

It is recommended that if suspected Aboriginal material has been uncovered because of development activities within the Project Area:

a) work in the surrounding area is to stop immediately;

b) a temporary fence is to be erected around the site, with a buffer zone of at least 10 metres around the known edge of the site;

c) an appropriately qualified archaeological consultant is to be engaged to identify the material; and

a) should the works be deemed to have harmed the Aboriginal objects the Heritage NSW should be notified immediately via the EPA Enviro Hotline.

It is recommended that an Unexpected Find Procedure is implemented

Having consideration for the outcomes of the ACHA it is recommended that Aboriginal sites monitors from Yaegl TOAC are engaged as "cultural heritage spotters" for ground disturbing works of original topsoils below the extent of the European fill layer.

Recommendation 2: Aboriginal Human Remains

Although it is unlikely that Aboriginal Human Remains will be located at any stage during earthworks within the Project Area, should this event arise it is recommended that all works must halt in the immediate area to prevent any further impacts to the remains. The site should be cordoned off and the remains themselves should be left untouched. The nearest Police Station (Yamba), Yaegl TOAC and the Heritage NSW Regional Office (Coffs Harbour) are all to be notified as soon as possible. If the remains are found to be of Aboriginal origin and the police do not wish to investigate the Site for criminal activities, the Aboriginal community and the Heritage NSW should be consulted as to how the remains should be dealt with. Work may only resume after agreement is reached between all notified parties, provided it is in accordance with all parties' statutory obligations.

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DEFINITIONS

The following definitions apply to the terms used in this report:

Aboriginal Object means any deposit, object or material evidence (not being a handicraft made for sale) relating to the Aboriginal habitation of the area that comprises New South Wales, being habitation before or concurrent with (or both) the occupation of that area by persons of non-Aboriginal extraction, and includes Aboriginal remains.

Aboriginal Place means any place declared to be an Aboriginal Place (under s. 84 of the NPW Act) by the Minister administering the NPW Act, by order published in the NSW Government Gazette, because the Minister is of the opinion that the place is or was of special significance with respect to Aboriginal culture. It may or may not contain Aboriginal Objects.

ACHA means Aboriginal Cultural Heritage Assessment.

ACHCRP Guidelines means the Aboriginal Cultural Heritage Consultation Requirements for Proponents (2010).

AHIMS means Aboriginal Heritage Information Management System.

AHIP means Aboriginal Heritage Impact Permit.

CoPAI means the Code of Practice for Archaeological Investigation in New South Wales (2010).

DECCW means the Department of the Environment, Climate Change, and Water (NSW).

Due Diligence Code means the Due Diligence Code for the Protection of Aboriginal Objects in NSW (2010).

LEP means Local Environment Plan.

MHE means Manufactured Housing Estate.

NPW Act means the National Parks and Wildlife Act 1974 (NSW).

NPWS means the National Parks and Wildlife Service.

NSW means New South Wales.

Project Area means Lot 2 DP 733507 and part Lot 3 DP 733507 at 104 & 120 Carrs Drive, Yamba, NSW.

Proponent means the Clifton Yamba Land Pty Ltd and all associated employees, contractors and subcontractors of the same.

Proposed Works means the proposed Manufactured Housing Estate ('MHE') development at Carrs Drive, Yamba, NSW.

The Consultant means qualified archaeological staff and/or contractors of Everick Heritage Pty Ltd.

1. INTRODUCTION

1.1. Scope of this Assessment

The following is a report detailing the results of an Aboriginal Cultural Heritage Assessment ('ACHA') for the proposed Manufactured Housing Estate ('MHE') development at Yamba, NSW ('the Proposed Works'). The lands subject to assessment comprise Lot 2 DP 733507 and part Lot 3 DP 733507 at 104 & 120 Carrs Drive, Yamba, New South Wales ('NSW') (the 'Project Area'). The ACHA will be used to support of a Development Application ('DA') to be submitted to Clarence Valley Council.

1.2. Assessment Methodology

The methods used for this assessment are in compliance with the Code of Practice for Archaeological Investigation of Aboriginal Objects in NSW (DECCW 2010) ('CoPAI') and all relevant legislation as described in Section 2 of this Report. The following are the broad requirements for compliance with the CoPAI;

a) consultation with the Yaegl Traditional Owners Aboriginal Corporation ('TOAC');

b) searches of applicable heritage registers;

c) review of ethnographic and historic resources relevant to the region;

d) review previous archaeological work and the landscape context;

e) summarise the local and regional character of Aboriginal land use and its material traces;

f) formulate a predictive model;

g) conduct an archaeological survey with representatives of the Yaegl TOAC to identify the potential for harm to Aboriginal objects and appropriate management response; and

h) report on findings and recommended management strategies.

1.3. Project Description

The proposed MHE layout involves the following components (see also Figure 2);

- 212 residential manufactured housing allotments;
- Bio-retention basins;
- Internal roads;
- Sub-surface electrical and sewerage amenities; and
- Landscaping.

1.4. Report Authorship

The ACHA was prepared by Principal Consultant (Northern NSW) Tim Hill and Archaeologist Matt Finlayson. The Aboriginal community consultation was conducted by Tim Hill.

Figure 1: Location of Proposed Works.

Figure 2:Proposed Lot and road access layout.

2. LEGISLATIVE AND PLANNING CONTEXT

The primary State legislation concerning cultural heritage in NSW is the National Parks and Wildlife Act 1974 (NSW) (NPW Act) and Local Environment Plans (LEP) made under the Environmental Planning & Assessment Act 1979 (NSW). The Commonwealth also has a role in the protection of nationally significant cultural heritage through the Environmental Protection and Biodiversity Conservation Act 1999 (Cth), The Protection of Movable Cultural Heritage Act 1986 (Cth) and the Historic Shipwrecks Act 1976 (Cth).

For the purposes of this assessment the State and local legislation are most relevant. The consent authority will be the Clarence Valley Council. The information below lists the legislative and policy framework within which this assessment is set.

2.1. The National Parks and Wildlife Act 1974 (NSW)

The NPW Act is the primary legislation concerning the identification and protection of Aboriginal cultural heritage. It provides for the management of both Aboriginal Objects and Aboriginal Places. Under the NPW Act, an Aboriginal Object is any deposit, object or material evidence (not being a handicraft made for sale) relating to the Aboriginal habitation of the area, regardless of whether the evidence of habitation occurred before or after non-Aboriginal settlement of the land. This means that every Aboriginal Object, regardless of its size or seeming isolation from other Objects, is protected under the Act.

An Aboriginal Place is an area of particular significance to Aboriginal people which has been declared an Aboriginal Place by the Minister. The drafting of this legislation reflects the traditional focus on Objects, rather than on areas of significance such as story places and ceremonial grounds. However, a gradual shift in cultural heritage management practices is occurring towards recognising the value of identifying the significance of areas to Indigenous peoples beyond their physical attributes. With the introduction of the National Parks and Wildlife Amendment Act 2010 (NSW) the former offence provisions under Section 86 of 'disturbing', 'moving', 'removing' or 'taking possession' of Aboriginal Objects or Places have been replaced by the new offence of 'harming or desecrating'. The definition of 'harm' is 'destroying, defacing or damaging an Object'. Importantly, in the context of the management recommendations in this assessment, harm to an Object that is 'trivial or negligible' will not constitute an offence.

The amendments also significantly strengthen the penalty provisions. The issue of intent to harm Aboriginal cultural heritage has been formally addressed by separating it from inadvertent harm. The penalty for individuals who inadvertently harm Aboriginal Objects has been set at up to $55,000, while for corporations it is $220,000. Also introduced is the concept of 'circumstances of aggravation' which allows for harsher penalties (up to $110,000) for individuals who inadvertently harm Aboriginal heritage in the course of undertaking a commercial activity or have a record for committing similar offences. For those who knowingly harm Aboriginal cultural heritage, the penalty will rise substantially. The maximum penalty will be set at $275,000- or one-year imprisonment for individuals, while for corporations it will rise to $1,100,000.

Where a land user has or is likely to undertake activities that will harm Aboriginal Objects, the Director General of Heritage NSW has a range of enforcement powers, including stop work orders, interim protection orders and remediation orders. The amended regulations also allow for a number of penalties in support of these provisions. The NPW Act also now includes a range of defence provisions for unintentionally harming Aboriginal Objects:

a) Undertaking activities that are prescribed as 'Low Impact'.

b) Acting in accordance with the Due Diligence Code of Practice for the Protection of Aboriginal Objects in NSW (2010) (the 'Due Diligence Code').

c) Using a consulting archaeologist who correctly applies the CoPAI.

d) Acting in accordance with an AHIP.

The regulations allow for a range of low impact activities to be undertaken without the need to consult the Heritage NSW or a consulting archaeologist. Generally, those who undertake activities of this nature will not be committing an offence, even if they inadvertently harm Aboriginal Objects. For the purposes of this assessment, it is not considered that the proposed management works are 'low impact activities'.

2.2. Due Diligence Code

The Due Diligence Code operates by posing a series of questions for land users before they commence development. These questions are based around assessing the potential for an area of land to contain Aboriginal Objects and previous ground disturbance. An activity will generally be unlikely to harm Aboriginal Objects where it:

a) will cause no additional ground disturbance; or

b) is in a developed area; or

c) in a significantly disturbed area.

Where these criteria are not fulfilled, further assessment for Aboriginal cultural heritage will typically be required prior to commencing the activity.

2.3. The ACHCRP Guidelines (2010) and Community Consultation.

The ACHCRP Guidelines provide an acceptable framework for conducting Aboriginal community consultation in preparation for impacts to Aboriginal cultural heritage. Proponents are required to follow them where a Project is likely to impact on cultural heritage and where they require an Aboriginal Heritage

Impact Permit ('AHIP'). However, it has been standard practice to undertake consultation with Aboriginal sites officers from the Local Aboriginal Land Council ('LALC') to assist the proponent to understand their requirements for additional consultation which may include Elders Groups, native title applicant groups or other knowledge holders who might have a particular type of knowledge about an area.

The ACHCRP Guidelines typically take a minimum of 90 days to complete. However, in complicated Projects this period may need to be extended by several months. The Guidelines require public notice of the assessment, preparation of a proposed methodology, undertaking site meetings and excavations where required, the production of a draft report, which is distributed to the registered Aboriginal parties and the production of a final report.

Although not strictly required, a thorough consultation process will treat the ACHCRP Guidelines as a minimum standard of community consultation where impacts to Aboriginal objects cannot reasonably be avoided. Generally, consultants must go to further effort to identify the significance of a given site to the Aboriginal community. This will likely include undertaking additional site inspections if requested by Aboriginal stakeholders, fully resourcing the community by providing copies of past archaeological and environmental assessments in the region and meeting with community members to seek their opinions of the site.

2.4. The Clarence Valley Local Environmental Plan 2011

The Clarence Valley LEP 2011 provides statutory protection for items already listed as being of heritage significance (Schedule 5), items that fall under the ambit of the Heritage Act 1977 (NSW) and Aboriginal Objects under the National Parks and Wildlife Act 1974 (NSW). It aims to ensure best practice components of the heritage decision making process are followed.

Under the Clarence Valley LEP 2011, development consent is required from Clarence Valley Council for any of the following actions (Part 5.10.4):

a) demolishing or moving any of the following or altering the exterior of any of the following (including, in the case of a building, making changes to its detail, fabric, finish or appearance):

   i. a heritage item,

   ii. an Aboriginal object,

   iii. a building, work, relic or tree within a conservation area,

b) altering a heritage item that is a building by making structural changes to its interior or by making changes to anything inside the item that is specified in Schedule 5 in relation to the item,

c) disturbing or excavating an archaeological site while knowing, or having reasonable cause to suspect, that the disturbance or excavation will or is likely to result in a relic being discovered, exposed, moved, damaged or destroyed,

d) disturbing or excavating an Aboriginal place of heritage significance,

e) erecting a building on land:

    i. on which a heritage item is located or that is within a heritage conservation area, or

    ii. on which an Aboriginal object is located or that is within an Aboriginal place of heritage significance

f) subdividing land:

    i. on which a heritage item is located or that is within a heritage conservation area, or

    ii. on which an Aboriginal object is located or that is within an Aboriginal place of heritage significance.

Regarding Aboriginal Cultural Heritage significance (Part 5.10.8) the consent authority must, before granting consent under this clause to the carrying out of development in a place of Aboriginal heritage significance:

a) consider the effect of the proposed development on the heritage significance of the place and any Aboriginal object known or reasonably likely to be located at the place, and

b) notify the local Aboriginal communities (in such way as it thinks appropriate) about the application and take into consideration any response received within 28 days after the notice is sent.

The Project Area is not identified as an item of environmental heritage (Schedule 5) under the Clarence Valley LEP (2011).

3. ABORIGINAL COMMUNITY CONSULTATION

The Aboriginal Cultural Heritage Guidelines for Proponents (DECCW 2010) act as a guide for conducting the community consultation process. The guidelines contain a number of minimum consultation standards, one of which requires the preparation of a methodology for conducting the Cultural Heritage Assessment. This methodology outlines the basic steps that need to be undertaken to determine the nature of the cultural heritage of the site, and the approaches required to manage that heritage.

Email correspondence and phone calls were made to Dianne Chapman, Administration Manager of Yaegl TOAC on 26 July 2021 to which an email response was received from Dianne on 29 July 2021 (see Appendix 1). An additional phone call was made with Uncle Bill Walker to discuss the proposal on 29 July 2021. The field survey was undertaken on 30 July 2021 with the following;

- Ken (Fox) Laurie (Director, Yaegl Knowledge Holder and Yaegl Senior Cultural Heritage Sites Officer); and
- Shane Eamens (Yaegl Senior Cultural Heritage Sites Officer).

Both men are experienced in the identification of Aboriginal sites and have extensive knowledge of Aboriginal cultural heritage within the Clarence Valley.

4. DESKTOP ASSESSMENT: ABORIGINAL CULTURAL HERITAGE

4.1. Environmental Context

4.1.1. Topography and Hydrology.

The Project Area is located within the Oyster Channel catchment, being adjacent to the eastern bank of the channel within a saltwater estuarine floodplain (see Figure 5). The topography ranges from 3 to 5 m above sea level ('ASL') with the higher ground along the eastern boundary. The Oyster Channel is located immediately adjacent to the west of the Project Area and would have provided ample opportunity for exploitation of the saltwater estuarine environment of molluscan species and fish in addition to terrestrial swampland fauna.

The Project Area is located within the Iluka soil landscape as mapped by Morand (2011). The following summarizes the characteristics of the Iluka soil landscape:

Table 1: Soil landscapes (Morand 2001)

Soil Landscape	Description	Vegetation model
Iluka (Morand 2001:166)	**Landscape**—extremely low, level to gently undulating Quaternary (Holocene and Pleistocene) sand sheets. Low beach ridges are common on Holocene sand. Slopes 0 – 2%; relief 1 – 3 m; elevation 1 – 5 m. Mix of uncleared and cleared areas of open-forest and closed-forest (littoral rainforest). **Landscape variant ila**—Holocene beach ridges; relief 1 – 3 m. **Landscape variant ilb**—sand mass of uncertain origin. **Soils**—deep (>200 cm), well-drained Aeric Podosols (Humus Podzols) and deep (>200 cm), poorly drained Aquic/Semiaquic Podosols (Humus Podzols). Deep (>200 cm), well-drained Sesquic Aeric Podosols (Podzols) within landscape variant ila.	A mix of uncleared and cleared open and closed-forest (littoral rainforest). Dominant trees include Corymbia intermedia (pink bloodwood), Eucalyptus tereticornis (forest red gum), Corymbia gummifera (red bloodwood), E. planchoniana (needlebark stringybark), Lophostemon suaveolens (swamp box), Banksia integrifolia var. integrifolia (coast banksia), Acacia aulacocarpa (brush ironbark wattle) and Melaleuca quinquenervia (broad-leaved paperbark). Imperata cylindrica (blady grass), Lomandra longifolia (mat-rush) and Pteridium esculentum (bracken) are common ground covers.

The Project Area was originally selected in 1912 by Mr Albert Carr for farmland (Mrs Garbet per comm. 1996). The area was originally described as comprising Melaleuca / Casaurina forest on coastal swampland, which was subsequently drained, and the trees removed to their roots (Everick 2011:35). As such, the existing vegetation in the West Yamba area is predominantly regrowth. Review of parish mapping of Yamba also indicates a former channel road existed on the western boundary of the Project

Area on the bank of the Oyster Channel, starting at Somerset Place to the north, wrapping around the bank of the channel to Yuraygir and Angourie to the south (see Figure 3 and Figure 4).

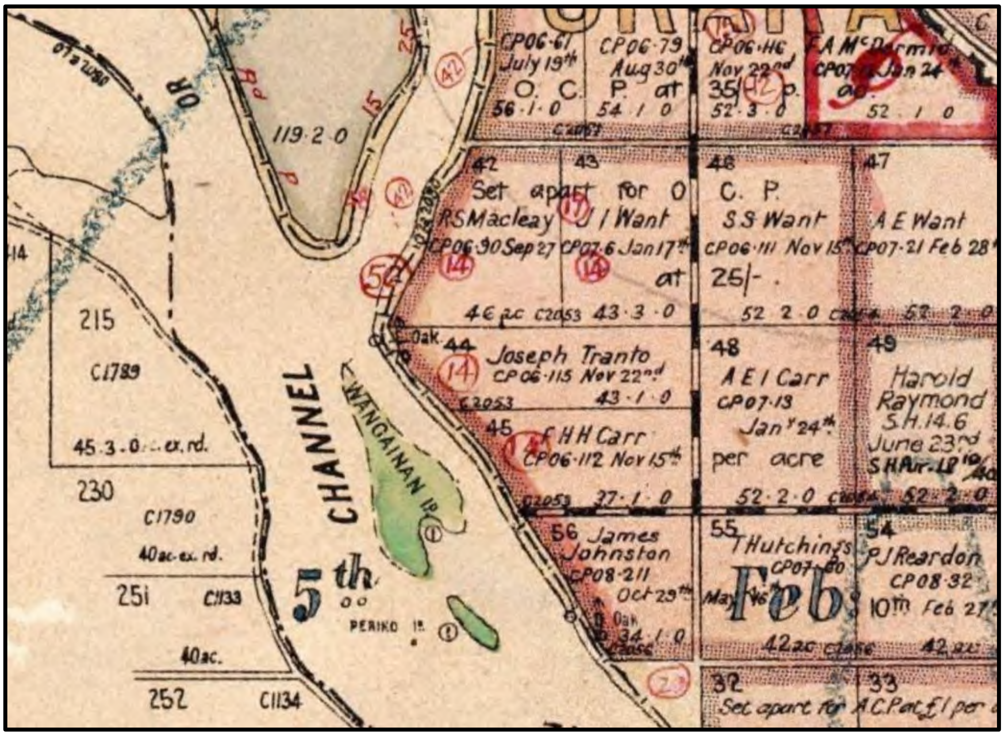

Figure 3: 1915 parish of Yamba map of the Project Area (source NSWLRS).

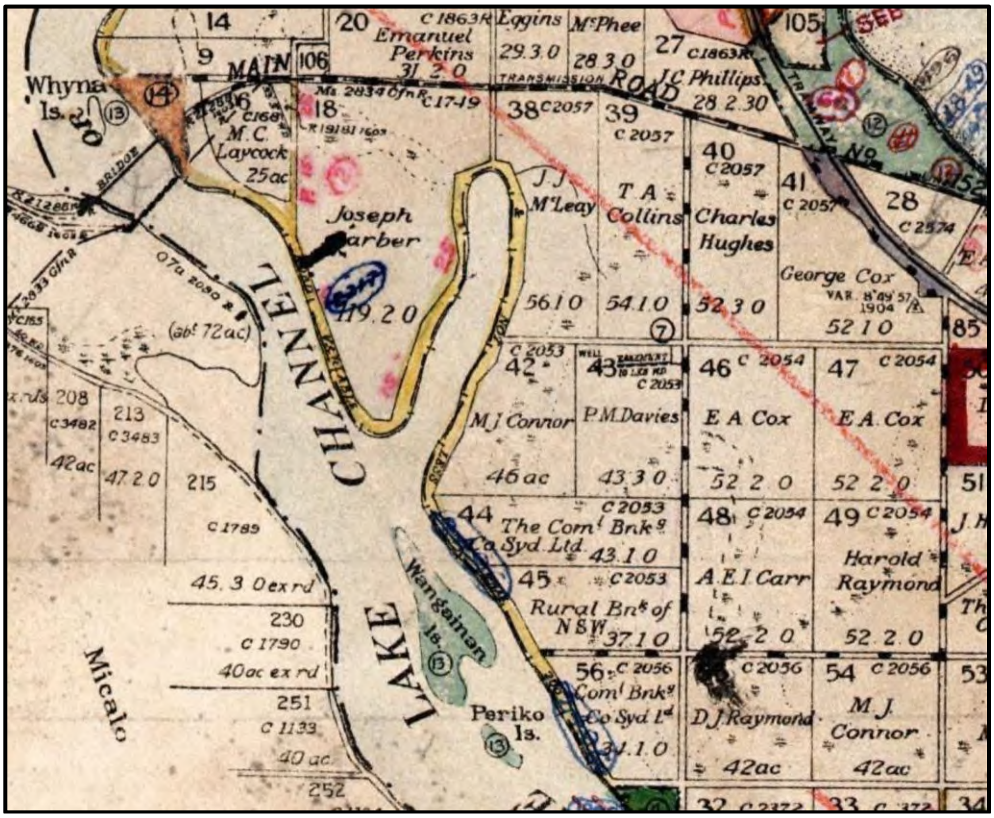

Figure 4: 1944 parish of Yamba map of the Project Area (source NSWLRS).

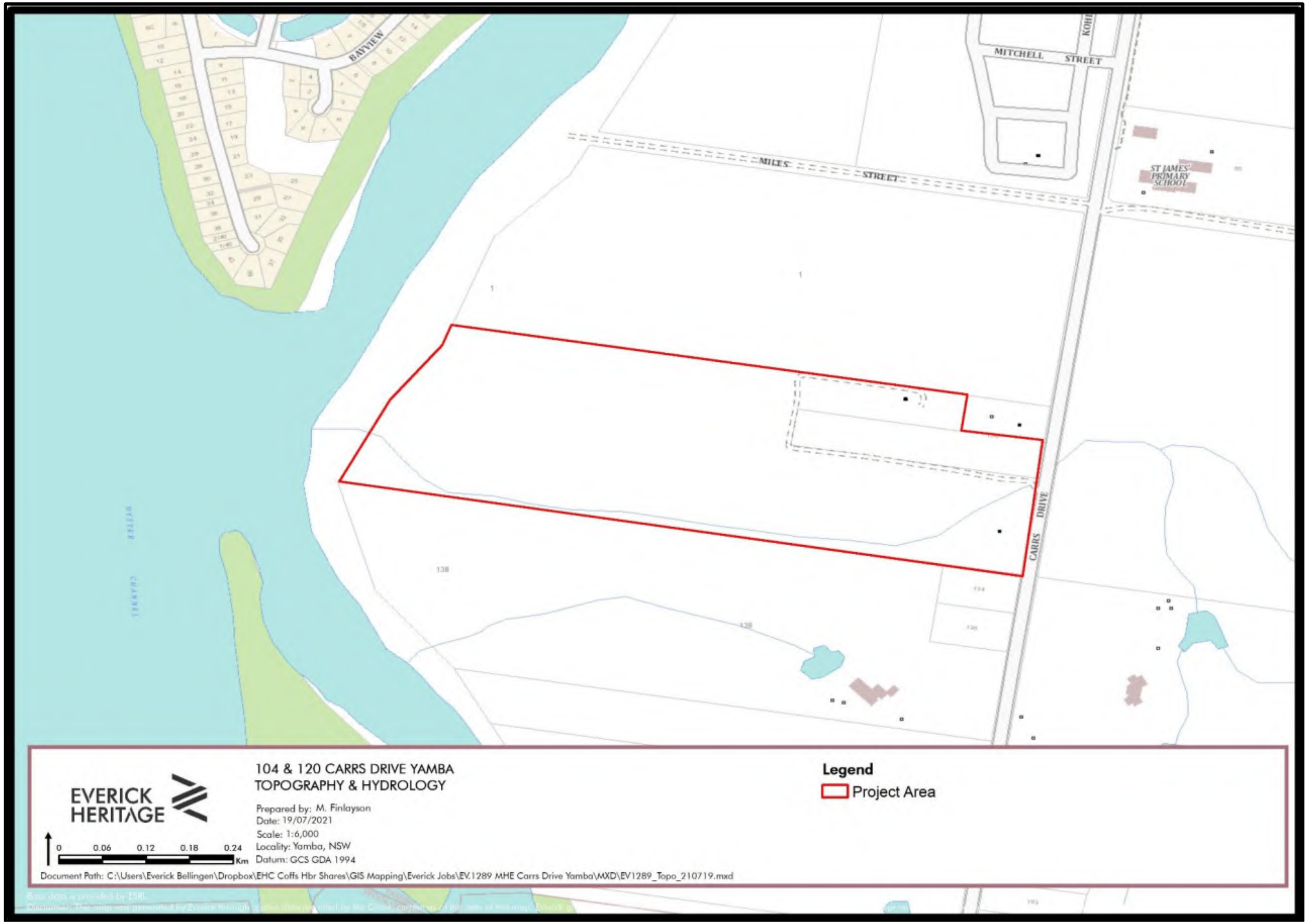

Figure 5: Topography and hydrology of the Project Area.

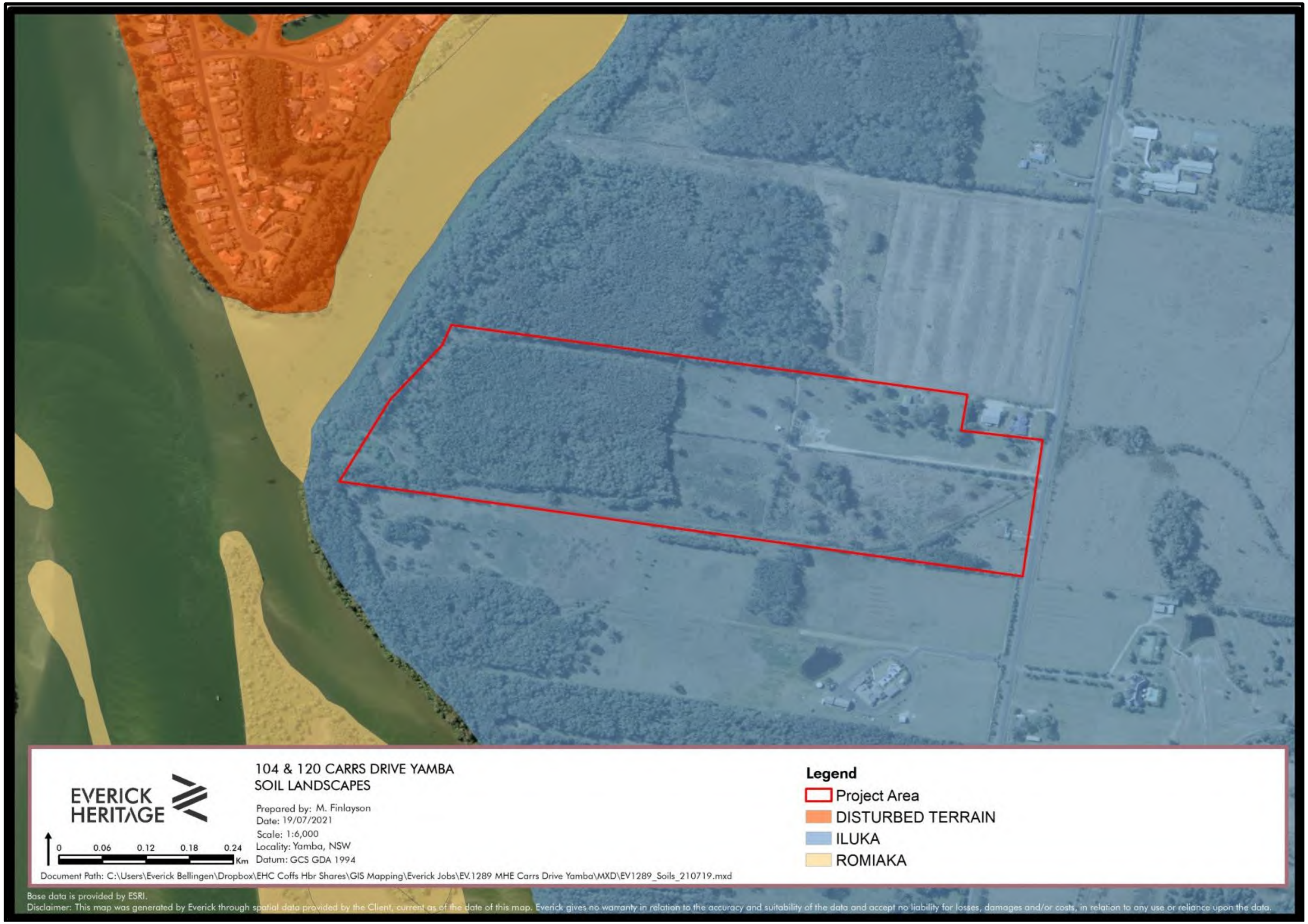

Figure 6: Soil landscapes of the Project Area.

4.2. The Aboriginal Heritage Information Management System (AHIMS)

Care should be taken when using the AHIMS database to reach conclusions about site prevalence or distribution. For example, a lack of sites in a given area should not be seen as evidence that the area was not occupied by Aboriginal people. It may simply be an indication that it has not been surveyed, or that the survey was undertaken in areas of poor surface visibility. Further, care needs to be taken when looking at the classification of sites. For example, the decision to classify a site as an Open Campsite containing shell, rather than a midden, can be a highly subjective exercise, the threshold for which may vary between archaeologists. There can also be errors with the data once it is entered onto the AHIMS database, including datum conversion errors.

An 'Extensive' search was undertaken of the AHIMS database (Reference: 607513) on 19 July 2021 (Appendix B). The search area was defined as Lot 2 DP 733507 with a buffer of 1 km. Three (3) results were returned, being the 'Golding Road Midden', 'Yamba C1' and 'Yamba C2' middens.

Golding Road Midden (13-1-0072) is within a cleared paddock adjacent to Golding Lane approximately 750 m northwest of the Project Area and is noted by Everick (2011) to have likely been partially destroyed as a result of road construction or maintenance. The location of Yamba C1 (13-1-0096) and Yamba C2 (13-1-0097) are noted as being on the eastern bank of the Oyster Channel, adjacent to the west of the Project Area, with Yamba C2 sitting on the western boundary (Figure 7). The sites have been converted from AGD to GDA coordinates, and as such may be inaccurate

Table 2: AHIMS Registered Sites (Client Service ID 607513).

Site ID	Site Name	Easting	Northing	Site Feature
13-1-0072	Golding Road Midden	532700	6743300	Shell; -, Artefact;-
13-1-0096	Yamba C1	531575	6743100	Shell; -, Artefact;-
13-1-0097	Yamba C2	531300	6743100	Shell; -, Artefact;-

4.3. Other Heritage Registers

The following heritage registers were accessed on 26 July 2021:

- **The National Heritage List (Australian Heritage Council):** Contains no Aboriginal heritage listings within or within close proximity to the Project Area.
- **Commonwealth Heritage List (Australian Heritage Council):** Contains no Aboriginal heritage listings within or within close proximity to the Project Area.

- **The State Heritage Register:**
  a) contains no Aboriginal heritage listings in Section 1 (Items listed under the NSW Act as Aboriginal Places) within or within close proximity to the Project Area;
  b) contains no Aboriginal heritage listings in Section 2 (Items listed under the NSW Heritage Act) within or within close proximity to the Project Area;
  c) contains no Aboriginal heritage listings in Section 3 (Items listed by Local Government and State Agencies) within or within close proximity to the Project Area.
- **Clarence Valley LEP (2011):** Contains no heritage items in proximity to the Project Area.
- **Register of the National Estate:** Contains no heritage items in proximity to the Project Area.

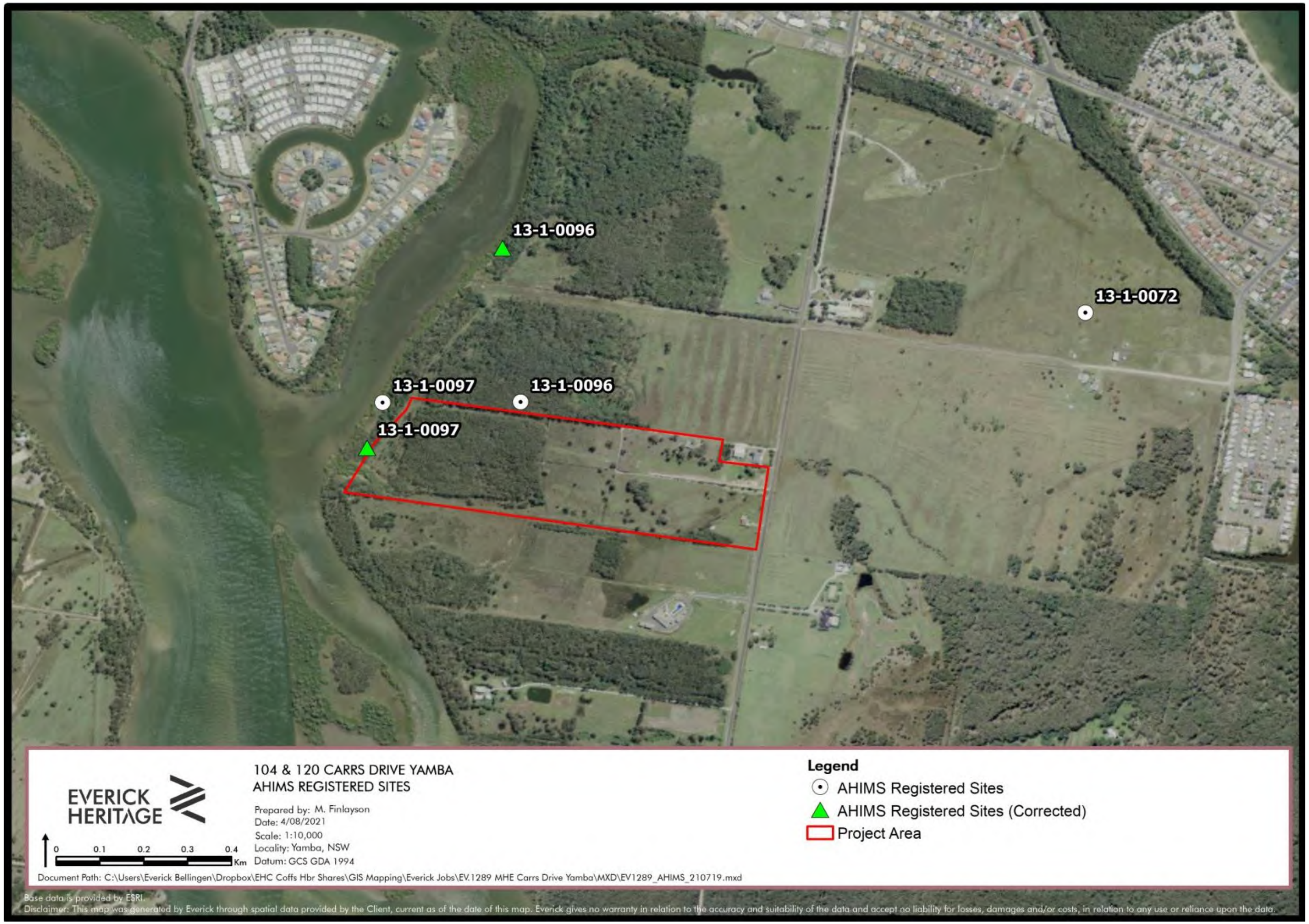

Figure 7: AHIMS Search Results (#607513) and revised locations (Everick 2011).

5. SELECTED ARCHAEOLOGICAL SYNTHESIS AND PREDICTIONS

5.1. Ethnohistory

The Aboriginal people of the lower Clarence River were part of linguistically and culturally associated groups called the Bundjalung, the coastal extent of which occupied the Clarence to Logan Rivers and west to the Dividing Range (Crowley 1978). Tindale (1974) recorded a Jiegera tribe occupying the Clarence River upstream to Grafton. Modern usage refers to the 'Yargir' (Yaegl) as the traditional Aboriginal occupants. Heron (1991) records that the 'Yargir' is more closely related to the southern Gumbaybggir than the Bundjaung, their territory extended south to Corindi Beach, west to Ulmara and north to the Clarence River including 98 of the 100 islands of the Clarence River (Heron 1991: 10). While 'Yargir' country is smaller than neighbouring territories, it is one of the richest in the region in terms of natural resources (Heron 1991: 16).

A review of sightings of Aboriginal coastal groups in Coleman's review of ethnohistorical sources led her to the conclusion that in the initial stages of European contact, observers of coastal groups described; '…consistently high, semi sedentary local populations on the coast with a highly sophisticated organic material culture which vanished almost overnight with European contact' (Coleman 1982: 7). Population densities for the lower Clarence are considered high, no doubt reflecting the wide variety of ecologies and hunting/gathering opportunities contained. Fry, Commissioner for Lands in the Clarence District, estimated the population for the Clarence as between 525 and 1,050 persons (Fry 1894 in Belshaw 1978), a density of one person per three to six square miles.

Later researchers consider that populations for the coastal plains and estuaries were much higher, at possibly one person per three square miles between the Clarence and Evans Rivers (Belshaw 1978: 730). In areas where marine and terrestrial foods were particularly abundant, which would apply to the lower Clarence, estimates may be placed even higher (Pierce 1978; Heron 1991). Population estimates by eye witnesses of Aboriginal numbers for the coastal regions, immediately after European settlement, are highly likely to be underestimates of pre contact numbers due to the impacts of diseases, particularly smallpox that spread throughout coastal groups prior to official settlement.

Land belonged to clan groups whose boundaries had been established in Yargir mythology (Creamer and Godwin 1984). Contact between local clans and more distant groups took place for the purposes of exchange, inter marriage, initiations, armed conflict and at times of seasonally abundant food supply. There are two current demographic models to describe possible settlement/movement patterns. One suggests that clan groups would range between the seacoast and the foothills of the coastal ranges on a seasonal basis (McBryde 1974). On ethno-historical evidence McBryde suggests that some seasonal movement was common and that the basic subsistence economy of hunting, fishing and gathering was neither static, nor completely migratory, but characterised by movement between the coast and the foothills (McBryde 1974: 337). A number of early references refer to seasonal movement on a limited scale including Ainsworth (1922) on the Richmond River, Dawson (1935: 25) and McFarlane (1934) on the Clarence River. Bray (1923) states that the Lismore 'tribe' used to go to Ballina at the mouth of the river. Sullivan (1976: 20) notes that inland groups were allowed to come to the Tweed coast for a time. The archaeological evidence for movement in the coastal river valleys is less conclusive (McBryde 1974: 338).

From the few eyewitness sources available for the North Coast, we can suggest that contact between members of the coastal clans was frequent and may have involved relatively large numbers. Bray records that the coastal Coodjinburra '…used to mix very much with the Ballina Richmond River Blacks' (Bray 1901:9). However, it may have been a way of life that rapidly disappeared under the impacts of disease and restrictions on Aboriginal groups by 'authorities' on the movement of Aboriginal people. A review of sightings of Aboriginal coastal groups in Coleman's review of ethno historical sources led her to a conclusion that in the initial stages of European contact, observers of coastal groups describe, '…consistently high, semi sedentary local populations on the coast with a highly sophisticated organic material culture which vanished almost overnight with European contact' (Coleman 1982:7).

McBryde (1974 and 1976) argues for a seasonal movement of people between the coast in summer exploiting marine foods and hunting inland in winter. On the ethno-historical evidence McBryde suggested that some seasonal movement was usual and that the basic subsistence economy of hunting, fishing and gathering was neither static, nor completely migratory, but characterised by movement between the coast and the foothills (McBryde 1974: 337). A number of early references refer to seasonal movement on a limited scale including Ainsworth (1922) on the Richmond River and Dawson (1935) and McFarlane on the Clarence River. Bray (1923) states that the Lismore 'tribe' used to go to Ballina at the mouth of the river. Sullivan (1964: 20) recorded that inland groups were allowed to come to the Tweed coast for a time. The archaeological evidence for movement in the coastal river valleys is less conclusive (McBryde 1974: 338).

Figure 8: 'Group of Blacks, Clarence River' (Source J. W. Lindt AM Consulting 2015:25).

Figure 9: 'Camp of Australian Aboriginals' (source F. Henningham 1935 source AM Consulting 2015:17).

5.2. Previous Archaeological Research

A broad outline of the known chronology of occupation of the immediate coastal zone between the Tweed and the Clarence Rivers is outlined below. The Aboriginal occupation of the Clarence region fits within the known chronology for the far North Coast. Coastal sites in northern N.S.W. date to within the Holocene period. The earliest of these is a shell midden at the base of Sexton Hill on the lower Tweed River where an occupation phase was dated between 4,700 BP and 4,200 BP (Appleton 1993:34). At Ballina a shell midden on Chickiba Creek was found to have accumulated between 1,750 BP and c.100 BP (Bailey 1975:52). Shell samples from the Angels Beach area are dated between 800 BP and 530 BP, with one sample at 900-1,000 BP (Rich 1994: 195). Stone artefacts were assessed on technological grounds to date to within the past 2,000 years (Rich 1994: 161). Bailey's basal date of 1,750 BP (1974) suggests that the modern resource-rich environment may not have been productive enough at an earlier time to support any more than small groups. In contrast, the Tweed River estuarine site was in use some 3,000 years earlier than this (Appleton 1993).

Beach foreshore sites investigated to date have been associated with more recent phases of occupation. Fore dune sites typically take the form of narrow bands of pipi shell, or surface scatters of pipi and stone artefacts. Pipi horizons at South Ballina and Broadwater have dated to 260 years BP and 200 years BP respectively (McBryde 1982: 77). A more substantial midden (AHIMS: #04-06-0061) investigated on the beach foreshore at Byron Bay had been used between approximately 1,000- and 400-years BP. The 80 cm deep midden deposit was overwhelmingly dominated by pipi shell, with minor inclusions of periwinkle, limpet, sand snail, oyster and cartrut. Bream was the most abundant vertebrate species. Although in lower quantities relative to bream, a broad range of fauna was represented in the midden, including other types of fish, tortoise, macropods, bandicoot, possums, rodents, birds and reptiles. The midden's stone assemblage was characterized by primary flaking debitage which reflected the poor knapping quality of the raw materials used. All of these materials are believed to have been collected from intertidal pebble beds adjacent to the site (Collins 1994).

The earliest dated coastal site in the Clarence area is the estuarine midden at Woombah, now located 10 km inland and 10.5 km southeast of the Project Area. The deposit indicated an occupation phase between c. 3260 BP and the contact period (McBryde 1974). The Woombah site had been the earliest known coastal occupation site in northern New South Wales until a shell midden excavation on the Tweed River indicated an occupation phase between 4,700 BP and 4,200 BP (Appleton 1993). At the Woombah site the bulk of shell remains were oyster (90%). Animal and fish bone were rare, suggesting that the economy was based almost entirely around the gathering of shellfish (McBryde 1974: 290). Few stone artefacts were represented. The stone kit consisted of unifaced pebble tools, perhaps used for preparing plant foods, ground edge axes, utilised flakes, some small, retouched tools and a few bone points (McBryde 1974: 290). The presence of glass artefacts indicated use of the site into the contact period. Despite the high volume of shell, McBryde concluded the site represented a great number of short sporadic occupations of the site, seasonal visits lasting only a few months (McBryde 1974: 288). Bailey (1975) drew similar conclusions from his calorific research of the North Creek Ballina oyster middens. The oysters provided little more than a minor supplement to the diet and the middens could only have been amassed by large groups over a matter of days (Bailey 1975: 57-59).

Archaeological assessment by Piper of the northern approaches to the Mororo Bridge identified three sites of isolated artefacts on low spurs adjoining the floodplain. The materials were a scraper/core, a retouched flake and flakes all on siliceous materials (Piper 1991). An earlier archaeological assessment sampled the low foothills, floodplain and the dune fields adjacent to Iluka Road and the Clarence River. No Aboriginal sites were identified in the hills and sloped landform units (Piper 1982). Byrne's Heritage Study of the Maclean Shire identified the suite of sites, principally middens, between Wombah and Woody Head as worthy of Class 1 status, Complete Conservation, that if adopted required that all designated developments be preceded by archaeological surveys and all sites be retained (Byrne 1986).

Aboriginal cultural heritage assessments in relation to the Pacific Highway Upgrade Woolgoolga to Ballina, have been the most numerous comprehensive studies in this region, be it by necessity, in a narrow corridor of search and subsequent archaeological investigations. The Iluka Road to Woodburn assessment section resulted in seven Aboriginal heritage sites and two Potential Archaeological Deposits ('PAD') (both associated with existing sites) being located within or near the highway boundary i.e., the highway upgrade corridor. These included one scarred tree near New Italy (13-1-0111) and a burial area at Sawpit Creek south of New Italy (13-1-0059). In the vicinity of the Woodburn Interchange an artefact scatter and PAD (13-1-0112), an isolated artefact and a PAD (13-1-0115) as well as an isolated artefact (13-1-0113) were found. The PADs returned 11 mainly silcrete artefacts and three artefacts respectively from test pits on the spurs from the Richmond Ranges called the Tabbimobile rises (NSW RMS EIS 2012:50-54). The sites were assessed as being of moderate to high overall Aboriginal significance with exception of isolated artefacts 13-1-113 and 13-1-0114 which were deemed low (NSW RMS EIS 2013:56).

The Piper (1996) study in Yamba included oral statements provided from Mrs Carbet (nee Carr), the daughter of the original European settler circa 1912. Mrs Garbet described West Yamba including Carrs Road as comprising Melaleuca swampland that was cleared out and drained. Mrs Garbet also recalled her own father's recollections c. 1894:

> "… Aborigines camped at the top of the lagoon, there is a Bora ring there and work their way down to micalo Island and across to Oyster Channel, crabbing, oystering, fishing etc. Then they would work their way across to the beach and back to the top of the lagoon … " (Garbet pers comm. 1996).

Piper (1996) also surveyed two recorded middens, being the Yamba C1 and C2 middens, to the west of the Project Area on the Oyster Channel bank. Both middens were within eroding low mounds within forested areas with undergrowth. Yamba C1 comprised fragmented oyster shell in a 'humic' litter that had been disturbed by animals. The site was inferred to extend 20 m x 5 m parallel to the Oyster Channel, approximately 5 m above the high-water mark. No stone tools were evident in proximity to the site and no indication was given that the shell was of European origin from an Oyster Lease. Yamba C2 however, located to the south of C1 was denoted as comprising a mixture of oyster, cockle and whelk eroding from a mound 20 m from the high-water mark, with no stone tools in proximity to the site. Piper (1996) indicates C2 to be more likely to be an Oyster lease deposit, however, also infers that both middens could possibly be the result of road construction from dumping or creation of a track base. However, the testimony of Mrs Garbet as per above raises the possibility that both sites are connected with Aboriginal food gathering on the eastern bank of the channel (Piper 1996:30).

In 2011, Everick Heritage conducted a cultural heritage assessment for the 'West Yamba' residential project, encompassing part of the current Project Area. The report denotes the location of 'Yamba C2' midden on AHIMS as being inaccurate due to conversion of the coordinates from AGD to GDA, as is common to AHIMS mapping data across New South Wales.

5.3. Predictive Modelling

The most comprehensive 'regional' model for the area is provided by Godwin (1990) in a major review of the earlier archaeological research of Isabelle McBryde (1974). Godwin's model specifically investigates patterns of movement between the coastal, sub-coastal and tablelands (escarpment) areas. For the purposes of understanding the archaeological record the study area is considered to fall into the 'coastal' area. Godwin makes the following statement on settlement and movement along the coast;

> Amongst coastal groups proper there was no movement from the coast back into the sub-coastal river valleys and foothills. These people were semi-sedentary and lived close to the coast the whole year round. Movement associated with the subsistence round involved travelling only short distances away from the littoral. There were instances of long distance travel associated with ceremonial gatherings. However, such movement was generally parallel to the coast (i.e. north-south along the coast rather than east-west from coast to hinterland) (Godwin 1990: 122,123).

It is likely that larger camps associated with relatively large coastal groups were situated on slightly elevated land nearby to the main river and estuary. While it is noted that the Project Area is within the tidal estuary, the low-lying nature of the land is not conducive to the discard and preservation of Aboriginal archaeological sites.

6. FIELD SURVEY: ABORIGINAL CULTURAL HERITAGE

6.1. Constraints to Site Detection

An assessment of the constraints to site detection is made to assist in formulating a view as to the effectiveness of the field inspection to find Aboriginal sites and cultural heritage materials. It also assists in the forming of a view of the likelihood of concealed sites, keeping in mind a site-specific knowledge of the disturbance impacts that European land uses and natural processes may have had on the 'survivability' of Aboriginal sites in a Project Area.

The constraints to site detection are almost always most influenced by post European settlement land uses and seldom by natural erosion processes. The area of surface exposure and the degree of surface visibility within exposed surfaces are usually the product of 'recent' land uses for example land clearing, ploughing, road construction, natural erosion and accelerated (manmade) erosion (McDonald et.al. 1990:92). In this case the major 'manmade' constraints to Aboriginal site survivability and detection are due to the following;

- Drainage of the former Yamba / West Yamba coastal swampland for farming;
- Removal of vegetation and replacement with sugar cane plantations and pasture for cattle;
- Removal of topsoil for access tracks and the existing dwelling; and
- Alluvial erosion as a result of seasonal inundation and flooding.

6.2. Site Inspection

To achieve as thorough and effective an archaeological assessment as possible a systematic ground survey of impacted sections of the Project Area was undertaken. The surface visibility was consistently low (10%), with grass cover, leaf litter, overgrown shrubbery and intermittent exposures across most of the Project Area. Exposures were generally limited to the area of fill surrounding the cleared house pad area and in vehicle / mud tracks on the northern boundary of the Project Area. GSV was approximately 10% through the Project Area. Vegetation generally comprises recent Melaleuca regrowth that has grown in the past 5 years, with few matures scattered through the Project Area that are likely at minimum 40 years old. Notably, vegetation on the property adjacent to the north comprises Melaleuca Forest that is generally older and less condensed than that found within the Project Area.

A site inspection of the Project Area was undertaken on Friday 30 July 2021 with Ken 'Fox' Laurie and Shane Eamens (Yaegl TOAC), with Tim Hill (Everick Heritage Principal Northern NSW) and Matt Finlayson (Everick Heritage Archaeologist). The site inspection aimed to identify;

- the potential for the Project Area to contain Aboriginal archaeological sites; and
- the potential constraints facing the MHE development in terms of the likelihood for harm to be caused to prospective Aboriginal sites (Table 3 and Figure 10).

The amount of vegetation was greater than anticipated from site aerials due to the level of vegetation regrowth in the past 5 years which limited the area subject to survey. As such, the survey served to provide a sample of the Project Area to ascertain the level of disturbance and requirement for further investigations (Figure 11- Figure 16). No Aboriginal sites were identified during the site inspection.

Table 3: Survey coverage.

Survey Unit	Landform	Survey Unit Area (m^2)	Visibility (%)	Exposure (%)	Effective Coverage Area (m2)	Effective Coverage (%)
1	Channel Floodplain	3675	10	10	36.75	1

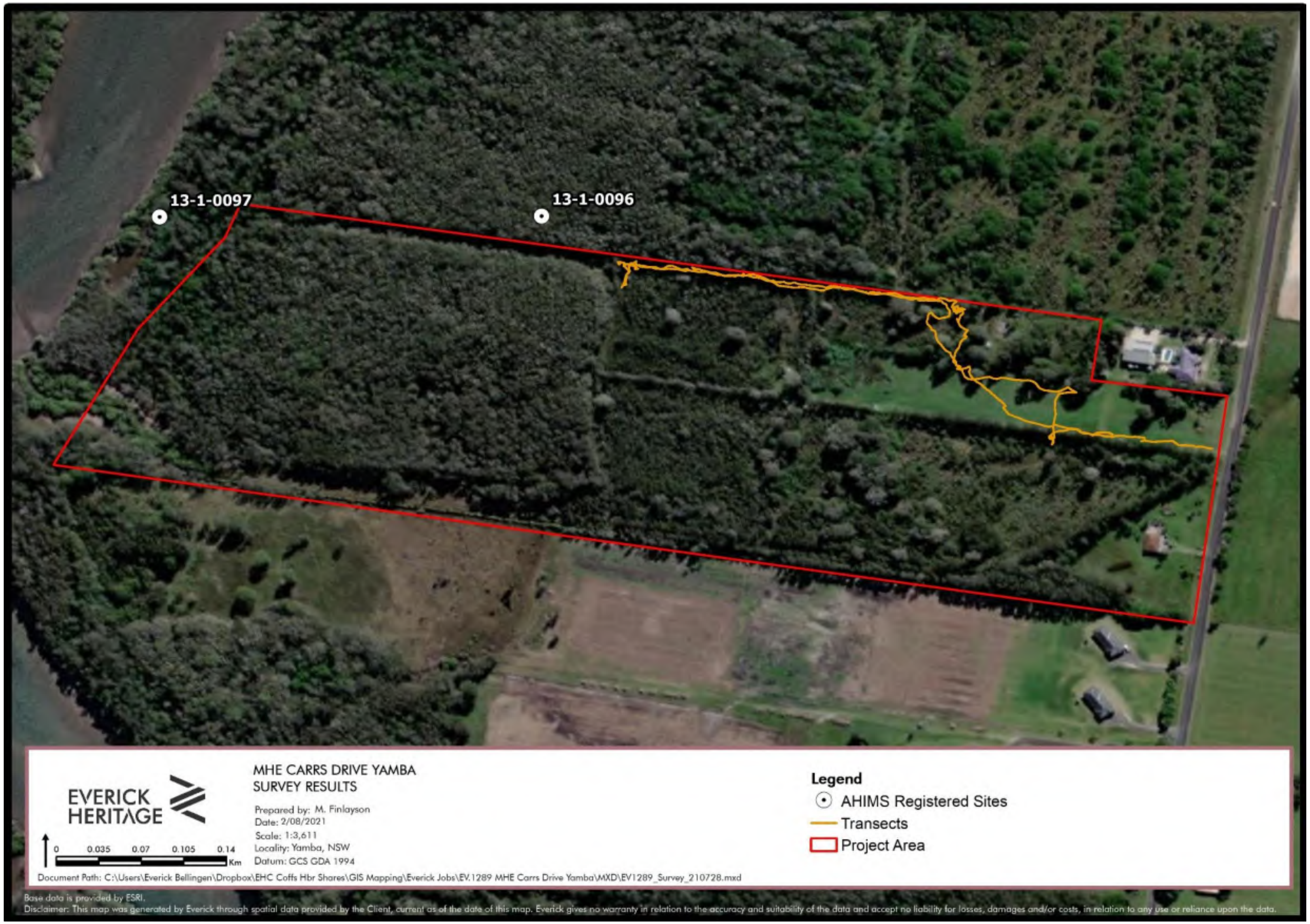

Figure 10: Survey transects and results.

Figure 11: Lot 3 from Carrs Road, looking west.

Figure 12: GSV and conditions of Lot 3 fill area.

Figure 13: Cleared easement on northern boundary of Project Area amidst regrowth, facing east.

Figure 14: Melaleuca and box regrowth, facing southeast from northern boundary of Project Area.

Figure 15: GSV and conditions within regrowth area, northern boundary of Project Area.

Figure 16: Change in level from swamp level to fill level, facing northwest across Lot 3.

7. RESULTS OF ABORIGINAL CULTURAL HERITAGE ASSESSMENT

As a result of the desktop study, field inspection and consultation with Yaegl TOAC the following can be concluded:

a) No Aboriginal sites were identified within the surveyed section of the Project Area.

b) The revised locations for the Yamba C1 and Yamba C2 middens (Everick 2011) report indicates both the C2 site is within or beside the environmental protection are to the west of the proposed footprint of the MHE development. The C1 site is further north along Oyster Channel.

c) Vegetation comprises predominantly juvenile Melaleuca spp. that has overgrown most of the area of the Proposed Works in the last 5 years. Few mature Melaleucas remain and none that were surveyed were noted to have cultural modification. South of the Lot 3 house pad, the vegetation comprises a more mixed variety of regrowth Casuarina and Oak with some remnant matures.

d) The cleared house pad / grassed area comprising 104 Carrs Drive (Lot 3) has been subject to the introduction of fill that has raised the ground surface above the original swampland surface level by approximately 1 m. It is inferred that the soil profile of this area would likely comprise fill overlying original swampy ground surfaces and topsoil deposits. This would be consistent with the findings of the Everick (2011) report which stated the West Yamba (Carrs Drive) area was, drained, cleared and filled by European settlers to overcome the coastal swampland conditions for farming.

e) It was generally agreed that midden material, if present would more likely be located within 80 metres of the Oyster Channel bank. However, Ken and Shane noted that midden material has been found further east of the Oyster Channel to the south of the Project Area and on Goldings Lane to the east. Low elevated aeolian sand dunes associated with the former coastline have the potential for midden material as these formed islands throughout the swampland.

f) Ken Laurie remembers the property as being predominantly used for cattle and believes vegetation would have been removed by bulldozer before fill was subsequently scattered to create a new surface.

g) Due to the level of ground-surface disturbance, lack of surveyable area and limited GSV, it was the conclusion of the Yaegl TOAC sites officers that Aboriginal spotters should be on-site during ground disturbing works for topsoil removal and installation of water retention basins. The objective of the monitoring program would be to identify any former mid-Holocene sand dunes that might occur through the area of the Proposed Works but have been levelled by historic agriculture.

h) Test excavations are not deemed to be required as per Section 3 of the *Code of Practice for Archaeological Investigation of Aboriginal Objects in NSW* (DECCW 2010) due to the level of disturbance and the lack of proximity of ground disturbing works to a previously recorded midden. This opinion is supported by the Yaegl TOAC representatives preferring on-site monitoring of any potential shell material that be encountered by development of the estate.

8. RECOMMENDATIONS

The assessment has concluded that ground disturbing works, being the MHE allotments, bio-retention basins, underground services and interior roads are unlikely to impact on Aboriginal objects and will not impact on any known places or sites of cultural significance to the Aboriginal community. As such additional consultation and archaeological investigation is not required. However, the following recommendations are provided as a precautionary measure to mitigate impacts to potential Aboriginal heritage values.

Recommendation 1: Aboriginal Objects Find Procedure

It is recommended that if suspected Aboriginal material has been uncovered because of development activities within the Project Area:

a) work in the surrounding area is to stop immediately;

b) a temporary fence is to be erected around the site, with a buffer zone of at least 10 metres around the known edge of the site;

c) an appropriately qualified archaeological consultant is to be engaged to identify the material; and

b) should the works be deemed to have harmed the Aboriginal objects the Heritage NSW should be notified immediately via the EPA Enviro Hotline.

Having consideration for the outcomes of the ACHA it is recommended that Aboriginal sites monitors from Yaegl TOAC are engaged as "cultural heritage spotters" for ground disturbing works of original topsoils below the extent of the European fill layer.

Recommendation 2: Aboriginal Human Remains

Although it is unlikely that Aboriginal Human Remains will be located at any stage during earthworks within the Project Area, should this event arise it is recommended that all works must halt in the immediate area to prevent any further impacts to the remains. The site should be cordoned off and the remains themselves should be left untouched. The nearest Police Station (Yamba), Yaegl TOAC and the Heritage NSW Regional Office (Coffs Harbour) are all to be notified as soon as possible. If the remains are found to be of Aboriginal origin and the police do not wish to investigate the Site for criminal activities, the Aboriginal community and the Heritage NSW should be consulted as to how the remains should be dealt with. Work may only resume after agreement is reached between all notified parties, provided it is in accordance with all parties' statutory obligations.

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APPENDIX A: CORRESPONDENCE WITH YAEGL TOAC

From: Yaegl Traditional Owners Aboriginal Corporation . <YaeglTOAC@outlook.com>

Sent: Thursday, 29 July 2021 12:05 PM

To: Tim Hill <t.hill@everick.net.au>

Cc: Bill <ceo@yaegltoacrntbc.org.au>

Subject: RE: 104 & 120 Carrs Drive Yamba - Fee Proposal Request

Hi Tim,

After our conversation this afternoon this is to confirm that both;

- Ken (Fox) Laurie

Director, Yaegl Knowledge Holder and Yaegl Senior Cultural Heritage Sites Officer

- Shane Eamens

Yaegl Senior Cultural Heritage Sites Officer

Will meet you on-site at 9:30am on Friday 30th July 2021.

Thank you and kind regards,

Dianne

Dianne Chapman

Manager Administration

Yaegl Traditional Owners

Aboriginal Corporation RNTBC

3 Stanley Street,

MACLEAN NSW 2463

Ph: 02 66 452930

M: 0457 925 458

manager@yaegltoacrntbc.org.au

Mobile: TBA

I acknowledge that I work & walk on Yaegl Country & pay respect to my Ancestors & my Elders for the legacy they left for Yaegl people to carry on

From: Tim Hill <t.hill@everick.net.au>

Sent: Monday, 26 July 2021 9:18 AM

To: YaeglTOAC@outlook.com

Cc: Bill <ceo@yaegltoacrntbc.org.au>; andrew@md-engineer.com.au

Subject: FW: 104 & 120 Carrs Drive Yamba - Fee Proposal Request

Dear Diane

Please see below the plan for the proposed Modular Housing Estate site at 104/120 Carrs Drive, Yamba. The Lot/DP are Lot 3 DP733507 and Lot 2 DP733507 respectively.

We have instructions to undertake an archaeological site inspection. Can you please indicate if a Yaegl sites officer would be available either this Thursday (29th) or Friday (30th).

Please call if its easier.

Ta

Tim Hill

BA (Hons)

Principal (Coffs Harbour)

Ph: (02) 6655 0225

Mob: 0422 309 822

Everick Heritage Pty Ltd

ABN 78 102 206 682

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APPENDIX B: AHIMS EXTENSIVE SEARCH RESULTS

Office of Environment & Heritage NSW GOVERNMENT

AHIMS Web Services (AWS)

Extensive search - Site list report

Your Ref/PO Number : EV1289

Client Service ID : 607513

SiteID	SiteName	Datum	Zone	Easting	Northing	Context	Site Status	SiteFeatures	SiteTypes	Reports
13-1-0072	Golding Road Midden;	AGD	56	532700	6743300	Open site	Valid	Shell : -, Artefact : -	Midden	
	Contact	Recorders	Mr.Luke Godwin					Permits		
13-1-0096	Yamba C1	AGD	56	531575	6743100	Open site	Valid	Shell : -, Artefact : -	Midden	
	Contact	Recorders	Mr.Adrian Piper					Permits		
13-1-0097	Yamba C2	AGD	56	531300	6743100	Open site	Valid	Shell : -, Artefact : -	Midden	
	Contact	Recorders	Mr.Adrian Piper					Permits		

Report generated by AHIMS Web Service on 19/07/2021 for Matthew Finlayson for the following area at Lot : 2, DP:DP733507 with a Buffer of 1000 meters. Additional Info : arch assessment.
Number of Aboriginal sites and Aboriginal objects found is 3

APPENDIX C – ACID SULPHATE SOILS MANAGEMENT PLAN

ACID SULFATE SOIL INVESTIGATION AND MANAGEMENT PLAN

Lot 2 DP733507 and Lot 32 DP1280863

110 - 120 Carrs Drive, Yamba, New South Wales

Easterly Point Environmental

August 2022

Precise Environmental Pty Ltd
ATF Precise Environmental Unit Trust

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Report

Precise Environmental Pty Ltd **ATF Precise Environmental Unit Trust**		**Job No:**	PE3394.22
Project Manager	Chris Butler	**Email:**	chris@preciseenvironmental.com.au
File reference	PE3394.22_110 - 120 Carrs Dr_ASSI_v1		
Title:	Acid Sulfate Soil Investigation and Management Plan Lot 2 DP733507 and Lot 32 DP1280863, 110 - 120 Carrs Drive, Yamba, New South Wales		
Client	Easterly Point Environmental		
Client contact	Hailey Spry		

Distribution

Version	Status	Date	Recipient
1	Final	17 August 2022	Easterly Point Environmental

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1 INTRODUCTION

Precise Environmental (PE) was commissioned by Easterly Point Environmental to conduct and acid sulfate soil investigation (ASSI) and prepare an acid sulfate soil management plan (ASSMP) for the proposed residential subdivision of Lot 2 DP733507 and Lot 32 DP1280863, 110 - 120 Carrs Drive, Yamba, New South Wales.

The current site layout is presented in Appendix A, Figure 1.

1.1 Project overview

The extent of the development is 10 ha and will be restricted to the eastern half of the site which is currently zoned for residential land use (refer Table 1). The western half of the site is zoned as environmental conservation and environmental management and is heavily vegetated. The proposed allotment layout is provided in Appendix B.

The development area will be filled by importing ~ 2.0 – 2.5 m of sand across the development area. Whilst most utility services will be constructed / installed within the imported fill, localised excavations will be required in natural soils at depths < 5 m AHD. The vertical extent of earthworks is expected to be limited to disturbance of natural soils in the top 0.5 – 1.0 m, noting the extent of PE's ASSI was 2.0 – 3.0 m depth.

Lateral extents of the ASSI were limited to areas of the site which could be accessed by a drilling rig. Borehole locations are provided in Appendix A, Figure 1.

1.1.1 Potential disturbance of ASS

ASS occur predominantly on coastal land with elevations generally below 5 m Australian Height Datum (AHD). These soils also occur further inland in saline seepage areas, rivers, lake beds and irrigation channels. Where ASS are present, draw-down of the local water table can expose these soils to oxidising conditions creating acidity and mobilising metals at potentially harmful concentrations.

In such situations, extracted groundwater can be impacted by acidity and dissolved heavy metals at potentially harmful concentrations, and requires appropriate management.

1.2 Objectives

The objectives of the ASSMP are to:

- Summarise acid sulfate soil (ASS) conditions within the development area
- Describe the nature and extents of ASS which may be disturbed and any requirement/s for management.

1.3 Scope of work

To meet the above objectives, the following scope of work was undertaken:

- Detailed site inspection
- Underground service clearance
- Drilling of fifteen boreholes ranging in depth from 2.0 – 3.0 m depth
- Collection of soil samples at 0.25 m depth intervals in each borehole
- ASS screen testing (pH_F and pH_{FOX}) of all recovered soil samples
- Selective chromium reducible sulfur suite (SCR Method 22B) and S_{KCl} analysis based on screen testing results
- Preparation of this ASSI and ASSMP.

1.4 Relevant guidance

It has been established with NSW EPA that Queensland-based guidance documents provide the best ASS management practices currently available, and therefore shall form the basis of the methodology described in this plan. NSW based guidance is also referenced for thoroughness.

Guidance information referenced in completing the scope of work included:

- Acid Sulfate Soils Laboratory Methods Guidelines (Ahern et al, 2004)
- Acid Sulfate Soil Manual (ASSMAC 1998)
- Clarence Valley Local Environmental Plan (LEP) 2011
- Guidelines for Sampling and Analysis of Lowland Acid Sulfate Soils (ASS) in Queensland (Ahern et al, 1998)
- Queensland Acid Sulfate Soil Technical Manual: Soil Management Guidelines Version 4 (Dear et. al. 2014)

1.5 Planning trigger for ASS management

The NSW Government ePlanning Spatial Viewer maps the site within a Class 2 acid sulfate soil (refer property reports presented in Appendix B). As per section 7.1 of the Clarence Valley LEP development consent is required in Class 2 land where works are carried out below the natural ground surface or where works which will lower the water table.

Section 7.1 states consent must not be granted under this clause for the carrying out of works unless an acid sulfate soils management plan has been prepared for the proposed works in accordance with the Acid Sulfate Soils Manual and has been provided to the consent authority.

1.6 Limitations

The findings of this report are based on the objectives and scope of work outlined above. PE performed the services in a manner consistent with the normal level of care and expertise exercised by members of the environmental assessment profession. No warranties or guarantees, express or implied, are made. Subject to the scope of work, PE's assessment is limited strictly to identifying typical environmental conditions associated with the subject property, and does not include evaluation of any other issues.

This report does not comment on any regulatory obligations based on the findings, for which a legal opinion should be sought. This report relates only to the objectives and scope of work stated, and does not relate to any other works undertaken for the Client. The report and conclusions are based on the information obtained at the time of the assessment. Changes to the subsurface conditions may occur subsequent to the investigation described herein, through natural processes or through the intentional or accidental addition of contaminants, and these conditions may change with space and time.

The results of this assessment are based upon site inspection and fieldwork conducted by PE personnel and information provided by the Client. All conclusions regarding the property area are the professional opinions of the PE personnel involved with the project, subject to the qualifications made above. While normal assessments of data reliability have been made, PE assumes no responsibility or liability for errors in any data obtained from regulatory agencies, information from sources outside of PE, or developments resulting from situations outside the scope of this project.

2 SITE CONDITIONS AND ENVIRONMENTAL SETTING

2.1 Site and environmental setting

Site identification, land use and environmental setting details are provided in Table 1. Key built features within the site are shown in Appendix A, Figure 1.

Table 1. Site and surrounding land details.

Aspect	Detail	
Street address	120 Carrs Drive, Yamba, New South Wales.	
Real property description	Lot 2 DP733507	Lot 32 DP1280863
Total area	16.2 ha	~1.5 ha
Local Government	Clarence Valley Council (CVC)	
Zoning (CVC)	Eastern half: R1 – General residential Western half: C2 – Environmental conservation C3 – Environmental management	R1 – General residential
	The objectives of the general residential zone are to: 1. Provide for the housing needs of the community 2. Provide for a variety of housing types and densities; and 3. Enable other land uses that provide facilities of services to meet the day to day needs of residents The objectives of the environmental conservation zone are to: 1. Protect, manage and restore areas of high ecological, scientific, cultural or aesthetic values 2. Prevent development that could destroy, damage or otherwise have an adverse effect on those values 3. Protect coastal wetlands and littoral rainforests 4. Protect land affected by coastal processes and environmentally sensitive coastal land 5. Prevent development that would adversely affect, or be adversely affect by coastal processes The objectives of the environmental management zone are to: 1. Protect, manage and restore areas with special ecological, scientific, cultural or aesthetic values 2. Provide for a limited range of development that does not have an adverse effect on those values 3. Prevent inappropriate development in geologically hazardous areas so as to minimise erosion and other adverse impacts on escarpment areas 4. Ensure that development does not unreasonably increase the demand for public services or public facilities 5. Ensure development is not adversely impacted by environmental hazards 6. Protect prominent hillsides, ridgelines, other major natural features, riparian areas and water catchment areas	
Existing land use and site structures	An existing (unoccupied) residential dwelling is located in the southeast corner of Lot 2 DP733507. A concrete slab located in the northeast corner of Lot 2	

Aspect	Detail
	DP733507 formerly contained a shed – anecdotal information supplied by the client indicates the building was demolished after a fire.
Surrounding land uses	North: Earthworks occurring for adjacent residential subdivision South: Low-density rural / residential land East: Low-density rural / residential land West: Oyster Channel – tidal waterbody between Wooloweyah Lagoon and Clarence River
Watercourses	An ephemeral watercourse is mapped in the southeast corner of the site and traverses west parallel to the southern site boundary terminating beyond the west site boundary in Oyster Channel. The ephemeral watercourse will be repurposed as a riparian zone as part of the redevelopment.

3 GEOTECHNICAL INFORMATION

The following sections presents key information derived / summarised from the geotechnical report which will need to be considered as part of the overall management strategy of disturbed ASS within the proposed development. The geotechnical report (GI 2021) was prepared by Geotech Investigations (GI) Pty Ltd on 7 July 2021.

Notwithstanding general limitations of the geotechnical report, it is noted boreholes constructed as part of the investigation were limited to three boreholes adjacent to the residential dwelling in the southeast corner of the site and one adjacent to the western boundary of Lot 32 DP1280863.

A summary of the soil conditions encountered by GI are presented in Table 2. No unconsolidated marine clay sediments were identified.

Table 2. Summary of soil conditions (GI 2021).

Material descriptions	BH1 (m)	BH2 (m)	BH3 (m)	BH4 (m)
Alluvial topsoil	0 – 0.2	0 – 0.3	0 – 0.2	NE
Alluvial Firm / stiff clay	0.2 – 0.3	0.3 – 0.5	0.2 – 0.3	NE
Loose or worse (SPT 'N' <10) sand	2.3 – 2.8	1.0 – 2.8	1.0 – 5.5	0.0 – 5.4
Medium dense (SPT 10 < 'N' < 30) sand	0.3 – 2.3 NE	0.5 – 1.0 NE	0.3 – 1.0 5.5 – 11.1	5.4 – 7.0 NE
Dense (SPT 30 < 'N' < 50) sand	NE	NE	11.1 – 12.4	NE
Very dense (SPT 'N' > 50) sand	NE	NE	NE	7.0 – 10.9
Terminated depth	2.8	2.8	12.4	10.9

Table notes:

NE denotes not encountered

3.1 Earthworks

Earthworks proposed for the proposed development include:

- Site preparation, clearing and grubbing
- Importation of up to 2.0 – 2.5 m of bulk filling across the site to achieve an estimated design level of up to RL 3.6 m
- Construction of a riparian corridor which is expected to comprise excavation and batter shaping
- Construction of a series of internal roads, entrances, and civil infrastructure.

PE has been advised by the client most civil infrastructure will be constructed within the bulk fill soils, with the exception of deeper utility services such as sewer rising mains, service trenches etc. PE has not been supplied with the proposed civil / utility services plan.

3.2 Stripping of topsoil

Topsoil stripping across the site will be in the order of 100 – 200 mm and will vary according to areas containing surface vegetation, root regrowth, site drainage and weather conditions encountered prior to stripping. Based on the development area of 10 ha there could be up to 20,000 m^3 of soil which cannot be reused as structural fill (not including uncontrolled fill encountered within the observed earthen access driveway). The topsoil may be reused onsite for landscaping following neutralisation treatment.

Alluvial soft to firm clays encountered from 100 – 500 mm in thickness below the topsoil in conjunction with the shallow water table won't be suitable to pass a 'test roll' and will cause trafficability issues during construction. Geotech Investigations have suggested importing a bridging layer to minimise the extent of disturbance to the natural ground. Building remnants and uncontrolled fill will also need to be stripped.

3.3 Bulk filling

Following clearing, site preparation and stripping, 500 mm of clean sand material shall be placed and compacted across the alluvial clay subgrade and a test roll completed prior to additional filling. Fill material should contain similar properties to the sites natural soil, and it was therefore recommended that clean cohesionless sand be used as the bulk filling material and should be placed in layers not exceeding 250 mm.

3.4 Groundwater

Groundwater was encountered at shallow depths across the site typically around 0.6 m (this was relatively consistent with PE's findings). Groundwater could rise to surface levels in times of flooding. The geotechnical report states the following relating to groundwater:

- Where excavations such as service trenches are proposed to extend near or below the water table, suitable methods of excavation and localised dewatering need to be considered
- Temporary retention such as shore boxes will be required where excavations of the groundwater is required
- Fill placement in areas within 0.5 – 1.0 m of the groundwater at the time of placement may pump groundwater into the placed fill causing heaving and compaction difficulties.

3.5 Batter slopes

The riparian zone is expected to be positioned at the natural surface level requiring no new fill and long-term batter slopes. The batter will need to be protected from erosion and scour protection.

3.6 Settlement

Settlement of the underlying alluvial sands at the site are relatively immediate and based on the depth of fill to be placed, settlement of the underlying alluvial sands is considered to be negligible (less than 20 – 30 mm). Settlements will occur as the surcharge layers are placed and will not impact the development infrastructure, or future structures.

4 ACID SULFATE SOIL INVESTIGATION METHODOLOGY

Standard operating procedures upon which the soil collection methods were based are provided in Appendix C.

4.1 Soil sampling and analysis

Fifteen boreholes (BH1 – BH15) were drilled on 12 July 2022 to depths of 2.0 – 3.0 m below ground level (BGL) using a track mounted drill rig with solid stem augers. Locations were selected to provide as much site coverage as possible noting parts of the site were inaccessible due to waterlogged soils / dense vegetation.

Soil samples were collected at 0.25 m intervals ensuring inclusion of distinct changes in soil type. Each sample was sealed in a snap-lock bag with excess air evacuated and stored and transported below 4°C to minimise samples oxidation and degradation. All samples were dispatched to a NATA accredited laboratory under chain of custody documentation for field screening. Select samples were analysed for Chromium Reducible Sulfur suite analysis (S_{CR} - Method 22B) in accordance with Acid Sulfate Soils Laboratory Methods Guidelines (Ahern et al, 2004).

4.2 Action criteria

The Guidelines for Sampling and Analysis of Lowland Acid Sulfate Soils (ASS) in Queensland (Ahern *et al*, 1998) describes field pH_F / pH_{FOX} test results which indicate potential acid sulfate soils (PASS). A combination of three factors is considered in arriving at positive field sulfide identification - (a) a reaction with hydrogen peroxide, (b) a much lower pH_{FOX} than field pH_F (▲pH) and (c) the actual value of pH_{FOX}.

The guidelines offer the following information regarding the interpretation of field pH results:

- The strength of the reaction with peroxide is a useful indicator but cannot be used alone. Organic matter and other soil constituents such as manganese oxides can also cause a reaction. Care must be exercised in interpreting a reaction on surface soils and high organic matter soils such as peat and some mangrove/estuarine muds and marine clays. This reaction should be rated.
- A pH_{FOX} value at least one unit below field pH_F may indicate a PASS. The greater the difference between the two measurements (▲ pH), the more indicative the value is of a PASS. The lower the final pH_{FOX} value is, the better the indication of a positive result.
- If the pH_{FOX} is < 3, and the other two conditions apply, then it strongly indicates a PASS. The more the pH_{FOX} drops below 3, the more positive the presence of sulfides.
- A pH_{FOX} 3 - 4 is less positive and laboratory analyses are needed to confirm if sulfides are present.
- For pH_{FOX} 4 - 5 the test is neither positive nor negative.
- For pH_{FOX} > 5 and little or no drop in pH from the field value, little net acidifying ability is indicated.

The appropriate criteria, or action thresholds, are the texture-based action criteria from the Queensland Acid Sulfate Soil Technical Manual (Dear *et al*. 2014). The action criteria have been developed to determine when management of disturbed acid sulfate soil is required. Soil texture influences the risk associated with a disturbance, due to differences in the rate of oxidation, permeability and potential buffering capacity of the soil. The action criteria are shown in Table 3.

The ASS to be disturbed is >1,000 tonnes and the applicable action criteria is 18 mol. H^+/t.

Table 3. Texture-based acid sulfate soil action criteria.

Type of Material	*Approx. clay content (%)*	*Sum of existing and potential acidity*			
		1-1000 tonnes disturbed		*>1000 tonnes disturbed*	
Texture range (NCST, 2009)		**% S-equiv. (oven-dried basis)**	**mol H^+/t (oven-dried basis)**	**% S-equiv. (oven-dried basis)**	**mol H^+/t (oven-dried basis)**
Fine Medium to heavy clays and silty clays	> 40	0.1	62	0.03	18
Medium Sandy loams to light clays	5 - 40	0.06	36		
Coarse Sands - loamy sands, peats	< 5	0.03	18		
Draft action criteria for poorly buffered sands					
Coarse Sands, poorly buffered	< 5	0.01	6	0.01	6

5 FIELD OBSERVATIONS AND LABORATORY RESULTS

The following section presents the results of the ASSI and should be read in conjunction with the borehole locations provided in Appendix A, data tables presented in Appendix D, complete soil profile descriptions in Appendix E and laboratory certificates of analysis presented in Appendix F.

5.1 Soil profiles

Fill soils were encountered in BH6, BH8 and BH11 which were drilled in the observed earthen access driveway (refer Appendix A, Figure 1). Fill soil comprised a mix of sand and clay of variable plasticity with silt inclusions to depths of 0.5 – 0.8 m.

With the exception of BH5 which comprised clayey sand and sand, natural soils comprised clay of variable plasticity (light to heavy) with silt and sand inclusions up to 0.95 m depth overlying sand (with some clay and silt inclusions).

Soil profiles were generally consistent with the geotechnical report (GI 2021) although deeper clay profiles were observed in some locations.

Groundwater seepage was observed on the day of works from 0.25 – 1.5 m.

5.2 Screening results

The screening results indicated the presence of PASS on the basis that:

- Most pH_{FOX} results were ≥1 unit less than pH_F results and pH_{FOX} results ≥ 2 units less than pH_F results was common.
- pH_{FOX} results < 3 were common although there did not appear to be any trends between sample depth and results.

5.3 Laboratory results

5.3.1 Fill soil

Net acidity excluding acid neutralising capacity (ANC) in analysed fill soils (applicable to BH6 0.5 – 0.75 m, BH8 0.0 – 0.25 m, BH8 0.25 – 0.5 m and BH11 0.5 – 0.75 m) ranged from 49 – 61 mol. H^+/tonne and exceeded the 18 mol. H+/tonne action criteria). Net acidity in these samples predominantly comprised titratable actual acidity (TAA) ranging from 32 – 45 mol. H^+ / tonne. Chromium reducible sulfur (potential acidity) was reported at <10 – 16 mol. H^+ / tonne.

5.3.2 Natural clay soil above the water bearing zone

Net acidity excluding ANC was detected in all analysed natural clay soil samples above the water bearing zone except for BH9 0.5 – 0.75 m. Results ranged from 26 – 138 mol H^+ / tonne and all results exceeded the action criteria.

Net acidity in these samples predominantly comprised TAA ranging from 9 – 124 mol H^+ / tonne and potential acidity ranged from <10 – 24 mol H^+ / tonne.

5.3.3 Natural sand soil below the water bearing zone

Net acidity excluding ANC was detected in all analysed natural sand soils below the water bearing zone. Results ranged from 13 – 142 mol H^+ / tonne and more than 60 % of samples exceeded the action criteria.

Net acidity in these samples predominantly comprised potential acidity ranging from <10 - 139 mol H^+ / tonne. TAA ranged from <2 – 15 mol H^+ / tonne.

6 ACID SULFATE SOIL MANAGEMENT MEASURES

6.1 Responsibility

The Principal Contractor shall be responsible for ensuring the appropriate management of acid sulfate soil (ASS) as detailed in the document.

6.2 Stripped surfaces

Aglime shall be placed at a rate ≥ 5 kg/m^2 across all surfaces following the stripping and grubbing of topsoil / clay above the water table. Additional aglime shall also be placed around the perimeter of stripped areas daily throughout the earthworks program. This shall be applied in all drainage lines, whether temporary or permanent.

6.3 Temporary ASS stockpiling and treatment areas

Stockpiling of untreated ASS should be minimised by preparing a detailed earthworks strategy that documents the timing of soil volumes to be moved, treatment locations and capacity of specified areas to accept materials.

Excavated ASS which has not been treated and verified must be contained within bunded areas constructed in accordance with relevant design standards and the cross sections presented in Appendix G. These areas will be positioned to mitigate potential runoff and/or stormwater ingress.

A guard layer of aglime shall be placed beneath and over the surface of untreated soils and surrounded by a lime enriched perimeter. The basal layer of aglime shall be at a minimum rate of 5 kg per m^2 per vertical metre of fill, with 5 kg per m^2 spread over the stockpile surface.

The recommended maximum time for which soils can be temporarily stockpiled without treatment are presented in Table 4. The total volume of material that is placed in short-term stockpiles should not exceed 20% of a day's total extraction, as immediate treatment should be implemented.

Table 4. Indicative maximum periods for short term stockpiling of untreated ASS.

Type of Material		***Sum of existing and potential acidity***
Texture range (NCST, 2009)	***Approx. clay content (%)***	
Fine Medium to heavy clays and silty clays	> 40	3 nights, e.g. a weekend (66 hours)
Medium Sandy loams to light clays	5 - 40	2 nights (42 hours)
Coarse Sands to loamy sands and peats	< 5	Overnight (18 hours)

6.4 Leachate collection and discharge

Leachate collection drains surrounding the treatment pads will be constructed within bunded areas. Leachate will be directed to a sump or holding ponds for monitoring, and treatment (if required), prior to discharge.

Alternatively, dispersal over land of leachate shall be the preferred method of disposal and shall be conducted in a manner to ensure the leachate does not enter the stormwater network, or adjacent waterways. Where this is not possible leachate must be managed in accordance with an approved Dewatering Management Plan.

Where off-site discharge via dispersal over land is required, or has the potential to occur, water quality monitoring shall be conducted prior to discharge in accordance Section 6.4.1.

6.4.1 Leachate monitoring

Where dewatering is occurring during works involving ASS, leachate generated shall be monitored in accordance with an approved DMP.

In all other cases (i.e. where leachate is generated in collection drains and stored in sumps / holding ponds) surface water quality monitoring shall be undertaken at the locations and frequencies specified in Table 5.

A suitably qualified person shall review the monitoring results. Non-compliance with the water quality objectives shall trigger corrective and preventive action to be determined by a suitably qualified expert (SQE).

Table 5. Water quality monitoring program.

Parameter	Water quality objectives	Location	Frequency
pH (units)	6.5 – 8.5 [A]	Discharge	Prior to release
Total suspended solids (mg/L)	≤50 [B]		
Dissolved aluminium and iron	-		

Table notes

A. Derived from Acid Sulfate Soils Management Guidelines (ASSMAC 1998)

B. Derived from Soils and construction (NSW Blue Book) Vol. 1 – 4th Edition, March 2004 (NSW Landcom 2004)

Corrective actions shall be implemented in consultation with a SQE to ensure potential impacts of the release on the receiving environment are mitigated.

Monitoring results shall be reviewed by a SQE prior to release and the necessary actions (e.g. water treatment) determined by the SQE. If visual and/or water quality monitoring indicates the production and migration of acidic leachate, additional treatment measures will be implemented as necessary. These measures may include:

- The application of additional neutralising agent (typically agricultural lime) to temporary and permanent stockpiles
- The application of additional neutralising agent (typically agricultural lime) to leachate collection drains and overland flow pathways
- Neutralisation treatment (typically hydrated lime) of surface water contained within the leachate collection tanks or basins.

6.5 Neutralisation treatment

6.5.1 Bulk excavated and trench excavated soils

All bulk excavated soils including topsoil will be treated using conventional neutralisation methods whereby agricultural lime is incorporated homogenously into the material either during the excavation process or on a purpose-built treatment pad/s (Refer Appendix G).

Testing will be undertaken on the treated soil not used as backfill on the day of excavation to verify that the quantity of lime added is sufficient to neutralise the soils net acidity to the standards specified in the Acid Sulfate Soils Laboratory Methods Guidelines (Ahern et al, 2004).

Verification results shall be interpreted by a SQE to assess conformance with the verification performance criteria (Table 2). Material deemed by the SQE to be non-conforming shall be re-treated at the liming rate nominated by the SQE and the verification process repeated.

Treated material may be reused within the development where fit for purpose or disposed of at a licensed landfill (Refer Section 6.7).

6.5.2 Excavations

The geotechnical investigation has not specified the depth of footings for the development as additional investigations are required following placement of compacted fill. Notwithstanding this, no ASS will be disturbed for all civil infrastructure constructed within the compacted fill.

Soils excavated as part of deeper service trenches which penetrate natural soils shall be treated by applying aglime at the nominated liming rate specified in Section 3.4.3 (according to the soil type encountered.

6.5.3 Liming rates

Based on a bulk density (BD) of 1.7 t / m^3, agricultural lime (97% pure fine $CaCO_3$) must be applied to the excavated material as per Table 6. Given the relatively high variability in net acidity between the three main soil types encountered at the site, liming rates have been calculated based on the 95%ile of net acidity results.

Where material requiring a higher liming rate cannot be separated from material with a lower liming rate then the highest liming applicable to those material types shall be used for neutralisation treatment.

Table 6. ASS treatment liming rates.

Soil type	Encountered depth	Liming rate minimum (kg / m^3)
Uncontrolled fill soils (earthen access driveway – refer Figure 1)	Up to 0.8 m below existing surface level	8.4
Natural clay	Up to 0.95 m below existing surface level	19.2
Natural sand	Generally ≥ 0.5 m below existing surface level	19.2

The calculation used to determine the liming rates was:

1) Sum of existing acidity + potential acidity (moles H+/t for oven-dried soil)
2) divided conversion factor for mol H+/t to kg $CaCO^3$/t (i.e. 19.98)
3) multiplied by lime purity factor for 97 % pure aglime (i.e. 100/97, or 1.03)
4) multiplied by default bulk density of wet soil (i.e. 1.7 t / m^3)
5) multiplied by default safety factor of (i.e. 1.5).

Note: Where soil bulk density is likely to vary from the default (1.7 t / m^3), or lime product used has a purity below 97%) lime treatment rates must be modified accordingly.

6.6 Verification of neutralisation treatment

All treated soil shall be verified at a minimum rate of 1 sample / 1,000 m^3 (as required for soils containing acidity concentrations < 142 mol H+/t), or greater where necessary in each batch of soil. Each sample shall be a composite sample made up of at least 6 sub-samples collected using a random or stratified-random approach.

Chromium suite acid base accounting will be used to verify treated material in accordance with Table A3.6 of the Laboratory Methods Guidelines (Ahern et al. 2004).

The following performance criteria must all be met for soil that has been treated:

- The neutralising capacity of the treated soil must exceed the existing plus potential acidity of the soil by at least a safety factor of 1.5
- Post-neutralisation, the soil pH (pH_{KCl}) is to be > 6.5, and preferably < 8.5
- Excess neutralising agent should stay within the treated soil until all acid generation reactions are complete and the soil has no further capacity to generate acidity.

Interpretation of verification results may consider the following:

Medium and fine textured material (sandy loams, light clays, heavy clays and silty clays):

1) No single sample shall exceed a net acidity of 62 mol H^+/t.
2) If any single sample is between 0 - 62 mol H+/t, then the average of any four spatially adjacent samples (including the exceeding sample) shall have an average net acidity of zero or less.

Coarse textured material (sands to loamy sands and peats):

1) No single sample shall exceed a net acidity of 18 mol H^+/t.
2) If any single sample is between 0 - 18 mol H+/t, then the average of any four spatially adjacent samples (including the exceeding sample) shall have an average net acidity of zero or less.

Poorly buffered sands (see Soil Management Guidelines Table 4.1 and associated commentary):

1) No single sample shall exceed a net acidity of 6 mol H+/t.
2) If any single sample is between 0 - 6 mol H+/t, then the average of any four spatially adjacent samples (including the exceeding sample) shall have an average net acidity of zero or less.

6.7 Disposal of surplus acid sulfate soil

Following treatment, material that cannot be re-used within the development site (namely uncontrolled fill and clay topsoil) shall be removed to a landfill licensed to accept ASS in accordance with the NSW Waste Classification Guidelines Part 4: Acid Sulfate Soils (Refer Appendix H).

Dry material shall be kept moist and covered during transport. Wet material shall be of at least 'spadable' consistency or carted in lined containers to minimise potential spillage. Council must be provided with the full details of the facility prior to any material being removed off-site, and other records such as tonnage receipts upon request following disposal.

6.8 Potential displacement and extrusion of ASS due to settlement of materials

The upper unconsolidated natural clay layer and loose underlying sand has the potential to displace and extrude during the bulk filling of the site, and a rise in the groundwater level in the surrounding area. The degree of soil and groundwater movement which will depend on the settlement strategy adopted.

A slow rate (i.e. many years) of compression of unconsolidated material may minimise the environmental risks associated with the oxidation of disturbed ASS. However, this may not be feasible for the site.

The Soil Management Guidelines (2014) state:

> *Dewatering soils using wick drains is a common management strategy available when sediments need to be compressed and dewatered. Vacuum settlement (also known as vacuum consolidation) methods can potentially be employed to hasten the compression process. Vacuum settlement involves sealing the surface of the soil with an impermeable membrane and then using a preinstalled drainage network to pump air and water out of the soil, rather than waiting for it to compress under load….*
>
> *Note that where these techniques are employed, extracted water must be treated to meet pH, metals (particularly iron and aluminium) and visual amenity targets prior to discharge, and care must be taken to properly isolate the soil to be dewatered from the surrounding environment.*
>
> *Note: These techniques do not necessarily provide a clearance layer of non-ASS or fully treated ASS material for future land uses.*

Wick drains enable the direct vertical rise and capture of groundwater (typically by a preload perimeter drain) reducing the likelihood of lateral displacement of groundwater and extrusion of ASS.

Where wick drains are not required (e.g. no to limited unconsolidated soils present), then a limestone filled cut-off drain of sufficient depth to neutralise horizontal sub-surface groundwater flow may need to be installed around the fill zone boundaries. Decisions on, and design of, the most appropriate management strategy will be the responsibility of the project geotechnical engineer, in consultation with the SQE.

Groundwater monitoring wells must be installed around the perimeter of the fill area and baseline groundwater conditions assess at these locations. Existing baseline groundwater information shall be incorporated for the wider site where available. There can be no decline in groundwater pH as a result of the filling activities. A groundwater neutralising agent may be required where there is an unacceptable change in pH to mitigate risks to groundwater dependant ecosystems including surfaces waters.

6.9 Dewatering and oxidation of ASS

Excavation methodologies that minimise the extent and duration of dewatering as far as practicable shall be adopted as a primary control measure. All dewatering shall be undertaken in accordance with an approved dewatering management plan.

7 MONITORING

7.1 Visual monitoring of ASS impacts

Regular visual monitoring shall be undertaken to detect:

- Unexplained scalding or degradation of vegetation
- Iron staining
- Green-blue or extremely clear water indicating high concentrations of aluminium.

Any observations of the above shall be reported to the SQE who shall inspect the site and advise appropriate corrective action/s, as required.

8 REPORTING

All incidents that have the potential to cause environmental harm shall be immediately reported to Clarence Valley Council. The Site Manager is responsible for liaising with the Principal's Representative to determine the most appropriate communication pathways for reporting such incidents in accordance with the Protection of the Environment Operations (PoEO) Act 1997 and its associated schedules.

The Principal Contractor shall maintain records of the following:

- ASS verification testing
- ASS disposal (volumes, contractor, disposal facility, waste transport certificates)
- Soil and water treatment
- Water quality monitoring
- Incidents
- Corrective and preventive actions.

The records shall be available for inspection on site during the construction phase and maintained for a minimum of 5 years.

9 REFERENCES

Ahern, C.R., McElnea, A.E., Sulivan, L.A. 2004. *Acid Sulfate Soils Laboratory Methods Guidelines*. Queensland Department of Natural Resources, Mines and Energy

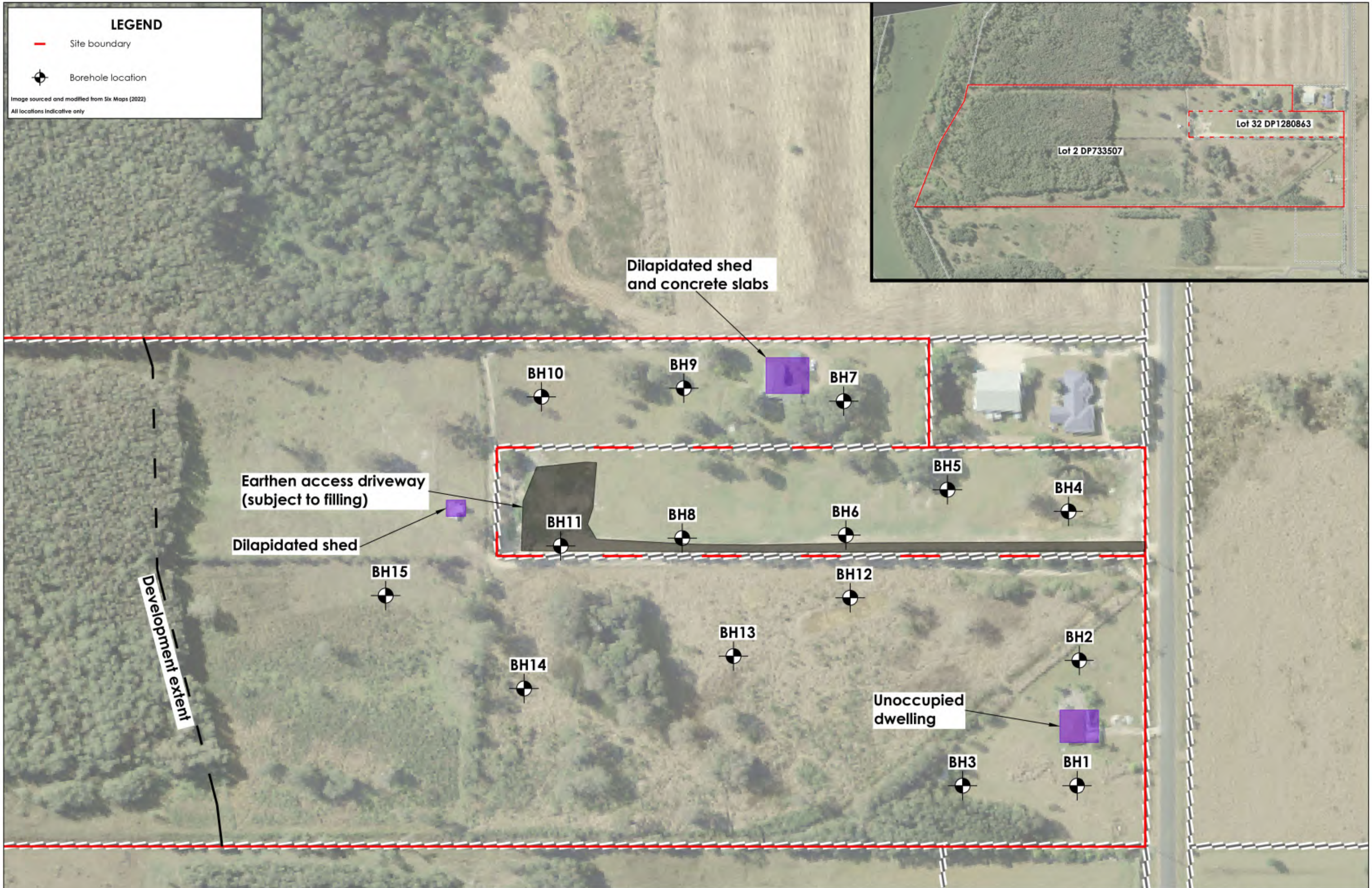
Ahern, C.R., Ahern, M.R. and Powell, B. 1998. *Guidelines for Sampling and Analysis of Lowland Acid Sulfate Soils (ASS) in Queensland 1998*. Queensland Department of Natural Resources, Resource Science Centre, Indooroopilly, Queensland, Australia. ISBN 0 7242 7442 1

Clarence Valley Local Environmental Plan 2011, July 2022, New South Wales Government

Dear, S-E., Ahern, C. R., O'Brien, L. E., Dobos, S. K., McElnea, A. E., Moore, N. G. & Watling, K. M., 2014. Queensland Acid Sulfate Soil Technical Manual: Soil Management Guidelines. Brisbane: Department of Science, Information Technology, Innovation and the Arts, Queensland Government.

GI. 2021. Preliminary Geotechnical Investigation for Proposed Manufactured Housing Estate at Carrs Drive, Yamba, NSW, Described as Lot 2 on DP733507, Geotech Investigatons Pty Ltd, 7 July 2022.

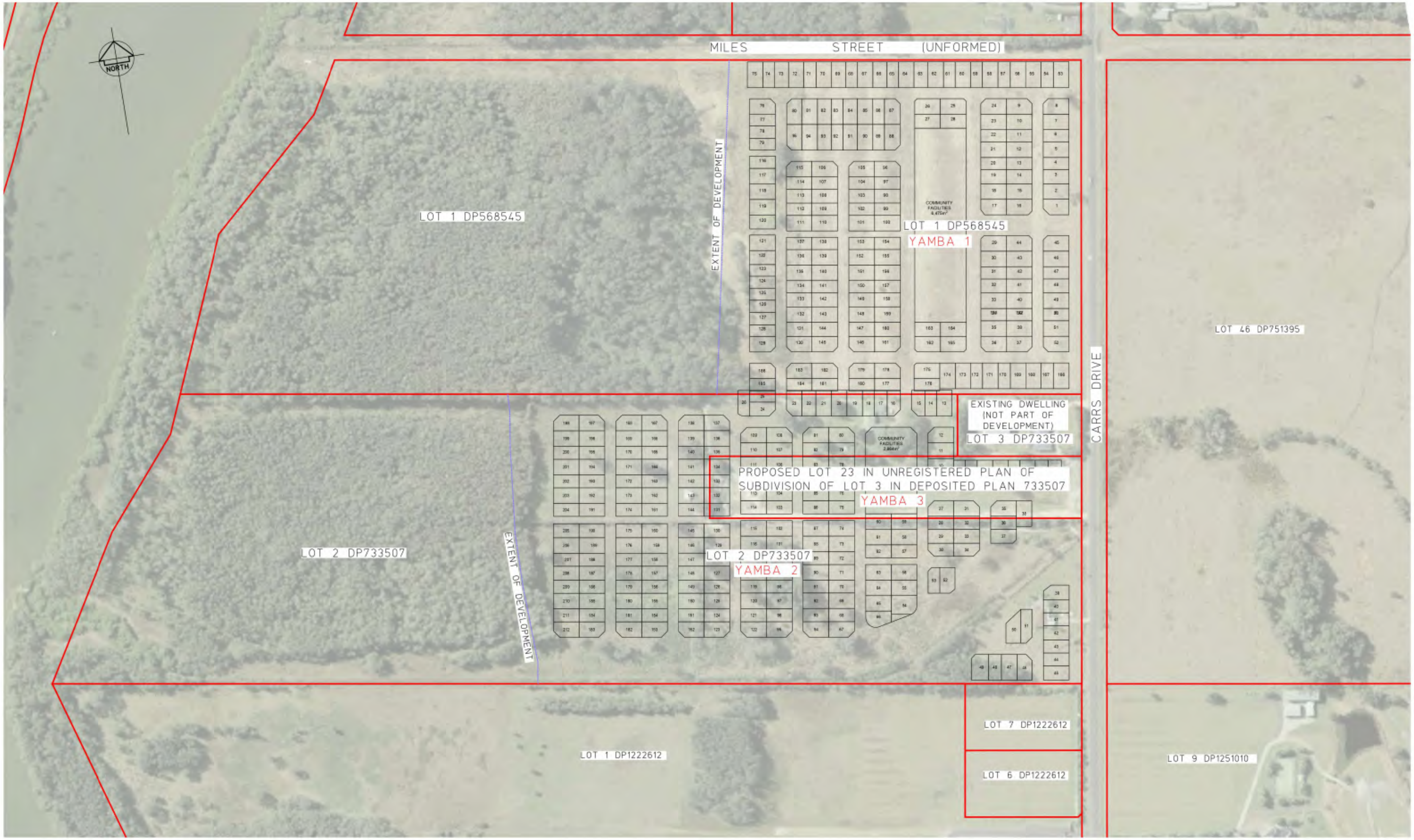
APPENDIX A – FIGURE



Client: EASTERLY POINT ENVIRONMENTAL	Site location: 110 - 120 CARRS DRIVE, YAMBA, NEW SOUTH WALES		Real property description: LOT 2 DP733507 AND LOT 32 DP1280863	Drawing number: FIGURE 1 Drawing version: A
Project: ACID SULFATE SOIL INVESTIGATION	Project number: PE3394.22	Scale: AS SHOWN	Drawn by: SG · Reviewed by: CB Date drawn: 16.08.22 · Approved: CB	Drawing title: SITE AND SAMPLING LOCATIONS

PRECISE ENVIRONMENTAL
Consulting Environmental Scientists
Unit 7 / 14 Fremantle Street, Burleigh Heads, Qld, 4220
PO Box 4424, Robina Town Centre, Qld 4230
Ph: (07) 5569 7848 Fax: (07) 5593 7020
mail@preciseenvironmental.com.au

APPENDIX B – PROPOSED SUBDIVISION LAYOUT AND PROPERTY REPORTS



30 15 0 30 60 90
Horizontal Scale 1:1500 (A1)
1:3000 (A3)

YAMBA 1:
LOT LAYOUT AS PER MASTERPLAN REV 16
TOTAL LOT YIELD 185

YAMBA 2 & 3:
LOT LAYOUT AS PER CONCEPT PLAN OPTION 3 REV 2
TOTAL LOTS YIELD 212

PLANS TO BE PRINTED IN COLOUR

PRELIMINARY FOR SITE PLANNING PURPOSES ONLY
NOT FOR CONSTRUCTION

NO ACCURACY SHOULD BE PLACED ON AERIAL IMAGE. AERIAL IMAGE IS FOR VISUAL PURPOSES ONLY

ISSUE	DESCRIPTION	DATE
3	MASTERPLAN LAYOUT OVERLAY ON AERIAL IMAGE YAMBA 1 & 2	02.12.2021
2	MASTERPLAN LAYOUT RE-ISSUED FOR CLIENT REVIEW	18.08.2021
1	MASTERPLAN LAYOUT RE-ISSUED FOR CLIENT REVIEW	23.07.2021
0	MASTERPLAN LAYOUT ISSUED FOR CLIENT REVIEW	28.06.2021

DESIGNED: T.RYDEN
DRAWN: A.SCHMID
SURVEYING:
DATE: DECEMBER 2021
SCALE: AS SHOWN
SHEET SIZE: A1

NOT FOR CONSTRUCTION

MANAGE-DESIGN-ENGINEER PTY LTD
PROJECT MANAGEMENT-CIVIL ENGINEERING-DESIGN-SURVEYING
SUITE 1, 64 BALLINA STREET, LENNOX HEAD NSW 2478
PO Box 44 LENNOX HEAD NSW 2478
www.md-engineer.com.au
ABN 88 607 189 357

CLIENT: CLIFTON YAMBA LAND PTY LTD
TITLE: PROPOSED MANUFACTURED HOUSING ESTATE
PROJECT: CARRS DRIVE
YAMBA NSW
LOT 2 DP733507

CIVIL DRAWING
DRAWING TITLE: SITE MASTERPLAN
YAMBA 1 & 2 OVER AERIAL IMAGE
DWG No: 01
SHEET: 1 OF 1
REV: 3

APPENDIX C – STANDARD OPERATING PROCEDURES

SOP.PROC.001 - SOIL SAMPLING

1 PURPOSE AND SCOPE

This is a standard procedure for the collection of soil samples for environmental assessment. This procedure must be followed to ensure that soil samples are collected in an appropriate and consistent manner, that the soil sampling is appropriate for the media and analytes, and to allow the documentation of standard operating procedures used for soil sample collection and handling.

This procedure has been written for environmental soil sampling of *in situ* and *ex situ* soils and fills for general physical and chemical tests and non-volatile, semi-volatile, and volatile analyses.

2 DEFINITIONS

CoC - chain of custody form

OH&S - occupational health and safety

PID - photo-ionisation detector

VOCs - volatile organic compounds

3 REFERENCES

Guidance considered in preparing this standard operating procedure included:

- Australian Standard AS 4482.1. 2005. Guide to sampling and investigation of potentially contaminated soil, Part 1 Non-Volatile and semi-volatile compounds
- Australian Standard AS 4482.2. 1999. Guide to sampling and investigation of potentially contaminated soil, Part 2: Volatile substances
- Contaminated Sites: Sampling Design Guidelines. NSW Environmental Protection Authority (EPA 2005)
- National Environment Protection (Assessment of Site Contamination) Measure 1999, Schedule B (1) Guideline on the Investigation Levels for Soil and Groundwater, National Environment Protection Council Service Corporation (NEPC 2013)

4 GENERAL

Sampling locations and depths should be clearly stated in a sampling analysis quality plan (SAQP) prior to commencement of fieldwork.

A health and safety plan (HSP) should be produced or Safe Work Method Statement induction completed prior to the commencement of any field work.

Soil samples should be representative of the target depth, media and environmental condition from which they are collected. Soil samples should not be influenced by the method of extraction or sampling from the soil.

Soil samples should not be retained if they have come into direct contact with machinery or sampling equipment that has not been decontaminated.

In general samples should be collected at the surface and at depth at regular intervals consistent with the lithology or contaminant transport encountered during the assessment. This may include soil profiles or horizons or areas of contamination or media.

The assessor must record all information on how the samples were taken in the geological log including refusal or exceedance of equipment reach. The geological log should clearly document the reason sampling was discontinued and a description of material if it continues to greater depths.

Surface samples should be 0 – 0.10 m or 0 – 0.15 m and samples from depth should not exceed a depth range of 0.5 m to avoid compositing effects. Some land uses may require shallower surface samples, e.g. banana lands 0.075 m, and this should be established as part of the SAQP.

As a general rule, never composite samples unless stated in the SAQP.

5 PROCEDURE

5.1 Sample collection

All personnel who will come into contact with the soil must always use clean disposable gloves for each sample. Prevention of contamination exposure to personnel and cross-contamination of samples is paramount in soil sampling.

All sampling equipment is to be decontaminated before use and between samples

5.2 Sample collection

Once collected, samples are to be transferred immediately to the appropriate sample container, ensuring that the container is filled to the top so that no head-space remains.

5.3 Hand tools

Hand tools, including spatulas, trowels, shovels, spades, etc, can be used to collect samples from the land surface, walls and floors of test pits or excavations, stockpiles, etc.

The surface to be sampled is first to be cleared of any organic material, e.g. grass and roots, and the sample collected from fresh, exposed soil. Fresh soil should be exposed prior to sampling to remove any smear affects from the sampling equipment. Soil peds or clods should be removed from the auger or trowel and split so that samples can be taken from the middle of the peds or clods. The sampler should not sample from exposed surfaces which may not be representative of contamination, especially where release of volatiles may have occurred from the exposed soil.

Test pits or excavations are not to be entered unless appropriate assessment of stability has been conducted and documented. Test pits over 1 m depth are not to be entered.

5.4 Test pits

The sampler should direct the excavator operator as to where the sample is to be collected and ensure the location is accurate. The sampler must be aware of the 'swing zone' of the machine and follow *SOP_PROC_008-Vehicle and heavy machinery operations.*

Sampling from excavator buckets is permissible, providing the procedures in *Section 5.1 – 5.3* are adhered to by the sampler, where appropriate, and the following sampling quality controls are observed by the sampler:

- The sample must be collected from within soil clods or material which has not contacted the excavator bucket
- The bucket must be screened with a PID prior to sampling where volatiles are a contaminant of concern.

5.5 Soil cores

For push tubes, split spoons, etc, samples should be transferred directly to the sampling container and procedures in *Section 5.1 – 5.3* adhered to by the sampler, where appropriate.

5.6 Augers

Samples should be collected from the auger with a trowel by cutting away the outside and collecting soil from the centre of the auger bit. Samples should then be transferred directly to the sampling container. Procedures in *Section 5.1 – 5.3* must be adhered to by the sampler, where appropriate.

5.7 Field screening for VOCs

If volatiles are a contaminant of concern and field screening using a photo-ionisation detector (PID) is required, a sample should also be transferred to a snap-lock plastic bag. Refer to SOP_PROC_011- Measurement of volatiles – PIDs for field screening procedure.

5.8 Composite sampling

Composite sampling is used to reduce analytical costs and involves the bulking and thorough mixing of soil samples (collected as above) to form one composite sample for laboratory analysis. Generally, compositing is not encouraged and should only be undertaken if specifically stated in the SAQP. Samples should be sent to the laboratory for compositing with appropriate instructions recorded on the CoC. Composite sampling must not be undertaken where volatile substances are present, including BTEXN compounds and F1 TRHs / TRHs C_6 – C_9, or soils that have a high clay content.

Composite samples must be collected from the same soil/fill horizon and no more than four sub-samples should be included in a composite sample. The sub-samples should be equal in size, from immediately adjacent sampling points, evenly spaced, and composited laterally.

6 SAMPLE CONTAINERS

Sample containers from a NATA laboratory, usually 125 mL to 250 mL clear glass jars, are to be used by the sampler. This will ensure the jars are decontaminated, clean and dry, and of the appropriate size and material. Ensure the appropriate preservative is present if required, and all jars have a gastight, non-absorptive seal, which allow no headspace. The laboratory should be contacted if numerous and/or specialty analytes are required, to confirm the required sample container type and size.

6.1 Sample labelling

Samples should be labelled clearly on the outside wall of the container with the project number, sampler's initials, sample location, depth of sample and the date. The sample location and depth should also be provided on the container lid. All labelling should be with water proof pens/markers.

The sample location number should be followed by either the sample depth or a letter, e.g. BH1 0.0 - 0.15 or TP3 A.

6.2 Sample handling, storage and dispatch

The soil jars, once filled with sample with no head space, are to be wiped clean and wrapped in bubble wrap/padding, and immediately placed in a cooler such as an Esky. Coolers should be kept out of direct sunlight, hot vehicles, etc, as far as practical, and appropriate cooling media added (ice or ice bricks) to ensure samples are kept below 4˚C. For longer term storage, samples should be kept below 4˚C in a fridge/freezer.

A chain of custody (CoC) form is to be filled out and the CoC is to be sent with the sample/s to the laboratories. The CoC/s is to be placed in a snap-lock plastic bag or plastic folder to prevent damage. All samples sent to the laboratories are to be included on the CoC/s, and if no analyses required, marked as 'Hold'.

If additional air space exists in the cooler, this should be filled with scrunched up newspaper, bubble wrap or similar to minimise movement of the samples. Coolers are to be secured with heavy tape and security seals, and clearly show the laboratory and sender contact information.

All samples, including QC samples, are to be transported to the primary and secondary laboratories. If dispatch is by courier, coolers are not to be dispatched on Fridays (or days before public holidays) unless delivery the next day has been organised.

If samples cannot be dispatched on the day of sampling with refreshed ice-blocks or ice for transport, then the samples are to be refrigerated until dispatch. The laboratory should be contacted if any delays to dispatch occur to confirm holding times available prior to extraction/analysis.

6.3 Sample location logging

A geological log is to be completed for each sample location by a qualified environmental scientist. Logs are to be completed for all sample locations, including surface samples and *ex situ* samples.

The log is to include:

- Job details, date, location, methods, climatic conditions
- Soil classification (material type and texture), colour, consistency or density, odour, staining, presence of artefacts, moisture content, sample number, and depth
- Depth of water inflow and/or groundwater level, if encountered, and comments regarding water if required; depth of excavation/drilling, excavation/drilling refusal and any field measurements taken or other relevant field observations.

7 QA DOCUMENTATION

A CoC is to be completed for all samples sent to the laboratories and/or to be analysed by the laboratories. Samples not to be analysed should be described as "Hold".

The CoC is to detail laboratory reference numbers (including quotes),site identification, the samplers initials, nature of the sample, collection time and date, analyses to be performed, sample preservation method, any relevant comments, e.g. level contamination expected, level of quality control required and dispatch information and signature.

7.1 QC samples

QC sampling should be documented in the SAQP, which should include trip spikes and trip blanks as prepared by the laboratory and should be organised through the laboratory prior to conducting the field work. Trip spikes and trip blanks should be held for as little time as possible prior to the field work, and should be kept below 4°C in a fridge/freezer. After sample collection, trip spikes and trip blanks are to be handled as a primary sample, and should also be included on the CoC.

APPENDIX D – DATA TABLES

Table A.1: Soil results

12 July 2022		Screen testing				Chromium Reducible Sulfur suite (mol H+/t)				
Borehole	Sample depth	pH_F	pH_{FOX}	Change	Reaction	pH-KCl	Titratable actual acidity	S_{Cr}	Net acidity	Net acidity not including ANC (mol H^+/t)
		Laboratory limit of reporting								
		0.1	**0.1**	**0.1**	**1**	**0.1**	**2**	**10**	**10**	**10**
BH1	0	5.9	2.9	3.0	2	5.1	31	12	43	**43**
BH1	0.25	6.1	3.1	3.0	2	-	-	-	-	-
BH1	0.5	6	4.9	1.1	1	5.8	4	<10	13	13
BH1	0.75	6.3	5.4	0.9	1	-	-	-	-	-
BH1	1	6.1	4.8	1.3	1	5.7	4	<10	13	13
BH1	1.25	5.9	4.5	1.4	1	-	-	-	-	-
BH1	1.5	6.1	1.8	4.3	4	5.4	6	123	129	**129**
BH1	1.75	6	1.8	4.2	4	-	-	-	-	-
BH1	2	6.3	1.8	4.5	4	-	-	-	-	-
BH1	2.25	6.3	2.3	4.0	4	-	-	-	-	-
BH1	2.5	7.4	2	5.4	4	5.6	4	121	125	**125**
BH1	2.75	7.7	3.7	4.0	2	-	-	-	-	-
BH2	0	6.6	3.3	3.3	3	4.9	66	<10	74	**74**
BH2	0.25	6.6	3.8	2.8	2	-	-	-	-	-
BH2	0.5	6.6	5.1	1.5	1	-	-	-	-	-
BH2	0.75	6.3	4.9	1.4	1	-	-	-	-	-
BH2	1	6.4	4.3	2.1	2	-	-	-	-	-
BH2	1.25	6.3	2.1	4.2	4	-	-	-	-	-
BH2	1.5	6.1	1.8	4.3	4	-	-	-	-	-
BH2	1.75	6.3	2.1	4.2	4	-	-	-	-	-
BH3	0	6.1	2.8	3.3	3	4.5	128	10	138	**138**
BH3	0.25	6.2	3.6	2.6	2	-	-	-	-	-
BH3	0.5	6.4	4.6	1.8	2	-	-	-	-	-
BH3	0.75	6.4	5	1.4	1	-	-	-	-	-
BH3	1	6.3	4.2	2.1	2	-	-	-	-	-
BH3	1.25	6.3	1.8	4.5	4	-	-	-	-	-
BH3	1.5	6.4	1.8	4.6	4	-	-	-	-	-
BH3	1.75	7.1	1.8	5.3	4	-	-	-	-	-
BH4	0	6.6	2.7	3.9	3	5.4	17	24	41	**41**
BH4	0.25	6.8	3.2	3.6	3	-	-	-	-	-
BH4	0.5	7.2	4.1	3.1	2	5.8	9	17	26	**26**
BH4	1	7.2	1.4	5.8	4	5.9	2	139	142	**142**
BH4	1.25	7.2	1.6	5.6	4	-	-	-	-	-
BH4	1.5	7	2	5.0	4	5.7	3	116	120	**120**
BH4	1.75	6.9	1.6	5.3	4	-	-	-	-	-
BH4	2	6.8	1.9	4.9	4	-	-	-	-	-
BH4	2.25	7.4	1.9	5.5	4	6	<2	94	94	**94**
BH5	0	6.5	4.6	1.9	3	-	-	-	-	-
BH5	0.5	6.7	5.3	1.4	1	-	-	-	-	-
BH5	0.75	6.4	5.3	1.1	1	-	-	-	-	-
BH5	1	5.6	3.3	2.3	2	-	-	-	-	-
BH5	1.25	5.1	1.8	3.3	4	-	-	-	-	-
BH5	1.5	5	2	3.0	4	-	-	-	-	-
BH5	1.75	5.4	1.8	3.6	4	-	-	-	-	-
Action criteria - disturbances > 1,000 m^3										**18**

Notes:

nd denotes laboratory limits of detection

- denotes not applicable or no criterion

Action criteria applicable to disturbances of untreated soil > 1,000 m^3 - Refer Section 4.1 of the Soil Management Guidelines (Dear et. al. 2014).

Performance criteria applicable to soil treated using neutralisation - Refer Section 8.2.1 of the Soil Management Guidelines (Dear et. al. 2014) for allowable variations in net acidity greater than laboratory limit of reporting.

BOLD denotes non-compliance with action / performance criteria.

Table A.2: Soil results

12 July 2022		Screen testing				Chromium Reducible Sulfur suite (mol H+/t)				
Borehole	**Sample depth**	pH_F	pH_{FOX}	Change	Reaction	pH-KCl	Titratable actual acidity	S_{Cr}	Net acidity	Net acidity not including ANC (mol H^+/t)
		Laboratory limit of reporting								
		0.1	**0.1**	**0.1**	**1**	**0.1**	**2**	**10**	**10**	**10**
BH6	0	5.6	2.9	2.7	3	5.3	12	14	26	**26**
BH6	0.25	5.7	2.6	3.1	3	-	-	-	-	-
BH6	0.5	5.6	2.5	3.1	3	4.7	45	16	61	**61**
BH6	0.75	5.8	3.1	2.7	3	-	-	-	-	-
BH6	1	6.1	4.1	2.0	2	5.2	15	12	27	**27**
BH6	1.25	5.7	3	2.7	2	-	-	-	-	-
BH6	1.5	6	1.9	4.1	4	5.3	10	88	97	**97**
BH6	1.75	6.2	1.8	4.4	4	-	-	-	-	-
BH6	2	6.3	2	4.3	4	-	-	-	-	-
BH6	2.25	6.3	2	4.3	4	-	-	-	-	-
BH6	2.5	6.2	2.1	4.1	4	5.4	8	100	108	**108**
BH6	2.75	5.6	1.8	3.8	4	-	-	-	-	-
BH7	0	5.4	3.5	1.9	3	4.6	106	11	117	**117**
BH7	0.25	5.8	3.8	2.0	2	-	-	-	-	-
BH7	0.5	5.4	4.7	0.7	2	-	-	-	-	-
BH7	0.75	6	4.6	1.4	2	-	-	-	-	-
BH7	1	5.5	2.1	3.4	4	-	-	-	-	-
BH7	1.25	5.6	1.7	3.9	4	-	-	-	-	-
BH7	1.5	5.9	1.8	4.1	4	-	-	-	-	-
BH7	1.75	6	1.6	4.4	4	-	-	-	-	-
BH8	0	5.7	2.4	3.3	3	4.8	40	<10	49	**49**
BH8	0.25	5.7	2.9	2.8	3	4.7	44	11	55	**55**
BH8	0.5	5.8	4.2	1.6	1	5.8	<2	12	12	12
BH8	0.75	5.6	3.6	2.0	1	-	-	-	-	-
BH8	1	5.9	2	3.9	1	-	-	-	-	-
BH8	1.25	6	2.1	3.9	4	-	-	-	-	-
BH8	1.5	5.8	2.3	3.5	4	-	-	-	-	-
BH8	1.75	5.8	2	3.8	4	-	-	-	-	-
BH9	0	5.8	2.4	3.4	3	4.6	79	18	98	**98**
BH9	0.25	5.9	2.8	3.1	3	-	-	-	-	-
BH9	0.5	6.2	3.8	2.4	1	5.8	<2	<10	<10	<10
BH9	0.75	6.3	4.2	2.1	1	-	-	-	-	-
BH9	1	6.4	2	4.4	1	5.6	3	23	26	**26**
BH9	1.25	5.6	1.9	3.7	1	-	-	-	-	-
BH9	1.5	5.1	1.8	3.3	1	5.2	7	77	84	**84**
BH9	1.75	5.2	1.7	3.5	1	-	-	-	-	-
BH10	0	5.4	2.6	2.8	3	4.8	42	14	56	**56**
BH10	0.25	5.7	3.5	2.2	2	-	-	-	-	-
BH10	0.5	5.4	3	2.4	2	-	-	-	-	-
BH10	0.75	5.7	2.5	3.2	2	-	-	-	-	-
BH10	1	5.8	2.2	3.6	4	-	-	-	-	-
BH10	1.25	5.7	2.1	3.6	4	-	-	-	-	-
BH10	1.5	5.5	2	3.5	4	-	-	-	-	-
BH10	1.75	5.6	2.3	3.3	4	-	-	-	-	-
Action criteria - disturbances > 1,000 m^3										**18**

Notes:

nd denotes laboratory limits of detection

- denotes not applicable or no criterion

Action criteria applicable to disturbances of untreated soil > 1,000 m^3 - Refer Section 4.1 of the Soil Management Guidelines (Dear et. al. 2014).

Performance criteria applicable to soil treated using neutralisation - Refer Section 8.2.1 of the Soil Management Guidelines (Dear et. al. 2014) for allowable variations in net acidity greater than laboratory limit of reporting.

BOLD denotes non-compliance with action / performance criteria.

Table A.3: Soil results

12 July 2022		Screen testing				Chromium Reducible Sulfur suite (mol H+/t)				
Borehole	**Sample depth**	**pH_F**	**pH_{FOX}**	**Change**	**Reaction**	**pH-KCl**	**Titratable actual acidity**	**S_{Cr}**	**Net acidity**	**Net acidity not including ANC (mol H^+/t)**
		Laboratory limit of reporting								
		0.1	**0.1**	**0.1**	**1**	**0.1**	**2**	**10**	**10**	**10**
BH11	0	5.8	2.7	3.1	3	6.1	4	12	16	16
BH11	0.25	5.7	2.8	2.9	3	-	-	-	-	-
BH11	0.5	5	3	2.0	3	5.1	32	<10	39	**39**
BH11	0.75	5.1	2.5	2.6	3	4.8	49	<10	57	**57**
BH11	1	5.5	2.6	2.9	3	5.5	8	<10	16	16
BH11	1.25	5.5	2.2	3.3	1	-	-	-	-	-
BH11	1.5	5.3	2.2	3.1	4	5.4	5	132	138	**138**
BH11	1.75	5.2	2.1	3.1	4	-	-	-	-	-
BH11	2	5.5	2	3.5	4	-	-	-	-	-
BH11	2.25	5.4	2	3.4	4	-	-	-	-	-
BH11	2.5	5.5	2	3.5	4	5.5	4	118	122	**122**
BH11	2.75	5.5	2.2	3.3	4	-	-	-	-	-
BH12	0	5.3	2.9	2.4	2	4.6	66	<10	74	**74**
BH12	0.25	5.6	3	2.6	2	-	-	-	-	-
BH12	0.5	5.6	4.2	1.4	1	-	-	-	-	-
BH12	0.75	5.5	3.6	1.9	1	-	-	-	-	-
BH12	1	5.9	2	3.9	4	-	-	-	-	-
BH12	1.25	5.4	2	3.4	4	-	-	-	-	-
BH12	1.5	5.4	2.1	3.3	4	-	-	-	-	-
BH12	1.75	5.2	2.1	3.1	4	-	-	-	-	-
BH13	0	5.3	2.1	3.2	3	4.6	87	<10	96	**96**
BH13	0.25	4.8	2.7	2.1	3	-	-	-	-	-
BH13	0.5	6	3	3.0	2	-	-	-	-	-
BH13	0.75	5.9	3.8	2.1	1	-	-	-	-	-
BH13	1	6	2.1	3.9	4	-	-	-	-	-
BH13	1.25	6	2.1	3.9	4	-	-	-	-	-
BH13	1.5	5.9	2	3.9	4	-	-	-	-	-
BH13	1.75	6	2.1	3.9	4	-	-	-	-	-
BH14	0	5.5	2.8	2.7	3	4.5	124	15	138	**138**
BH14	0.25	5.6	3.3	2.3	1	-	-	-	-	-
BH14	0.5	5.5	3.6	1.9	1	5.6	4	<10	13	13
BH14	0.75	5.9	3.4	2.5	1	-	-	-	-	-
BH14	1	5.9	2	3.9	4	5.3	7	67	74	**74**
BH14	1.25	6.2	2	4.2	4	-	-	-	-	-
BH14	1.5	6	2.1	3.9	4	5	11	58	69	**69**
BH14	1.75	6.1	2	4.1	4	-	-	-	-	-
BH15	0	5.7	3	2.7	3	4.6	108	13	121	**121**
BH15	0.25	5.6	3.3	2.3	3	-	-	-	-	-
BH15	0.5	6.3	3.6	2.7	1	5.8	4	<10	14	14
BH15	0.75	6.4	4.3	2.1	1	-	-	-	-	-
BH15	1	6.6	1.9	4.7	1	5.6	4	67	71	**71**
BH15	1.25	6.8	2.1	4.7	4	-	-	-	-	-
BH15	1.5	6.9	2	4.9	1	-	-	-	-	-
BH15	1.75	7	1.9	5.1	1	-	-	-	-	-
Action criteria - disturbances > 1,000 m^3										**18**

Notes:

nd denotes laboratory limits of detection

- denotes not applicable or no criterion

Action criteria applicable to disturbances of untreated soil > 1,000 m^3 - Refer Section 4.1 of the Soil Management Guidelines (Dear et. al. 2014).

Performance criteria applicable to soil treated using neutralisation - Refer Section 8.2.1 of the Soil Management Guidelines (Dear et. al. 2014) for allowable variations in net acidity greater than laboratory limit of reporting.

BOLD denotes non-compliance with action / performance criteria.

Table B.1: Fill soils chromium suite results and calculated liming rates

12 July 2022				Chromium Reducible Sulfur suite (mol H+/t)					Calculated liming rate (kg $CaCO_3$ / m^3)
Borehole	Sample depth	Predominant soil type	Wet	pH-KCl	Titratable actual acidity	S_{Cr}	Net acidity	Net acidity not including ANC (mol H^+/t)	
				Limit of reporting					
				0.1	2	10	10	10	
BH6	0.5	Clay - F	No	4.7	45	16	61	61	8.5
BH8	0	Clay - F	No	4.8	40	5	49	49	6.8
BH8	0.25	Clay - F	No	4.7	44	11	55	55	7.7
BH11	0.5	Clay - F	No	5.1	32	5	39	39	5.4
Statistics									
Minimum				4.7	32	5	39	39	5.4
Mean				4.8	40.3	9.3	51.0	51.0	7.1
Median				4.75	42	8	52	52	7.2
Maximum				5.1	45	16	61	61	8.5
95%ile				5.1	44.9	15.3	60.1	60.1	8.4
Standard deviation				0.2	5.9	5.3	9.4	9.4	

Table notes:

Half LOR applied for results less than laboratory detection limits (grey shaded cells)

Table B.2: Natural clay chromium suite results and calculated liming rates

12 July 2022				Chromium Reducible Sulfur suite (mol H+/t)					Calculated liming rate (kg $CaCO_3$ / m^3)
Borehole	Sample depth	Predominant soil type	Wet	pH-KCl	Titratable actual acidity	S_{Cr}	Net acidity	Net acidity not including ANC (mol H^+/t)	
				Limit of reporting					
				0.1	2	10	10	10	
BH1	0	Clay - N	No	5.1	31	12	43	43	6.0
BH4	0	Clay - N	No	5.4	17	24	41	41	5.7
BH7	0	Clay - N	No	4.6	106	11	117	117	16.3
BH12	0	Clay - N	No	4.6	66	5	74	74	10.3
BH13	0	Clay - N	No	4.6	87	5	96	96	13.4
BH14	0	Clay - N	No	4.5	124	15	138	138	19.2
BH15	0	Clay - N	No	4.6	108	13	121	121	16.8
BH2	0	Clay - N	No	4.9	66	5	74	74	10.3
BH3	0	Clay - N	No	4.5	128	10	138	138	19.2
BH9	0	Clay - N	No	4.6	79	18	98	98	13.6
BH10	0	Clay - N	No	4.8	42	14	56	56	7.8
BH4	0.5	Clay - N	No	5.8	9	17	26	26	3.6
BH9	0.5	Clay - N	No	5.8	1	5	5	5	0.7
BH11	0.75	Clay - N	No	4.8	49	5	57	57	7.9
Statistics									
Minimum				4.5	1	5	5	5	0.7
Mean				4.9	67.8	11.3	80.1	80.1	11.1
Median				4.6	66	11	74	74	10.3
Maximum				5.8	128	24	138	138	19.2
95%ile				5.8	125.6	20.4	138.0	138.0	19.2
Standard deviation				0.5	42.7	6.2	42.4	42.4	

Table notes:

Half LOR applied for results less than laboratory detection limits (grey shaded cells)

Table B.3: Natural sand chromium suite results and calculated liming rates

12 July 2022				Chromium Reducible Sulfur suite (mol H+/t)					Calculated liming rate (kg $CaCO_3$ / m^3)
Borehole	Sample depth	Predominant soil type	Wet	pH-KCl	Titratable actual acidity	S_{Cr}	Net acidity	Net acidity not including ANC (mol H^+/t)	
				Limit of reporting					
				0.1	2	10	10	10	
BH8	0.5	Sand - N	Yes	5.8	1	12	12	12	1.7
BH1	0.5	Sand - N	Yes	5.8	4	5	13	13	1.8
BH14	0.5	Sand - N	Yes	5.6	4	5	13	13	1.8
BH15	0.5	Sand - N	Yes	5.8	4	5	14	14	1.9
BH4	1	Sand - N	Yes	5.9	2	139	142	142	19.8
BH9	1	Sand - N	Yes	5.6	3	23	26	26	3.6
BH11	1	Sand - N	No	5.5	8	5	16	16	2.2
BH14	1	Sand - N	Yes	5.3	7	67	74	74	10.3
BH1	1	Sand - N	Yes	5.7	4	5	13	13	1.8
BH6	1	Sand - N	Yes	5.2	15	12	27	27	3.8
BH15	1	Sand - N	Yes	5.6	4	67	71	71	9.9
BH1	1.5	Sand - N	Yes	5.4	6	123	129	129	17.9
BH4	1.5	Sand - N	Yes	5.7	3	116	120	120	16.7
BH6	1.5	Sand - N	Yes	5.3	10	88	97	97	13.5
BH9	1.5	Sand - N	Yes	5.2	7	77	84	84	11.7
BH11	1.5	Sand - N	Yes	5.4	5	132	138	138	19.2
BH14	1.5	Sand - N	Yes	5	11	58	69	69	9.6
BH4	2.25	Sand - N	Yes	6	1	94	94	94	13.1
BH1	2.5	Sand - N	Yes	5.6	4	121	125	125	17.4
BH6	2.5	Sand - N	Yes	5.4	8	100	108	108	15.0
BH11	2.5	Sand - N	Yes	5.5	4	118	122	122	17.0
Statistics									
Minimum				5	1	5	13	13	1.8
Mean				5.5	5.7	68.0	74.8	74.8	10.4
Median				5.55	4	72	79	79	11.0
Maximum				6	15	139	142	142	19.8
95%ile				5.9	11.2	132.4	138.2	138.0	19.2
Standard deviation				0.3	3.4	49.8	47.9	47.9	

Table notes:
Half LOR applied for results less than laboratory detection limits (grey shaded cells)

APPENDIX E – SOIL PROFILE DESCRIPTIONS

Table A. Soil profile description and sample analysis logs

Client:	Easterly Point Environmental	**Site Address:**	120 Carrs Drive, Yamba, New South Wales
Project:	Acid Sulfate Soil Investigation and Management Plan	**RPD:**	Lot 2 DP733507 and Lot 32 DP1280863
Project Number:	PE3394.22	**Equipment Type:**	Track mounted rig solid stem augers
Commenced	12 July 2022	**Completed:**	12 July 2022
Logged by:	Chris Butler	**Checked by:**	Sean Gardiner

BOREHOLE	FILL/NATURAL	DEPTH (m)	MATERIAL CLASSIFICATION	MATERIAL CONSTITUENTS	COLOUR	OTHER MATERIALS	SEEPAGE	ODOUR	FIELD SCREEN SAMPLE DEPTH	CHROMIUM SUITE SAMPLE DEPTH	Key Results: Titratable actual acidity results (mol H⁺/t)	Key Results: S_{cr} (potential acidity)	Key Results: Net acidity not including ANC (mol H⁺/t)
BH1	Natural	0.0	Sandy Light Clay	Fine to medium grained sand, moist	Brown	Organics	Nil	Nil	0.0 - 0.25	0.0 - 0.25	31	12	43
		0.25	Sandy Light to Medium Clay	Fine to medium grainded sand, moist	Brown	Trace organics	Nil	Nil	0.25 - 0.5	-	-	-	-
		0.5	Sand	Fine to medium grained, wet	Yellow brown	Trace silt	Yes	Nil	0.5 - 0.75	0.5 - 0.75	4	<10	13
									0.75 - 1.0	-	-	-	-
									1.0 - 1.25	1.0 - 1.25	4	<10	13
		1.25	Sand	Fine to medium grained, wet	Grey	Trace silt	Nil	Nil	1.25 - 1.5	-	-	-	-
									1.5 - 1.75	1.5 - 1.75	6	123	129
									1.75 - 2.0	-	-	-	-
									2.0 - 2.25	-	-	-	-
									2.25 - 2.5	-	-	-	-
									2.5 - 2.75	2.5 - 2.75	4	121	125
									2.75 - 3.0	-	-	-	-
		3.0	Borehole terminated										
BH2	Natural	0.0	Silty Medium Clay	Moist	Dark grey	Trace fine grained sand	Nil	Nil	0.0 - 0.25	0.0 - 0.25	66	<10	74
		0.25	Sandy Light to Medium Clay	Fine to medium grained sand, moist	Grey yellow orange	-	Nil	Nil	0.25 - 0.4	-	-	-	-
		0.40	Clayey Sand	Fine to medium grained sand, moist	Grey yellow orange	-	Nil	Nil	-	-	-	-	-
		0.50	Sand	Fine to medium grained, wet	Grey	-	Yes	Nil	0.5 - 0.75	-	-	-	-
		1.25	Sand	Fine to medium grained, wet	Grey	Trace silt	Nil	Nil	1.25 - 1.5	-	-	-	-
		2.0	Borehole terminated										
BH3	Natural	0.0	Silty Medium Clay	Moist	Dark grey	Trace fine grained sand	Nil	Nil	0.0 - 0.25	0.0 - 0.25	128	10	138
		0.25	Sandy Medium Clay	Fine to medium grained sand, abundant organics, moist	Grey orange brown mottled	-	Nil	Nil	0.25 - 0.5	-	-	-	-
		0.50	Sand	Fine grained, wet	Yellow brown	-	Yes	Nil	0.5 - 0.75	-	-	-	-
									0.75 - 1.0	-	-	-	-
									1.0 - 1.2	-	-	-	-
		1.20	Sand	Fine grained, wet	Grey	-	Nil	Nil	1.25 - 1.5	-	-	-	-
									1.5 - 1.75	-	-	-	-
									1.75 - 2.0	-	-	-	-
		2.0	Borehole terminated										
BH4	Natural	0.0	Sandy Medium Clay	Fine to coarse grained sand, moist to very moist	Brown	-	Nil	Nil	0.0 - 0.25	0.0 - 0.25	17	24	41
									0.25 - 0.5	-	-	-	-
		0.5	Sandy Heavy Clay	Fine to medium grained sand, moist	Brown with orange mottles	-	Nil	Nil	0.5 - 0.75	0.5 - 0.75	9	17	26
									0.75 - 0.9	-	-	-	-
		0.9	Silty Sand	Fine to coarse grained sand, wet	Grey	-	Yes	Nil	1.0 - 1.25	1.0 - 1.25	2	139	142
									1.25 - 1.5	-	-	-	-
									1.5 - 1.75	1.5 - 1.75	3	116	120
									1.75 - 2.0	-	-	-	-
									2.0 - 2.25	-	-	-	-
									2.25 - 2.5	2.25 - 2.5	<2	94	94
		3.0	Borehole terminated										
BH5	Natural	0.0	Clayey Sand	Fine to coarse grained sand, very moist	Dark grey	-	Nil	Nil	0.0 - 0.25	-	-	-	-
		0.4	Sand	Fine to medium grained, very moist	Brown grey with orange mottles	-	Nil	Nil	0.5 - 0.75	-	-	-	-
									0.75 - 0.9	-	-	-	-
		0.9	Sand	Fine to medium grained, wet	Brown grey with orange	-	Yes	Nil	1.0 - 1.1	-	-	-	-
		1.1	Sand	Fine to medium grained, wet	Grey	-	Nil	Nil	1.25 - 1.5	-	-	-	-
									1.5 - 1.75	-	-	-	-
									1.75 - 2.0	-	-	-	-
									2.0 - 2.25	-	-	-	-
		3.0	Borehole terminated										
BH6	Fill	0.0	Clayey Sand	Fine to medium grained sand, moist	Orange grey brown	-	Nil	Nil	0.0 - 0.2	0.0 - 0.2	12	14	26
		0.2	Sandy Light Clay	Fine to medium grained sand, moist	Grey black	-	Nil	Nil	0.25 - 0.5	-	-	-	-
									0.5 - 0.75	0.5 - 0.75	45	16	61
									0.75 - 0.8	-	-	-	-
	Natural	0.8	Clayey Sand	Fine to coarse grained sand, wet	Brown grey	-	Yes	Nil	-	-	-	-	-
		1.0	Sand	Fine to coarse grained, wet	Brown grey with orange mottles	-	Nil	Nil	1.0 - 1.25	1.0 - 1.25	15	12	27
									1.25 - 1.5	-	-	-	-
		1.5	Sand	Fine to coarse grained, wet	Grey	-	Nil	Nil	1.5 - 1.75	1.5 - 1.75	10	88	97
									1.75 - 2.0	-	-	-	-
									2.0 - 2.25	-	-	-	-
									2.25 - 2.5	-	-	-	-
									2.5 - 2.75	2.5 - 2.75	8	100	107
									2.75 - 3.0	-	-	-	-
		3.0	Borehole terminated										
BH7	Natural	0.0	Sandy silty medium clay	Fine to medium grained sand, moist	Dark brown	-	Nil	Nil	0.0 - 0.25	0.0 - 0.25	106	11	117
		0.25	Clayey Sand	Fine to coarse grained sand, very moist	Yellow brown	-	Nil	Nil	0.25 - 0.4	-	-	-	-
		0.4	Sand	Fine to coarse grained, wet	Grey yellow brown	-	Yes	Nil	0.5 - 0.75	-	-	-	-
									0.75 - 1.0	-	-	-	-
									1.0 - 1.25	-	-	-	-
		1.25	Sand	Fine to coarse grained, wet	Grey	-	Nil	Nil	1.25 - 1.5	-	-	-	-
									1.5 - 1.75	-	-	-	-
									1.75 - 2.0	-	-	-	-
		2.0	Borehole terminated										
BH8	Fill	0.0	Sandy Light Clay	Fine to medium grained sand, moist	Dark grey with brown mottles	-	Nil	Nil	0.0 - 0.25	0.0 - 0.25	40	<10	49
		0.25	Silty Sandy Heavy Clay	Fine to medium grained sand, moist	Grey with orange mottles	-	Nil	Nil	0.25 - 0.5	0.25 - 0.5	44	11	55
	Natural	0.5	Sand	Fine to medium grained, wet	Grey	-	Yes	Nil	0.5 - 0.75	0.5 - 0.75	<2	12	12
									0.75 - 1.0	-	-	-	-
									1.0 - 1.25	-	-	-	-
									1.25 - 1.5	-	-	-	-
									1.5 - 1.75	-	-	-	-
									1.75 - 2.0	-	-	-	-
		2.0	Borehole terminated										

Table A. Soil profile description and sample analysis logs

Client:	Easterly Point Environmental	**Site Address:**	110 - 120 Carrs Drive, Yamba, New South Wales
Project:	Acid Sulfate Soil Investigation and Management Plan	**RPD:**	Lot 2 DP733507 and Lot 32 DP1280863
Project Number:	PE3394.22	**Equipment Type:**	Track mounted rig solid stem augers
Commenced	12 July 2022	**Completed:**	12 July 2022
Logged by:	Chris Butler	**Checked by:**	Sean Gardiner

BOREHOLE	FILL/NATURAL	DEPTH (m)	MATERIAL CLASSIFICATION	MATERIAL CONSTITUENTS	COLOUR	OTHER MATERIALS	SEEPAGE	ODOUR	FIELD SCREEN SAMPLE DEPTH	CHROMIUM SUITE SAMPLE DEPTH	Key Results: Titratable actual acidity results (mol H$^+$/t)	S_{cr} (potential acidity)	Net acidity not including ANC (mol H$^+$/t)
BH9	Natural	0.0	Sandy Light Clay	Fine to medium grained, sand, moist	Dark grey	Trace tree roots and	Nil	Nil	0.0 - 0.25	0.0 - 0.25	79	18	98
		0.25	Sandy Medium Clay	Fine to medium grained sand, moist to very moist	Grey with orange mottles	-	Nil	Nil	0.25 - 0.5	-	-	-	-
									0.5 - 0.7	0.5 - 0.7	<2	<10	<10
		0.7	Sand	Fine to medium grained, wet	Brown	-	Yes	Nil	0.75 - 1.0	-	-	-	-
		1.0	Sand	Fine to medium grained, wet	Grey	Trace of silt	Nil	Nil	1.0 - 1.25	1.0 - 1.25	3	23	26
									1.25 - 1.5	-	-	-	-
									1.5 - 1.75	1.5 - 1.75	7	77	84
									1.75 - 2.0	-	-	-	-
		2.0	Borehole terminated										
BH10	Natural	0.0	Sandy Light to Medium Clay	Fine to medium grained sand, moist	Dark grey	Trace tree roots	Nil	Nil	0.0 - 0.25	0.0 - 0.25	42	14	56
		0.25	Clayey Sand	Fine to medium grained sand, wet	Grey brown		Yes	Nil	0.25 - 0.4	-	-	-	-
		0.4	Sand	Fine to medium grained, wet	Yellow brown	-	Nil	Nil	0.5 - 0.75	-	-	-	-
									0.75 - 1.0	-	-	-	-
		0.9	Sand	Fine to medium grained, wet	Grey	-	Nil	Nil	1.0 - 1.25	-	-	-	-
									1.25 - 1.5	-	-	-	-
									1.5 - 1.75	-	-	-	-
									1.75 - 2.0	-	-	-	-
		2.0	Borehole terminated										
BH11	Fill	0.0	Sand	Fine to medium grained, moist	Grey	-	Nil	Nil	0.0 - 0.25	0.0 - 0.25	4	12	16
		0.25	Sandy Light Clay	Fine to medium grained sand, moist	Grey with dark grey mottles	-	Nil	Nil	0.25 - 0.5	-	-	-	-
									0.5 - 0.75	0.5 - 0.75	32	<10	39
	Natural	0.75	Sandy Light Clay	Fine to medium grained sand, moist	Dark grey	Trace organics	Nil	Nil	0.75 - 0.95	0.75 - 0.95	49	<10	57
		0.95	Sand	Fine to medium grained, moist	Grey	-	Nil	Nil	1.0 - 1.2	1.0 - 1.2	8	<10	16
		1.2	Sand	Fine to medium grained, moist	Light grey	-	Nil	Nil	1.25 - 1.5	-	-	-	-
		1.5	Sand	Fine to medium grained, wet	Light grey	-	Yes	Nil	1.5 - 1.75	1.5 - 1.75	5	132	138
									1.75 - 2.0	-	-	-	-
									2.0 - 2.25	-	-	-	-
									2.25 - 2.5	-	-	-	-
									2.5 - 2.75	2.5 - 2.75	4	118	122
									2.75 - 3.0	-	-	-	-
		3.0	Borehole terminated										
BH12	Natural	0.0	Silty Medium Clay	-	Brown	Moderate organics	Nil	Nil	0.0 - 0.25	0.0 - 0.25	66	<10	74
		0.25	Sand	Fine to coarse grained, wet	Brown	-	Yes	Nil	0.25 - 0.5	-	-	-	-
									0.5 - 0.75	-	-	-	-
									0.75 - 1.0	-	-	-	-
		1.0	Sand	Fine to coarse grained, wet	Grey	-	Nil	Nil	1.0 - 1.25	-	-	-	-
									1.25 - 1.5	-	-	-	-
									1.5 - 1.75	-	-	-	-
									1.75 - 2.0	-	-	-	-
		2.0	Borehole terminated										
BH13	Natural	0.0	Sandy Light Clay	Fine to medium grained sand, very moist	Dark brown	-	Nil	Nil	0.0 - 0.25	0.0 - 0.25	87	<10	96
		0.25	Sandy Light Clay	Fine to medium grained sand, very moist	Grey with orange mottles	-	Nil	Nil	0.25 - 0.5	-	-	-	-
		0.5	Sand	Fine to coarse grained, wet	Brown grey	-	Yes	Nil	0.5 - 0.75	-	-	-	-
									0.75 - 1.0	-	-	-	-
									1.0 - 1.25	-	-	-	-
									1.25 - 1.5	-	-	-	-
									1.5 - 1.75	-	-	-	-
									1.75 - 2.0	-	-	-	-
		2.0	Borehole terminated										
BH14	Natural	0.0	Sandy Light Clay	Fine to medium grained sand, very moist	Dark brown	-	Nil	Nil	0.0 - 0.2	0.0 - 0.2	124	15	138
		0.2	Sandy Light Clay	Fine to medium grained sand, very moist	Grey with orange mottles	-	Nil	Nil	0.25 - 0.5	-	-	-	-
		0.5	Sand	Fine to coarse grained, wet	Grey orange	-	Yes	Nil	0.5 - 0.75	0.5 - 0.75	4	<10	13
									0.75 - 1.0	-	-	-	-
		1.0	Sand	Fine to coarse grained, wet	Grey	-	Nil	Nil	1.0 - 1.25	1.0 - 1.25	7	67	74
									1.25 - 1.5	-	-	-	-
									1.5 - 1.75	1.5 - 1.75	11	69	69
									1.75 - 2.0	-	-	-	-
		2.0	Borehole terminated										
BH15	Natural	0.0	Sandy Light Clay	Fine to medium grained sand, very moist	Dark brown	-	Nil	Nil	0.0 - 0.25	0.0 - 0.25	108	13	121
		0.25	Sandy Light Clay	Fine to medium grained sand, very moist	Grey with orange mottles	-	Nil	Nil	0.25 - 0.5	-	-	-	-
		0.5	Sand	Fine to coarse grained, wet	Grey brown	-	Yes	Nil	0.5 - 0.75	0.5 - 0.75	4	<10	14
									0.75 - 1.0	-	-	-	-
									1.0 - 1.25	1.0 - 1.25	4	67	71
									1.25 - 1.5	-	-	-	-
		1.5	Sand	Fine to coarse grained, wet	Grey	-	Nil	Nil	1.5 - 1.75	-	-	-	-
									1.75 - 2.0	-	-	-	-
		2.0	Borehole terminated										

APPENDIX F – LABORATORY CERTIFICATES OF ANALYSIS

ALS Environmental

SAMPLE RECEIPT NOTIFICATION (SRN)

Work Order	: **EB2220520**		
Client	: **PRECISE ENVIRONMENTAL PTY LTD**	Laboratory	: Environmental Division Brisbane
Contact	: MR CHRIS BUTLER	Contact	: Nidhi Bhimani
Address	: PO BOX 4424 ROBINA TOWN CENTRE QLD, AUSTRALIA 4230	Address	: 2 Byth Street Stafford QLD Australia 4053
E-mail	: mail@preciseenvironmental.com.au	E-mail	: nidhi.bhimani@alsglobal.com
Telephone	: ----	Telephone	: +61-7-3243 7222
Facsimile	: ----	Facsimile	: +61-7-3243 7218
Project	: PE3394.22	Page	: 1 of 4
Order number	: PE3394.22	Quote number	: EB2017PREENV0003 (EN/222)
C-O-C number	: ----	QC Level	: NEPM 2013 B3 & ALS QC Standard
Site	: ----		
Sampler	: CHRIS BUTLER, SEAN GARDINER		

Dates

Date Samples Received	: 14-Jul-2022 11:35	Issue Date	: 14-Jul-2022
Client Requested Due Date	: 21-Jul-2022	Scheduled Reporting Date	: **21-Jul-2022**

Delivery Details

Mode of Delivery	: Carrier	Security Seal	: Intact.
No. of coolers/boxes	: 4	Temperature	: 3.8, 5.0, 3.4, 4.4°C - Ice present
Receipt Detail	: HARD ESKY	No. of samples received / analysed	: 68 / 68

General Comments

- This report contains the following information:
  - Sample Container(s)/Preservation Non-Compliances
  - Summary of Sample(s) and Requested Analysis
  - Proactive Holding Time Report
  - Requested Deliverables
- **Please be advised that the container for "BH10 1.75"(ALS ID#24) was received, labelled as "10". As all other "BH10" samples have been accounted for, this container will be reported as this sample. If you wish to discuss this further, please contact Client Services at ALSEnviro.Brisbane@alsglobal.com.**
- **SPLIT WORK ORDER: It should be noted that ALS has split this work order over the following work orders EB2220520 and EB2220427 due to the size of the sample numbers. For any further information regarding this processing of samples please contact ALS client services division on ALSEnviro.Brisbane@alsglobal.com**
- Discounted Package Prices apply only when specific ALS Group Codes ('W', 'S', 'NT' suites) are referenced on COCs.
- Please direct any turn around / technical queries to the laboratory contact designated above.
- Sample Disposal - Aqueous (3 weeks), Solid (2 months ± 1 week) from receipt of samples.
- Analysis will be conducted by ALS Environmental, Brisbane, NATA accreditation no. 825, Site No. 818 (Micro site no. 18958).
- **Breaches in recommended extraction / analysis holding times (if any) are displayed overleaf in the Proactive Holding Time Report table.**
- Please be aware that APHA/NEPM recommends water and soil samples be chilled to less than or equal to 6°C for chemical analysis, and less than or equal to 10°C but unfrozen for Microbiological analysis. Where samples are received above this temperature, it should be taken into consideration when interpreting results. Refer to ALS EnviroMail 85 for ALS recommendations of the best practice for chilling samples after sampling and for maintaining a cool temperature during transit.
- **Please refer to the Proactive Holding Time Report table below which summarises breaches of recommended holding times that have occurred prior to samples/instructions being received at the laboratory. The laboratory will process these samples unless instructions are received from you indicating you do not wish to proceed. The absence of this summary table indicates that all samples have been received within the recommended holding times for the analysis requested.**

Sample Container(s)/Preservation Non-Compliances

All comparisons are made against pretreatment/preservation AS, APHA, USEPA standards.

- **No sample container / preservation non-compliance exists.**

Summary of Sample(s) and Requested Analysis

Some items described below may be part of a laboratory process necessary for the execution of client requested tasks. Packages may contain additional analyses, such as the determination of moisture content and preparation tasks, that are included in the package.
If no sampling time is provided, the sampling time will default 00:00 on the date of sampling. If no sampling date is provided, the sampling date will be assumed by the laboratory and displayed in brackets without a time component

Matrix: **SOIL**

Laboratory sample ID	Sampling date / time	Sample ID	SOIL - EA033 Chromium Suite for Acid Sulphate Soils	SOIL - EA037 ASS Field Screening Analysis
EB2220520-001	12-Jul-2022 00:00	BH8 0.0		✓
EB2220520-002	12-Jul-2022 00:00	BH8 0.25		✓
EB2220520-003	12-Jul-2022 00:00	BH8 0.50		✓
EB2220520-004	12-Jul-2022 00:00	BH8 0.75		✓
EB2220520-005	12-Jul-2022 00:00	BH8 1.00		✓
EB2220520-006	12-Jul-2022 00:00	BH8 1.25		✓
EB2220520-007	12-Jul-2022 00:00	BH8 1.50		✓
EB2220520-008	12-Jul-2022 00:00	BH8 1.75		✓
EB2220520-009	12-Jul-2022 00:00	BH9 0.0		✓
EB2220520-010	12-Jul-2022 00:00	BH9 0.25		✓
EB2220520-011	12-Jul-2022 00:00	BH9 0.50		✓
EB2220520-012	12-Jul-2022 00:00	BH9 0.75		✓
EB2220520-013	12-Jul-2022 00:00	BH9 1.00		✓
EB2220520-014	12-Jul-2022 00:00	BH9 1.25		✓
EB2220520-015	12-Jul-2022 00:00	BH9 1.50		✓
EB2220520-016	12-Jul-2022 00:00	BH9 1.75		✓
EB2220520-017	12-Jul-2022 00:00	BH10 0.0		✓
EB2220520-018	12-Jul-2022 00:00	BH10 0.25		✓
EB2220520-019	12-Jul-2022 00:00	BH10 0.50		✓
EB2220520-020	12-Jul-2022 00:00	BH10 0.75		✓
EB2220520-021	12-Jul-2022 00:00	BH10 1.00		✓
EB2220520-022	12-Jul-2022 00:00	BH10 1.25		✓
EB2220520-023	12-Jul-2022 00:00	BH10 1.50		✓
EB2220520-024	12-Jul-2022 00:00	BH10 1.75		✓
EB2220520-025	12-Jul-2022 00:00	BH11 0.0	✓	✓
EB2220520-026	12-Jul-2022 00:00	BH11 0.25		✓
EB2220520-027	12-Jul-2022 00:00	BH11 0.50	✓	✓
EB2220520-028	12-Jul-2022 00:00	BH11 0.75		✓
EB2220520-029	12-Jul-2022 00:00	BH11 1.00	✓	✓
EB2220520-030	12-Jul-2022 00:00	BH11 1.25		✓
EB2220520-031	12-Jul-2022 00:00	BH11 1.50	✓	✓
EB2220520-032	12-Jul-2022 00:00	BH11 1.75		✓
EB2220520-033	12-Jul-2022 00:00	BH11 2.00		✓
EB2220520-034	12-Jul-2022 00:00	BH11 2.25		✓
EB2220520-035	12-Jul-2022 00:00	BH11 2.50	✓	✓

			SOIL - EA033 Chromium Suite for Acid Sulphate Soils	SOIL - EA037 ASS Field Screening Analysis
EB2220520-036	12-Jul-2022 00:00	BH11 2.75		✓
EB2220520-037	12-Jul-2022 00:00	BH12 0.0		✓
EB2220520-038	12-Jul-2022 00:00	BH12 0.25		✓
EB2220520-039	12-Jul-2022 00:00	BH12 0.50		✓
EB2220520-040	12-Jul-2022 00:00	BH12 0.75		✓
EB2220520-041	12-Jul-2022 00:00	BH12 1.00		✓
EB2220520-042	12-Jul-2022 00:00	BH12 1.25		✓
EB2220520-043	12-Jul-2022 00:00	BH12 1.50		✓
EB2220520-044	12-Jul-2022 00:00	BH12 1.75		✓
EB2220520-045	12-Jul-2022 00:00	BH13 0.0		✓
EB2220520-046	12-Jul-2022 00:00	BH13 0.25		✓
EB2220520-047	12-Jul-2022 00:00	BH13 0.50		✓
EB2220520-048	12-Jul-2022 00:00	BH13 0.75		✓
EB2220520-049	12-Jul-2022 00:00	BH13 1.00		✓
EB2220520-050	12-Jul-2022 00:00	BH13 1.25		✓
EB2220520-051	12-Jul-2022 00:00	BH13 1.50		✓
EB2220520-052	12-Jul-2022 00:00	BH13 1.75		✓
EB2220520-053	12-Jul-2022 00:00	BH14 0.0		✓
EB2220520-054	12-Jul-2022 00:00	BH14 0.25		✓
EB2220520-055	12-Jul-2022 00:00	BH14 0.50		✓
EB2220520-056	12-Jul-2022 00:00	BH14 0.75		✓
EB2220520-057	12-Jul-2022 00:00	BH14 1.00		✓
EB2220520-058	12-Jul-2022 00:00	BH14 1.25		✓
EB2220520-059	12-Jul-2022 00:00	BH14 1.50		✓
EB2220520-060	12-Jul-2022 00:00	BH14 1.75		✓
EB2220520-061	12-Jul-2022 00:00	BH15 0.0	✓	✓
EB2220520-062	12-Jul-2022 00:00	BH15 0.25		✓
EB2220520-063	12-Jul-2022 00:00	BH15 0.50	✓	✓
EB2220520-064	12-Jul-2022 00:00	BH15 0.75		✓
EB2220520-065	12-Jul-2022 00:00	BH15 1.00	✓	✓
EB2220520-066	12-Jul-2022 00:00	BH15 1.25		✓
EB2220520-067	12-Jul-2022 00:00	BH15 1.50		✓
EB2220520-068	12-Jul-2022 00:00	BH15 1.75		✓

Proactive Holding Time Report

Sample(s) have been received within the recommended holding times for the requested analysis.

Requested Deliverables

RESULTS & INVOICE

- *AU Certificate of Analysis - NATA (COA)	Email	mail@preciseenvironmental.com.au
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	mail@preciseenvironmental.com.au
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	mail@preciseenvironmental.com.au
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	mail@preciseenvironmental.com.au
- A4 - AU Tax Invoice (INV)	Email	mail@preciseenvironmental.com.au
- Chain of Custody (CoC) (COC)	Email	mail@preciseenvironmental.com.au
- EDI Format - XTab (XTAB)	Email	mail@preciseenvironmental.com.au

Environmental Division
Brisbane
Work Order Reference
EB2220520

Telephone : + 61-7-3243 7222

CHAIN OF CUSTODY CHAIN OF CUSTODY

ALS Laboratory: please tick → *ALS Laboratory: please tick →*

☐ Sydney: 277 Woodpark Rd, Smithfield NSW 2176 Ph: 02 8784 8555 E:samples.sydney@alsenviro.com
☐ Newcastle: 5 Rosegum Rd, Warabrook NSW 2304 Ph:02 4968 9433 E:samples.newcastle@alsenviro.com
☐ Brisbane: 32 Shand St, Stafford QLD 4053 Ph 07 3243 7222 E:samples.brisbane@alsenviro.com
☐ Townsville: 14-15 Desma Ct, Bohle QLD 4818 Ph 07 4796 0600 E: townsville.environmental@alsenviro.com
☐ Melbourne: 2-4 Westall Rd, Springvale VIC 3171 Ph:03 8549 9600 E: samples.melbourne@alsenviro.com
☐ Adelaide: 2-1 Burma Rd, Pooraka SA 5095 Ph: 08 8359 0890 E adelaide@alsenviro.com
☐ Perth: 10 Hod W Ph: 08 9209 7655 E
☐ Launceston: 27 Ph: 03 6331 2158 E

CLIENT:	PRECISE ENVIRONMENTAL	TURNAROUND REQUIREMENTS : (Standard TAT may be longer for some tests e.g.. Ultra Trace Organics)	☐ Standard TAT (List due date): ☐ Non Standard or urgent TAT (List due date):
OFFICE:	7/14 FREMANTLE ST, BURLEIGH HEADS 4220		
PROJECT:	PE3394.22	ALS QUOTE NO.:	BN031/16 v4
ORDER NUMBER:	PE3394.22	COC SEQUENCE NUMBER (Circle)	COC: 1 2 3 4 5 6 7 / OF: 1 2 3 4 5 6 7
PROJECT MANAGER:	CHRIS BUTLER	CONTACT: 0431 565 210	
SAMPLER:	CHRIS BUTLER / SEAN GARDINER	SAMPLER MOBILE: 0409 827 396	
COC emailed to ALS? (YES / NO)		EDD FORMAT (or default):	
Email Reports to: mail@preciseenvironmental.com.au			
Mail Invoice to: PO Box 4424, Robina Town Centre 4230			

RELINQUISHED BY:	RECEIVED BY:	RELINQUISHED
CHRIS BUTLER		
DATE/TIME: 13.07.22 9AM	DATE/TIME:	DATE/TIME:

C Butler

FOR LABO... Custody Seal... Free ice/froz... receipt? Random San... Other comme...

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

ALS USE ONLY	SAMPLE DETAILS	Water(W)		MATRIX: Solid(S)	CONTAINER INFORMATION		ANALYSIS REQUIRED including SUITES (NB. Suite Codes must be listed to attract suite price) Where Metals are required, specify Total (unfiltered bottle required) or Dissolved (field filtered bottle required).								Additional Information
LAB ID	SAMPLE ID	SAMPLE DESCRIPTION	DATE / TIME	MATRIX	TYPE & PRESERVATIVE (refer to codes below)	TOTAL BOTTLES	EA037 (pHF and pHFOX)	EA033 (Chromium suite)							Comments on likely contaminant levels, dilutions, or samples requiring specific QC analysis etc.
1	BH8	0.0	12.07.22	S	BAG/<4°C	1	X								
2	BH8	0.25	12.07.22	S	BAG/<4°C	1	X								
3	BH8	0.50	12.07.22	S	BAG/<4°C	1	X								
4	BH8	0.75	12.07.22	S	BAG/<4°C	1	X								
5	BH8	1.00	12.07.22	S	BAG/<4°C	1	X								
6	BH8	1.25	12.07.22	S	BAG/<4°C	1	X								
7	BH8	1.50	12.07.22	S	BAG/<4°C	1	X								
8	BH8	1.75	12.07.22	S	BAG/<4°C	1	X								
					TOTAL	8									

SPLIT BATCH
Test .... Assoc. Batch No.
EB2220427

Water Container Codes: P = Unpreserved Plastic; N = Nitric Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide/Cd Preserved; S = Sodium Hydroxide Preserved Plastic; AG = Amber Glass Unpreserved; AP - Airfreight Unpreserved Plastic
V = VOA Vial HCl Preserved; VB = VOA Vial Sodium Bisulphate Preserved; VS = VOA Vial Sulfuric Preserved; AV = Airfreight Unpreserved Vial SG = Sulfuric Preserved Amber Glass; H = HCl preserved Plastic; HS = HCl preserved Speciation bottle; SP = Sulfuric Preserved Plastic; F = Formaldehyde Preserved Glass;
Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; ASS = Plastic Bag for Acid Sulphate Soils; B = Unpreserved Bag.

CHAIN OF CUSTODY CHAIN OF CUSTODY

ALS Laboratory: please tick → *ALS Laboratory: please tick →*

☐ **Sydney:** 277 Woodpark Rd, Smithfield NSW 2176 Ph: 02 8784 8555 E: samples.sydney@alsenviro.com
☐ **Newcastle:** 5 Rosegum Rd, Warabrook NSW 2304 Ph: 02 4968 9433 E: samples.newcastle@alsenviro.com
☐ **Brisbane:** 32 Shand St, Stafford QLD 4053 Ph: 07 3243 7222 E: samples.brisbane@alsenviro.com
☐ **Townsville:** 14-15 Desma Ct, Bohle QLD 4818 Ph: 07 4796 0600 E: townsville.environmental@alsenviro.com
☐ **Melbourne:** 2-4 Westall Rd, Springvale VIC 3171 Ph: 03 8549 9600 E: samples.melbourne@alsenviro.com
☐ **Adelaide:** 2-1 Burma Rd, Pooraka SA 5095 Ph: 08 8359 0890 E: adelaide@alsenviro.com
☐ **Perth:** 10 Hod Way, Malaga WA 6090 Ph: 08 9209 7655 E: samples.perth@alsenviro.com
☐ **Launceston:** 27 Wellington St, Launceston TAS 7250 Ph: 03 6331 2158 E: launceston@alsenviro.com

CLIENT:	PRECISE ENVIRONMENTAL	TURNAROUND REQUIREMENTS : (Standard TAT may be longer for some tests e.g. Ultra Trace Organics)	☐ Standard TAT (List due date): ☐ Non Standard or urgent TAT (List due date):
OFFICE:	7/14 FREMANTLE ST, BURLEIGH HEADS 4220		
PROJECT:	PE3394.22	ALS QUOTE NO.:	BN031/16 v4
ORDER NUMBER:	PE3394.22	COC SEQUENCE NUMBER (Circle)	COC: 1 2 3 4 5 6 7
PROJECT MANAGER:	CHRIS BUTLER	CONTACT: 0431 565 210	OF: 1 2 3 4 5 6 7
SAMPLER:	CHRIS BUTLER / SEAN GARDINER	SAMPLER MOBILE: 0409 827 396	
COC emailed to ALS? (YES / NO)		EDD FORMAT (or default):	
Email Reports to: mail@preciseenvironmental.com.au			
Mail Invoice to: PO Box 4424, Robina Town Centre 4230			

FOR LABORATORY USE ONLY (Circle)			
Custody Seal Intact?	Yes	No	N/A
Free ice / frozen ice bricks present upon receipt?	Yes	No	N/A
Random Sample Temperature on Receipt:	°C		
Other comment:			

RELINQUISHED BY:	RECEIVED BY:	RELINQUISHED BY:	RECEIVED BY:
CHRIS BUTLER			
DATE/TIME: C Butler	DATE/TIME:	DATE/TIME:	DATE/TIME:
13.07.22 9AM			

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

ALS USE ONLY	SAMPLE DETAILS	Water(W)	MATRIX: Solid(S)		CONTAINER INFORMATION		ANALYSIS REQUIRED including SUITES (NB. Suite Codes must be listed to attract suite price) Where Metals are required, specify Total (unfiltered bottle required) or Dissolved (field filtered bottle required).								Additional Information
LAB ID	SAMPLE ID	SAMPLE DESCRIPTION	DATE / TIME	MATRIX	TYPE & PRESERVATIVE (refer to codes below)	TOTAL BOTTLES	EA037 (pHF and pHFOX)	EA033 (Chromium suite)							Comments on likely contaminant levels, dilutions, or samples requiring specific QC analysis etc.
9	BH9	0.0	12.07.22	S	BAG/<4°C	1	X								
10	BH9	0.25	12.07.22	S	BAG/<4°C	1	X								
11	BH9	0.50	12.07.22	S	BAG/<4°C	1	X								
12	BH9	0.75	12.07.22	S	BAG/<4°C	1	X								
13	BH9	1.00	12.07.22	S	BAG/<4°C	1	X								
14	BH9	1.25	12.07.22	S	BAG/<4°C	1	X								
15	BH9	1.50	12.07.22	S	BAG/<4°C	1	X								
16	BH9	1.75	12.07.22	S	BAG/<4°C	1	X								
					TOTAL	8									

Water Container Codes: P = Unpreserved Plastic; N = Nitric Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide/Cd Preserved; S = Sodium Hydroxide Preserved Plastic; AG = Amber Glass Unpreserved; AP - Airfreight Unpreserved Plastic
V = VOA Vial HCl Preserved; VB = VOA Vial Sodium Bisulphate Preserved; VS = VOA Vial Sulfuric Preserved; AV = Airfreight Unpreserved Vial SG = Sulfuric Preserved Amber Glass; H = HCl preserved Plastic; HS = HCl preserved Speciation bottle; SP = Sulfuric Preserved Plastic; F = Formaldehyde Preserved Glass;
Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; ASS = Plastic Bag for Acid Sulphate Soils; B = Unpreserved Bag.

CHAIN OF CUSTODY CHAIN OF CUSTODY

ALS Laboratory: please tick → ALS Laboratory: please tick →

☐ Sydney: 277 Woodpark Rd, Smithfield NSW 2176 Ph: 02 8784 8555 E: samples.sydney@alsenviro.com
☐ Newcastle: 5 Rosegum Rd, Warabrook NSW 2304 Ph: 02 4968 9433 E: samples.newcastle@alsenviro.com
☐ Brisbane: 32 Shand St, Stafford QLD 4053 Ph: 07 3243 7222 E: samples.brisbane@alsenviro.com
☐ Townsville: 14-15 Desma Ct, Bohle QLD 4818 Ph: 07 4796 0600 E: townsville.environmental@alsenviro.com
☐ Melbourne: 2-4 Westall Rd, Springvale VIC 3171 Ph: 03 8549 9600 E: samples.melbourne@alsenviro.com
☐ Adelaide: 2-1 Burma Rd, Pooraka SA 5095 Ph: 08 8359 0890 E: adelaide@alsenviro.com
☐ Perth: 10 Hod Way, Malaga WA 6090 Ph: 08 9209 7655 E: samples.perth@alsenviro.com
☐ Launceston: 27 Wellington St, Launceston TAS 7250 Ph: 03 6331 2158 E: launceston@alsenviro.com

CLIENT:	PRECISE ENVIRONMENTAL	TURNAROUND REQUIREMENTS : (Standard TAT may be longer for some tests e.g., Ultra Trace Organics)	☐ Standard TAT (List due date): ☐ Non Standard or urgent TAT (List due date):
OFFICE:	7/14 FREMANTLE ST, BURLEIGH HEADS 4220		
PROJECT:	PE3394.22	ALS QUOTE NO.:	BN031/16 v4
ORDER NUMBER:	PE3394.22		
PROJECT MANAGER:	CHRIS BUTLER	CONTACT: 0431 565 210	
SAMPLER:	CHRIS BUTLER / SEAN GARDINER	SAMPLER MOBILE: 0409 827 396	
COC emailed to ALS? (YES / NO)		EDD FORMAT (or default):	
Email Reports to: mail@preciseenvironmental.com.au			
Mail Invoice to: PO Box 4424, Robina Town Centre 4230			

COC SEQUENCE NUMBER (Circle)
COC: 1 2 3 4 5 6 7
OF: 1 2 3 4 5 6 7

FOR LABORATORY USE ONLY (Circle)
Custody Seal Intact? Yes No N/A
Free ice / frozen ice bricks present upon receipt? Yes No N/A
Random Sample Temperature on Receipt: °C
Other comment:

RELINQUISHED BY:	RECEIVED BY:	RELINQUISHED BY:	RECEIVED BY:
CHRIS BUTLER			
DATE/TIME: C. Butler 13.07.22 9AM	DATE/TIME:	DATE/TIME:	DATE/TIME:

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

ALS USE ONLY | SAMPLE DETAILS MATRIX: Solid(S) Water(W) | CONTAINER INFORMATION | ANALYSIS REQUIRED including SUITES (NB. Suite Codes must be listed to attract suite price) Where Metals are required, specify Total (unfiltered bottle required) or Dissolved (field filtered bottle required). | Additional Information

LAB ID	SAMPLE ID	SAMPLE DESCRIPTION	DATE / TIME	MATRIX	TYPE & PRESERVATIVE (refer to codes below)	TOTAL BOTTLES	EA037 (pHF and pHFOX)	EA033 (Chromium suite)							Comments on likely contaminant levels, dilutions, or samples requiring specific QC analysis etc.
17	BH10	0.0	12.07.22	S	BAG/<4°C	1	X								
18	BH10	0.25	12.07.22	S	BAG/<4°C	1	X								
19	BH10	0.50	12.07.22	S	BAG/<4°C	1	X								
20	BH10	0.75	12.07.22	S	BAG/<4°C	1	X								
21	BH10	1.00	12.07.22	S	BAG/<4°C	1	X								
22	BH10	1.25	12.07.22	S	BAG/<4°C	1	X								
23	BH10	1.50	12.07.22	S	BAG/<4°C	1	X								
24	BH10	1.75	12.07.22	S	BAG/<4°C	1	X								
					TOTAL	8									

Water Container Codes: P = Unpreserved Plastic; N = Nitric Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide/Cd Preserved; S = Sodium Hydroxide Preserved Plastic; AG = Amber Glass Unpreserved; AP - Airfreight Unpreserved Plastic
V = VOA Vial HCl Preserved; VB = VOA Vial Sodium Bisulphate Preserved; VS = VOA Vial Sulfuric Preserved; AV = Airfreight Unpreserved Vial SG = Sulfuric Preserved Amber Glass; H = HCl preserved Plastic; HS = HCl preserved Speciation bottle; SP = Sulfuric Preserved Plastic; F = Formaldehyde Preserved Glass;
Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; ASS = Plastic Bag for Acid Sulphate Soils; B = Unpreserved Bag.

CHAIN OF CUSTODY CHAIN OF CUSTODY

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☐ Perth: 10 Hod Way, Malaga WA 6090 Ph: 08 9209 7655 E: samples.perth@alsenviro.com
☐ Launceston: 27 Wellington St, Launceston TAS 7250 Ph: 03 6331 2158 E: launceston@alsenviro.com

CLIENT:	PRECISE ENVIRONMENTAL	TURNAROUND REQUIREMENTS : (Standard TAT may be longer for some tests e.g. Ultra Trace Organics)	☐ Standard TAT (List due date): ☐ Non Standard or urgent TAT (List due date):	FOR LABORATORY USE ONLY (Circle)
OFFICE:	7/14 FREMANTLE ST, BURLEIGH HEADS 4220			Custody Seal Intact? Yes No N/A
PROJECT:	PE3394.22	ALS QUOTE NO.:	BN031/16 v4	Free ice / frozen ice bricks present upon receipt? Yes No N/A
ORDER NUMBER:	PE3394.22		COC SEQUENCE NUMBER (Circle) COC: 1 2 3 4 5 6 7	Random Sample Temperature on Receipt: °C
PROJECT MANAGER:	CHRIS BUTLER	CONTACT: 0431 565 210	OF: 1 2 3 4 5 6 7	Other comment:

SAMPLER: CHRIS BUTLER / SEAN GARDINER	SAMPLER MOBILE: 0409 827 396	RELINQUISHED BY: CHRIS BUTLER	RECEIVED BY:	RELINQUISHED BY:	RECEIVED BY:
COC emailed to ALS? (YES / NO)	EDD FORMAT (or default):	DATE/TIME: 13.07.22 9AM (signature: C. Butler)	DATE/TIME:	DATE/TIME:	DATE/TIME:
Email Reports to: mail@preciseenvironmental.com.au					
Mail Invoice to: PO Box 4424, Robina Town Centre 4230					

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

ALS USE ONLY	SAMPLE DETAILS	Water(W)	MATRIX: Solid(S)		CONTAINER INFORMATION		ANALYSIS REQUIRED including SUITES (NB. Suite Codes must be listed to attract suite price) Where Metals are required, specify Total (unfiltered bottle required) or Dissolved (field filtered bottle required).								Additional Information
LAB ID	SAMPLE ID	SAMPLE DESCRIPTION	DATE / TIME	MATRIX	TYPE & PRESERVATIVE (refer to codes below)	TOTAL BOTTLES	EA037 (pHF and pHFOX)	EA033 (Chromium suite)							Comments on likely contaminant levels, dilutions, or samples requiring specific QC analysis etc.
25	BH11	0.0	12.07.22	S	BAG/<4°C	1	X	X							
26	BH11	0.25	12.07.22	S	BAG/<4°C	1	X								
27	BH11	0.50	12.07.22	S	BAG/<4°C	1	X	X							
28	BH11	0.75	12.07.22	S	BAG/<4°C	1	X								
29	BH11	1.00	12.07.22	S	BAG/<4°C	1	X	X							
30	BH11	1.25	12.07.22	S	BAG/<4°C	1	X								
31	BH11	1.50	12.07.22	S	BAG/<4°C	1	X	X							
32	BH11	1.75	12.07.22	S	BAG/<4°C	1	X								
33	BH11	2.00	12.07.22	S	BAG/<4°C	1	X								
34	BH11	2.25	12.07.22	S	BAG/<4°C	1	X								
35	BH11	2.50	12.07.22	S	BAG/<4°C	1	X	X							
36	BH11	2.75	12.07.22	S	BAG/<4°C	1	X								
					TOTAL	12									

Water Container Codes: P = Unpreserved Plastic; N = Nitric Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide/Cd Preserved; S = Sodium Hydroxide Preserved Plastic; AG = Amber Glass Unpreserved; AP - Airfreight Unpreserved Plastic
V = VOA Vial HCl Preserved; VB = VOA Vial Sodium Bisulphate Preserved; VS = VOA Vial Sulfuric Preserved; AV = Airfreight Unpreserved Vial SG = Sulfuric Preserved Amber Glass; H = HCl preserved Plastic; HS = HCl preserved Speciation bottle; SP = Sulfuric Preserved Plastic; F = Formaldehyde Preserved Glass;
Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; ASS = Plastic Bag for Acid Sulphate Soils; B = Unpreserved Bag.

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☐ Brisbane: 32 Shand St, Stafford QLD 4053 Ph:07 3243 7222 E:samples.brisbane@alsenviro.com
☐ Townsville: 14-15 Desma Ct, Bohle QLD 4818 Ph:07 4796 0600 E: townsville.environmental@alsenviro.com
☐ Melbourne: 2-4 Westall Rd, Springvale VIC 3171 Ph 03 8549 9600 E: samples.melbourne@alsenviro.com
☐ Adelaide: 2-1 Burma Rd, Pooraka SA 5095 Ph: 08 8359 0890 E adelaide@alsenviro.com
☐ Perth: 10 Hod Way, Malaga WA 6090 Ph: 08 9209 7655 E: samples.perth@alsenviro.com
☐ Launceston: 27 Wellington St, Launceston TAS 7250 Ph: 03 6331 2158 E: launceston@alsenviro.com

CLIENT:	PRECISE ENVIRONMENTAL	TURNAROUND REQUIREMENTS : (Standard TAT may be longer for some tests e.g., Ultra Trace Organics)	☐ Standard TAT (List due date): ☐ Non Standard or urgent TAT (List due date):
OFFICE:	7/14 FREMANTLE ST, BURLEIGH HEADS 4220	ALS QUOTE NO.:	BN031/16 v4
PROJECT:	PE3394.22	COC SEQUENCE NUMBER (Circle)	COC: 1 2 3 4 5 6 7 / OF: 1 2 3 4 5 6 7
ORDER NUMBER:	PE3394.22		
PROJECT MANAGER:	CHRIS BUTLER	CONTACT: 0431 565 210	
SAMPLER:	CHRIS BUTLER / SEAN GARDINER	SAMPLER MOBILE: 0409 827 396	
COC emailed to ALS? (YES / NO)		EDD FORMAT (or default):	
Email Reports to: mail@preciseenvironmental.com.au			
Mail Invoice to: PO Box 4424, Robina Town Centre 4230			

FOR LABORATORY USE ONLY (Circle)
Custody Seal Intact? Yes No N/A
Free ice / frozen ice bricks present upon receipt? Yes No N/A
Random Sample Temperature on Receipt: °C
Other comment:

RELINQUISHED BY:	RECEIVED BY:	RELINQUISHED BY:	RECEIVED BY:
CHRIS BUTLER			
DATE/TIME: 13.07.22 9AM	DATE/TIME:	DATE/TIME:	DATE/TIME:

C Butler

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

ANALYSIS REQUIRED including SUITES (NB. Suite Codes must be listed to attract suite price) Where Metals are required, specify Total (unfiltered bottle required) or Dissolved (field filtered bottle required).

ALS USE ONLY: LAB ID	SAMPLE DETAILS MATRIX: Solid(S) Water(W): SAMPLE ID	SAMPLE DESCRIPTION	DATE / TIME	MATRIX	CONTAINER INFORMATION: TYPE & PRESERVATIVE (refer to codes below)	TOTAL BOTTLES	EA037 (pHF and pHFOX)	EA033 (Chromium suite)							Additional Information: Comments on likely contaminant levels, dilutions, or samples requiring specific QC analysis etc.
37	BH12	0.0	12.07.22	S	BAG/<4°C	1	X								
38	BH12	0.25	12.07.22	S	BAG/<4°C	1	X								
39	BH12	0.50	12.07.22	S	BAG/<4°C	1	X								
40	BH12	0.75	12.07.22	S	BAG/<4°C	1	X								
41	BH12	1.00	12.07.22	S	BAG/<4°C	1	X								
42	BH12	1.25	12.07.22	S	BAG/<4°C	1	X								
43	BH12	1.50	12.07.22	S	BAG/<4°C	1	X								
44	BH12	1.75	12.07.22	S	BAG/<4°C	1	X								
					TOTAL	8									

Water Container Codes: P = Unpreserved Plastic; N = Nitric Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide/Cd Preserved; S = Sodium Hydroxide Preserved Plastic; AG = Amber Glass Unpreserved; AP - Airfreight Unpreserved Plastic
V = VOA Vial HCl Preserved; VB = VOA Vial Sodium Bisulphate Preserved; VS = VOA Vial Sulfuric Preserved; AV = Airfreight Unpreserved Vial SG = Sulfuric Preserved Amber Glass; H = HCl preserved Plastic; HS = HCl preserved Speciation bottle; SP = Sulfuric Preserved Plastic; F = Formaldehyde Preserved Glass;
Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; ASS = Plastic Bag for Acid Sulphate Soils; B = Unpreserved Bag

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☐ Launceston: 27 Wellington St, Launceston TAS 7250 Ph: 03 6331 2158 E: launceston@alsenviro.com

CLIENT:	PRECISE ENVIRONMENTAL	TURNAROUND REQUIREMENTS : (Standard TAT may be longer for some tests e.g., Ultra Trace Organics)	☐ Standard TAT (List due date): ☐ Non Standard or urgent TAT (List due date):
OFFICE:	7/14 FREMANTLE ST, BURLEIGH HEADS 4220		
PROJECT:	PE3394.22	ALS QUOTE NO.:	BN031/16 v4
ORDER NUMBER:	PE3394.22	COC SEQUENCE NUMBER (Circle)	COC: 1 2 3 4 5 6 7 / OF: 1 2 3 4 5 6 7
PROJECT MANAGER:	CHRIS BUTLER	CONTACT: 0431 565 210	
SAMPLER:	CHRIS BUTLER / SEAN GARDINER	SAMPLER MOBILE: 0409 827 396	
COC emailed to ALS? (YES / NO)		EDD FORMAT (or default):	
Email Reports to: mail@preciseenvironmental.com.au			
Mail Invoice to: PO Box 4424, Robina Town Centre 4230			

FOR LABORATORY USE ONLY (Circle)
Custody Seal Intact? Yes No N/A
Free ice / frozen ice bricks present upon receipt? Yes No N/A
Random Sample Temperature on Receipt: °C
Other comment:

RELINQUISHED BY:	RECEIVED BY:	RELINQUISHED BY:	RECEIVED BY:
CHRIS BUTLER			
DATE/TIME: 13.07.22 9AM (signed) C. Butler	DATE/TIME:	DATE/TIME:	DATE/TIME:

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

ALS USE ONLY	SAMPLE DETAILS	Water(W)		MATRIX: Solid(S)	CONTAINER INFORMATION		ANALYSIS REQUIRED including SUITES (NB. Suite Codes must be listed to attract suite price) Where Metals are required, specify Total (unfiltered bottle required) or Dissolved (field filtered bottle required).								Additional Information
LAB ID	SAMPLE ID	SAMPLE DESCRIPTION	DATE / TIME	MATRIX	TYPE & PRESERVATIVE (refer to codes below)	TOTAL BOTTLES	EA037 (pHF and pHFOX)	EA033 (Chromium suite)							Comments on likely contaminant levels, dilutions, or samples requiring specific QC analysis etc.
45	BH13	0.0	12.07.22	S	BAG/<4°C	1	X								
46	BH13	0.25	12.07.22	S	BAG/<4°C	1	X								
47	BH13	0.50	12.07.22	S	BAG/<4°C	1	X								
48	BH13	0.75	12.07.22	S	BAG/<4°C	1	X								
49	BH13	1.00	12.07.22	S	BAG/<4°C	1	X								
50	BH13	1.25	12.07.22	S	BAG/<4°C	1	X								
51	BH13	1.50	12.07.22	S	BAG/<4°C	1	X								
52	BH13	1.75	12.07.22	S	BAG/<4°C	1	X								
					TOTAL	8									

Water Container Codes: P = Unpreserved Plastic; N = Nitric Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide/Cd Preserved; S = Sodium Hydroxide Preserved Plastic; AG = Amber Glass Unpreserved; AP - Airfreight Unpreserved Plastic
V = VOA Vial HCl Preserved; VB = VOA Vial Sodium Bisulphate Preserved; VS = VOA Vial Sulfuric Preserved; AV = Airfreight Unpreserved Vial SG = Sulfuric Preserved Amber Glass; H = HCl preserved Plastic; HS = HCl preserved Speciation bottle; SP = Sulfuric Preserved Plastic; F = Formaldehyde Preserved Glass;
Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; ASS = Plastic Bag for Acid Sulphate Soils; B = Unpreserved Bag.

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CLIENT:	PRECISE ENVIRONMENTAL	TURNAROUND REQUIREMENTS : (Standard TAT may be longer for some tests e.g. Ultra Trace Organics)	☐ Standard TAT (List due date): ☐ Non Standard or urgent TAT (List due date):
OFFICE:	7/14 FREMANTLE ST, BURLEIGH HEADS 4220		
PROJECT:	PE3394.22	ALS QUOTE NO.:	BN031/16 v4
ORDER NUMBER:	PE3394.22	COC SEQUENCE NUMBER (Circle)	COC: 1 2 3 4 5 6 7 / OF: 1 2 3 4 5 6 7
PROJECT MANAGER:	CHRIS BUTLER	CONTACT: 0431 565 210	
SAMPLER:	CHRIS BUTLER / SEAN GARDINER	SAMPLER MOBILE: 0409 827 396	
COC emailed to ALS? (YES / NO)		EDD FORMAT (or default):	
Email Reports to: mail@preciseenvironmental.com.au			
Mail Invoice to: PO Box 4424, Robina Town Centre 4230			

FOR LABORATORY USE ONLY (Circle)
Custody Seal Intact? Yes No N/A
Free ice / frozen ice bricks present upon receipt? Yes No N/A
Random Sample Temperature on Receipt: °C
Other comment:

RELINQUISHED BY:	RECEIVED BY:	RELINQUISHED BY:	RECEIVED BY:
CHRIS BUTLER			
DATE/TIME: 13.07.22 9AM C. Butler	DATE/TIME:	DATE/TIME:	DATE/TIME:

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

ALS USE ONLY | SAMPLE DETAILS MATRIX: Solid(S) Water(W) | CONTAINER INFORMATION | ANALYSIS REQUIRED including SUITES (NB. Suite Codes must be listed to attract suite price) Where Metals are required, specify Total (unfiltered bottle required) or Dissolved (field filtered bottle required). | Additional Information

LAB ID	SAMPLE ID	SAMPLE DESCRIPTION	DATE / TIME	MATRIX	TYPE & PRESERVATIVE (refer to codes below)	TOTAL BOTTLES	EA037 (pHF and pHFOX)	EA033 (Chromium suite)							Comments on likely contaminant levels, dilutions, or samples requiring specific QC analysis etc.
53	BH14	0.0	12.07.22	S	BAG/<4°C	1	X								
54	BH14	0.25	12.07.22	S	BAG/<4°C	1	X								
55	BH14	0.50	12.07.22	S	BAG/<4°C	1	X								
56	BH14	0.75	12.07.22	S	BAG/<4°C	1	X								
57	BH14	1.00	12.07.22	S	BAG/<4°C	1	X								
58	BH14	1.25	12.07.22	S	BAG/<4°C	1	X								
59	BH14	1.50	12.07.22	S	BAG/<4°C	1	X								
60	BH14	1.75	12.07.22	S	BAG/<4°C	1	X								
					TOTAL	8									

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V = VOA Vial HCl Preserved; VB = VOA Vial Sodium Bisulphate Preserved; VS = VOA Vial Sulfuric Preserved; AV = Airfreight Unpreserved Vial SG = Sulfuric Preserved Amber Glass; H = HCl preserved Plastic; HS = HCl preserved Speciation bottle; SP = Sulfuric Preserved Plastic; F = Formaldehyde Preserved Glass;
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PROJECT:	PE3394.22	ALS QUOTE NO.: BN031/16 v4	COC SEQUENCE NUMBER (Circle)	Free ice / frozen ice bricks present upon receipt? Yes No N/A
ORDER NUMBER:	PE3394.22		COC: 1 2 3 4 5 6 7	Random Sample Temperature on Receipt: °C
PROJECT MANAGER:	CHRIS BUTLER	CONTACT: 0431 565 210	OF: 1 2 3 4 5 6 7	Other comment:

SAMPLER: CHRIS BUTLER / SEAN GARDINER	SAMPLER MOBILE: 0409 827 396	RELINQUISHED BY:	RECEIVED BY:	RELINQUISHED BY:	RECEIVED BY:
COC emailed to ALS? (YES / NO)	EDD FORMAT (or default):	CHRIS BUTLER			
Email Reports to: mail@preciseenvironmental.com.au		DATE/TIME: C. Butler	DATE/TIME:	DATE/TIME:	DATE/TIME:
Mail Invoice to: PO Box 4424, Robina Town Centre 4230		13.07.22 9AM			

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

ALS USE ONLY	SAMPLE DETAILS	Water(W)		MATRIX: Solid(S)	CONTAINER INFORMATION		ANALYSIS REQUIRED including SUITES (NB. Suite Codes must be listed to attract suite price) Where Metals are required, specify Total (unfiltered bottle required) or Dissolved (field filtered bottle required).								Additional Information
LAB ID	SAMPLE ID	SAMPLE DESCRIPTION	DATE / TIME	MATRIX	TYPE & PRESERVATIVE (refer to codes below)	TOTAL BOTTLES	EA037 (pHF and pHFOX)	EA033 (Chromium suite)							Comments on likely contaminant levels, dilutions, or samples requiring specific QC analysis etc.
61	BH15	0.0	12.07.22	s	BAG/<4°C	1	x	x							
62	BH15	0.25	12.07.22	s	BAG/<4°C	1	x								
63	BH15	0.50	12.07.22	s	BAG/<4°C	1	x	x							
64	BH15	0.75	12.07.22	s	BAG/<4°C	1	x								
65	BH15	1.00	12.07.22	s	BAG/<4°C	1	x	x							
66	BH15	1.25	12.07.22	s	BAG/<4°C	1	x								
67	BH15	1.50	12.07.22	s	BAG/<4°C	1	x								
68	BH15	1.75	12.07.22	s	BAG/<4°C	1	x								
					TOTAL	8									

Water Container Codes: P = Unpreserved Plastic; N = Nitric Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide/Cd Preserved; S = Sodium Hydroxide Preserved Plastic; AG = Amber Glass Unpreserved; AP - Airfreight Unpreserved Plastic
V = VOA Vial HCl Preserved; VB = VOA Vial Sodium Bisulphate Preserved; VS = VOA Vial Sulfuric Preserved; AV = Airfreight Unpreserved Vial SG = Sulfuric Preserved Amber Glass; H = HCl preserved Plastic; HS = HCl preserved Speciation bottle; SP = Sulfuric Preserved Plastic; F = Formaldehyde Preserved Glass;
Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; ASS = Plastic Bag for Acid Sulphate Soils; B = Unpreserved Bag

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **EB2220520**	Page	: 1 of 16
Client	: **PRECISE ENVIRONMENTAL PTY LTD**	Laboratory	: Environmental Division Brisbane
Contact	: MR CHRIS BUTLER	Contact	: Nidhi Bhimani
Address	: PO BOX 4424 ROBINA TOWN CENTRE QLD, AUSTRALIA 4230	Address	: 2 Byth Street Stafford QLD Australia 4053
Telephone	: ----	Telephone	: +61-7-3243 7222
Project	: PE3394.22	Date Samples Received	: 14-Jul-2022 11:35
Order number	: PE3394.22	Date Analysis Commenced	: 19-Jul-2022
C-O-C number	: ----	Issue Date	: 21-Jul-2022 15:20
Sampler	: CHRIS BUTLER, SEAN GARDINER		
Site	: ----		
Quote number	: EN/222		
No. of samples received	: 68		
No. of samples analysed	: 68		

Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Ben Felgendrejeris	Senior Acid Sulfate Soil Chemist	Brisbane Acid Sulphate Soils, Stafford, QLD

General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contract for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

- **SPLIT WORK ORDER: It should be noted that ALS has split this work order over the following work orders EB2220520 and EB2220427 due to the size of the sample numbers. For any further information regarding this processing of samples please contact ALS client services division on ALSEnviro.Brisbane@alsglobal.com**
- ASS: EA033 (CRS Suite):Retained Acidity not required because pH KCl greater than or equal to 4.5
- ASS: EA033 (CRS Suite): ANC not required because pH KCl less than 6.5
- ASS: EA037 (Rapid Field and F(ox) screening): pH F(ox) Reaction Rate: 1 - Slight; 2 - Moderate; 3 - Strong; 4 - Extreme
- ASS: EA033 (CRS Suite): Liming rate is calculated and reported on a dry weight basis assuming use of fine agricultural lime ($CaCO3$) and using a safety factor of 1.5 to allow for non-homogeneous mixing and poor reactivity of lime. For conversion of Liming Rate from 'kg/t dry weight' to 'kg/m3 in-situ soil', multiply 'reported results' x 'wet bulk density of soil in t/m3'.
- EA037 ASS Field Screening: NATA accreditation does not cover performance of this service.

Analytical Results

Sub-Matrix: **SOIL**
(Matrix: **SOIL**)

Compound	CAS Number	LOR	Unit	BH8 0.0	BH8 0.25	BH8 0.50	BH8 0.75	BH8 1.00
			Sampling date / time	12-Jul-2022 00:00	12-Jul-2022 00:00	12-Jul-2022 00:00	12-Jul-2022 00:00	12-Jul-2022 00:00
				EB2220520-001	EB2220520-002	EB2220520-003	EB2220520-004	EB2220520-005
				Result	Result	Result	Result	Result
EA037: Ass Field Screening Analysis								
ø pH (F)	----	0.1	pH Unit	5.7	5.7	5.8	5.6	5.9
ø pH (Fox)	----	0.1	pH Unit	2.4	2.9	4.2	3.6	2.0
ø Reaction Rate	----	1	-	3	3	1	1	1

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	BH8 1.25	BH8 1.50	BH8 1.75	BH9 0.0	BH9 0.25
			Sampling date / time	12-Jul-2022 00:00	12-Jul-2022 00:00	12-Jul-2022 00:00	12-Jul-2022 00:00	12-Jul-2022 00:00
Compound	CAS Number	LOR	Unit	EB2220520-006	EB2220520-007	EB2220520-008	EB2220520-009	EB2220520-010
				Result	Result	Result	Result	Result
EA037: Ass Field Screening Analysis								
ø pH (F)	----	0.1	pH Unit	6.0	5.8	5.8	5.8	5.9
ø pH (Fox)	----	0.1	pH Unit	2.1	2.3	2.0	2.4	2.8
ø Reaction Rate	----	1	-	4	4	4	3	3

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	BH9 0.50	BH9 0.75	BH9 1.00	BH9 1.25	BH9 1.50
			Sampling date / time	12-Jul-2022 00:00	12-Jul-2022 00:00	12-Jul-2022 00:00	12-Jul-2022 00:00	12-Jul-2022 00:00
Compound	CAS Number	LOR	Unit	EB2220520-011	EB2220520-012	EB2220520-013	EB2220520-014	EB2220520-015
				Result	Result	Result	Result	Result
EA037: Ass Field Screening Analysis								
ø pH (F)	----	0.1	pH Unit	6.2	6.3	6.4	5.6	5.1
ø pH (Fox)	----	0.1	pH Unit	3.8	4.2	2.0	1.9	1.8
ø Reaction Rate	----	1	-	1	1	1	1	1

Analytical Results

Sub-Matrix: **SOIL**
(Matrix: **SOIL**)

Compound	CAS Number	LOR	Unit	BH9 1.75	BH10 0.0	BH10 0.25	BH10 0.50	BH10 0.75
			Sampling date / time	12-Jul-2022 00:00	12-Jul-2022 00:00	12-Jul-2022 00:00	12-Jul-2022 00:00	12-Jul-2022 00:00
				EB2220520-016	EB2220520-017	EB2220520-018	EB2220520-019	EB2220520-020
				Result	Result	Result	Result	Result
EA037: Ass Field Screening Analysis								
ø pH (F)	----	0.1	pH Unit	5.2	5.4	5.7	5.4	5.7
ø pH (Fox)	----	0.1	pH Unit	1.7	2.6	3.5	3.0	2.5
ø Reaction Rate	----	1	-	1	3	2	2	2

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	BH10 1.00	BH10 1.25	BH10 1.50	BH10 1.75	BH11 0.0
			Sampling date / time	12-Jul-2022 00:00	12-Jul-2022 00:00	12-Jul-2022 00:00	12-Jul-2022 00:00	12-Jul-2022 00:00
Compound	CAS Number	LOR	Unit	EB2220520-021	EB2220520-022	EB2220520-023	EB2220520-024	EB2220520-025
				Result	Result	Result	Result	Result
EA033-A: Actual Acidity								
pH KCl (23A)	----	0.1	pH Unit	----	----	----	----	6.1
Titratable Actual Acidity (23F)	----	2	mole H+ / t	----	----	----	----	4
sulfidic - Titratable Actual Acidity (s-23F)	----	0.02	% pyrite S	----	----	----	----	<0.02
EA033-B: Potential Acidity								
Chromium Reducible Sulfur (22B)	----	0.005	% S	----	----	----	----	0.020
acidity - Chromium Reducible Sulfur (a-22B)	----	10	mole H+ / t	----	----	----	----	12
EA033-E: Acid Base Accounting								
ANC Fineness Factor	----	0.5	-	----	----	----	----	1.5
Net Acidity (sulfur units)	----	0.02	% S	----	----	----	----	0.02
Net Acidity (acidity units)	----	10	mole H+ / t	----	----	----	----	16
Liming Rate	----	1	kg CaCO3/t	----	----	----	----	1
Net Acidity excluding ANC (sulfur units)	----	0.02	% S	----	----	----	----	0.02
Net Acidity excluding ANC (acidity units)	----	10	mole H+ / t	----	----	----	----	16
Liming Rate excluding ANC	----	1	kg CaCO3/t	----	----	----	----	1
EA037: Ass Field Screening Analysis								
ø pH (F)	----	0.1	pH Unit	5.8	5.7	5.5	5.6	5.8
ø pH (Fox)	----	0.1	pH Unit	2.2	2.1	2.0	2.3	2.7
ø Reaction Rate	----	1	-	4	4	4	4	3

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	BH11 0.25	BH11 0.50	BH11 0.75	BH11 1.00	BH11 1.25
			Sampling date / time	12-Jul-2022 00:00	12-Jul-2022 00:00	12-Jul-2022 00:00	12-Jul-2022 00:00	12-Jul-2022 00:00
Compound	CAS Number	LOR	Unit	EB2220520-026	EB2220520-027	EB2220520-028	EB2220520-029	EB2220520-030
				Result	Result	Result	Result	Result
EA033-A: Actual Acidity								
pH KCl (23A)	----	0.1	pH Unit	----	5.1	----	5.5	----
Titratable Actual Acidity (23F)	----	2	mole H+ / t	----	32	----	8	----
sulfidic - Titratable Actual Acidity (s-23F)	----	0.02	% pyrite S	----	0.05	----	<0.02	----
EA033-B: Potential Acidity								
Chromium Reducible Sulfur (22B)	----	0.005	% S	----	0.011	----	0.014	----
acidity - Chromium Reducible Sulfur (a-22B)	----	10	mole H+ / t	----	<10	----	<10	----
EA033-E: Acid Base Accounting								
ANC Fineness Factor	----	0.5	-	----	1.5	----	1.5	----
Net Acidity (sulfur units)	----	0.02	% S	----	0.06	----	0.02	----
Net Acidity (acidity units)	----	10	mole H+ / t	----	39	----	16	----
Liming Rate	----	1	kg CaCO3/t	----	3	----	1	----
Net Acidity excluding ANC (sulfur units)	----	0.02	% S	----	0.06	----	0.02	----
Net Acidity excluding ANC (acidity units)	----	10	mole H+ / t	----	39	----	16	----
Liming Rate excluding ANC	----	1	kg CaCO3/t	----	3	----	1	----
EA037: Ass Field Screening Analysis								
ø pH (F)	----	0.1	pH Unit	5.7	5.0	5.1	5.5	5.5
ø pH (Fox)	----	0.1	pH Unit	2.8	3.0	2.5	2.6	2.2
ø Reaction Rate	----	1	-	3	3	3	3	1

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	BH11 1.50	BH11 1.75	BH11 2.00	BH11 2.25	BH11 2.50
			Sampling date / time	12-Jul-2022 00:00	12-Jul-2022 00:00	12-Jul-2022 00:00	12-Jul-2022 00:00	12-Jul-2022 00:00
Compound	CAS Number	LOR	Unit	EB2220520-031	EB2220520-032	EB2220520-033	EB2220520-034	EB2220520-035
				Result	Result	Result	Result	Result
EA033-A: Actual Acidity								
pH KCl (23A)	----	0.1	pH Unit	5.4	----	----	----	5.5
Titratable Actual Acidity (23F)	----	2	mole H+ / t	5	----	----	----	4
sulfidic - Titratable Actual Acidity (s-23F)	----	0.02	% pyrite S	<0.02	----	----	----	<0.02
EA033-B: Potential Acidity								
Chromium Reducible Sulfur (22B)	----	0.005	% S	0.212	----	----	----	0.189
acidity - Chromium Reducible Sulfur (a-22B)	----	10	mole H+ / t	132	----	----	----	118
EA033-E: Acid Base Accounting								
ANC Fineness Factor	----	0.5	-	1.5	----	----	----	1.5
Net Acidity (sulfur units)	----	0.02	% S	0.22	----	----	----	0.19
Net Acidity (acidity units)	----	10	mole H+ / t	138	----	----	----	122
Liming Rate	----	1	kg CaCO3/t	10	----	----	----	9
Net Acidity excluding ANC (sulfur units)	----	0.02	% S	0.22	----	----	----	0.19
Net Acidity excluding ANC (acidity units)	----	10	mole H+ / t	138	----	----	----	122
Liming Rate excluding ANC	----	1	kg CaCO3/t	10	----	----	----	9
EA037: Ass Field Screening Analysis								
ø pH (F)	----	0.1	pH Unit	5.3	5.2	5.5	5.4	5.5
ø pH (Fox)	----	0.1	pH Unit	2.2	2.1	2.0	2.0	2.0
ø Reaction Rate	----	1	-	4	4	4	4	4

Analytical Results

Sub-Matrix: SOIL
(Matrix: SOIL)

Compound	CAS Number	LOR	Unit	BH11 2.75	BH12 0.0	BH12 0.25	BH12 0.50	BH12 0.75
			Sampling date / time	12-Jul-2022 00:00	12-Jul-2022 00:00	12-Jul-2022 00:00	12-Jul-2022 00:00	12-Jul-2022 00:00
				EB2220520-036	EB2220520-037	EB2220520-038	EB2220520-039	EB2220520-040
				Result	Result	Result	Result	Result
EA037: Ass Field Screening Analysis								
ø pH (F)	----	0.1	pH Unit	5.5	5.3	5.6	5.6	5.5
ø pH (Fox)	----	0.1	pH Unit	2.2	2.9	3.0	4.2	3.6
ø Reaction Rate	----	1	-	4	2	2	1	1

Analytical Results

Sub-Matrix: **SOIL**
(Matrix: **SOIL**)

Compound	CAS Number	LOR	Unit	BH12 1.00	BH12 1.25	BH12 1.50	BH12 1.75	BH13 0.0
			Sampling date / time	12-Jul-2022 00:00	12-Jul-2022 00:00	12-Jul-2022 00:00	12-Jul-2022 00:00	12-Jul-2022 00:00
				EB2220520-041	EB2220520-042	EB2220520-043	EB2220520-044	EB2220520-045
				Result	Result	Result	Result	Result
EA037: Ass Field Screening Analysis								
ø pH (F)	----	0.1	pH Unit	5.9	5.4	5.4	5.2	5.3
ø pH (Fox)	----	0.1	pH Unit	2.0	2.0	2.1	2.1	2.1
ø Reaction Rate	----	1	-	4	4	4	4	3

Analytical Results

Sub-Matrix: **SOIL**
(Matrix: **SOIL**)

Compound	CAS Number	LOR	Unit	BH13 0.25	BH13 0.50	BH13 0.75	BH13 1.00	BH13 1.25
			Sampling date / time	12-Jul-2022 00:00	12-Jul-2022 00:00	12-Jul-2022 00:00	12-Jul-2022 00:00	12-Jul-2022 00:00
				EB2220520-046	EB2220520-047	EB2220520-048	EB2220520-049	EB2220520-050
				Result	Result	Result	Result	Result
EA037: Ass Field Screening Analysis								
ø pH (F)	----	0.1	pH Unit	4.8	6.0	5.9	6.0	6.0
ø pH (Fox)	----	0.1	pH Unit	2.7	3.0	3.8	2.1	2.1
ø Reaction Rate	----	1	-	3	2	1	4	4

Analytical Results

Sub-Matrix: **SOIL** (Matrix: **SOIL**)			Sample ID	BH13 1.50	BH13 1.75	BH14 0.0	BH14 0.25	BH14 0.50
			Sampling date / time	12-Jul-2022 00:00	12-Jul-2022 00:00	12-Jul-2022 00:00	12-Jul-2022 00:00	12-Jul-2022 00:00
Compound	CAS Number	LOR	Unit	EB2220520-051	EB2220520-052	EB2220520-053	EB2220520-054	EB2220520-055
				Result	Result	Result	Result	Result
EA037: Ass Field Screening Analysis								
ø pH (F)	----	0.1	pH Unit	5.9	6.0	5.5	5.6	5.5
ø pH (Fox)	----	0.1	pH Unit	2.0	2.1	2.8	3.3	3.6
ø Reaction Rate	----	1	-	4	4	3	1	1

Analytical Results

Sub-Matrix: **SOIL** (Matrix: **SOIL**)			Sample ID	**BH14 0.75**	**BH14 1.00**	**BH14 1.25**	**BH14 1.50**	**BH14 1.75**
			Sampling date / time	12-Jul-2022 00:00	12-Jul-2022 00:00	12-Jul-2022 00:00	12-Jul-2022 00:00	12-Jul-2022 00:00
Compound	CAS Number	LOR	Unit	**EB2220520-056**	**EB2220520-057**	**EB2220520-058**	**EB2220520-059**	**EB2220520-060**
				Result	Result	Result	Result	Result
EA037: Ass Field Screening Analysis								
ø **pH (F)**	----	0.1	pH Unit	**5.9**	**5.9**	**6.2**	**6.0**	**6.1**
ø **pH (Fox)**	----	0.1	pH Unit	**3.4**	**2.0**	**2.0**	**2.1**	**2.0**
ø **Reaction Rate**	----	1	-	**1**	**4**	**4**	**4**	**4**

Analytical Results

Sub-Matrix: **SOIL** (Matrix: **SOIL**)			Sample ID	**BH15 0.0**	**BH15 0.25**	**BH15 0.50**	**BH15 0.75**	**BH15 1.00**
			Sampling date / time	12-Jul-2022 00:00	12-Jul-2022 00:00	12-Jul-2022 00:00	12-Jul-2022 00:00	12-Jul-2022 00:00
Compound	CAS Number	LOR	Unit	**EB2220520-061**	**EB2220520-062**	**EB2220520-063**	**EB2220520-064**	**EB2220520-065**
				Result	Result	Result	Result	Result
EA033-A: Actual Acidity								
pH KCl (23A)	----	0.1	pH Unit	**4.6**	----	**5.8**	----	**5.6**
Titratable Actual Acidity (23F)	----	2	mole H+ / t	**108**	----	**4**	----	**4**
sulfidic - Titratable Actual Acidity (s-23F)	----	0.02	% pyrite S	**0.17**	----	<0.02	----	<0.02
EA033-B: Potential Acidity								
Chromium Reducible Sulfur (22B)	----	0.005	% S	**0.020**	----	**0.016**	----	**0.107**
acidity - Chromium Reducible Sulfur (a-22B)	----	10	mole H+ / t	**13**	----	<10	----	**67**
EA033-E: Acid Base Accounting								
ANC Fineness Factor	----	0.5	-	**1.5**	----	**1.5**	----	**1.5**
Net Acidity (sulfur units)	----	0.02	% S	**0.19**	----	**0.02**	----	**0.11**
Net Acidity (acidity units)	----	10	mole H+ / t	**121**	----	**14**	----	**71**
Liming Rate	----	1	kg CaCO3/t	**9**	----	**1**	----	**5**
Net Acidity excluding ANC (sulfur units)	----	0.02	% S	**0.19**	----	**0.02**	----	**0.11**
Net Acidity excluding ANC (acidity units)	----	10	mole H+ / t	**121**	----	**14**	----	**71**
Liming Rate excluding ANC	----	1	kg CaCO3/t	**9**	----	**1**	----	**5**
EA037: Ass Field Screening Analysis								
ø pH (F)	----	0.1	pH Unit	**5.7**	**5.6**	**6.3**	**6.4**	**6.6**
ø pH (Fox)	----	0.1	pH Unit	**3.0**	**3.3**	**3.6**	**4.3**	**1.9**
ø Reaction Rate	----	1	-	**3**	**3**	**1**	**1**	**1**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	BH15 1.25	BH15 1.50	BH15 1.75	----	----
			Sampling date / time	12-Jul-2022 00:00	12-Jul-2022 00:00	12-Jul-2022 00:00	----	----
Compound	CAS Number	LOR	Unit	EB2220520-066	EB2220520-067	EB2220520-068	--------	--------
				Result	Result	Result	----	----
EA037: Ass Field Screening Analysis								
ø pH (F)	----	0.1	pH Unit	6.8	6.9	7.0	----	----
ø pH (Fox)	----	0.1	pH Unit	2.1	2.0	1.9	----	----
ø Reaction Rate	----	1	-	4	1	1	----	----

ALS Environmental

QUALITY CONTROL REPORT

Work Order	: **EB2220520**	Page	: 1 of 4
Client	: **PRECISE ENVIRONMENTAL PTY LTD**	Laboratory	: Environmental Division Brisbane
Contact	: MR CHRIS BUTLER	Contact	: Nidhi Bhimani
Address	: PO BOX 4424 ROBINA TOWN CENTRE QLD, AUSTRALIA 4230	Address	: 2 Byth Street Stafford QLD Australia 4053
Telephone	: ----	Telephone	: +61-7-3243 7222
Project	: PE3394.22	Date Samples Received	: 14-Jul-2022
Order number	: PE3394.22	Date Analysis Commenced	: 19-Jul-2022
C-O-C number	: ----	Issue Date	: 21-Jul-2022
Sampler	: CHRIS BUTLER, SEAN GARDINER		
Site	: ----		
Quote number	: EN/222		
No. of samples received	: 68		
No. of samples analysed	: 68		

Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percentage Difference (RPD) and Acceptance Limits
- Method Blank (MB) and Laboratory Control Spike (LCS) Report; Recovery and Acceptance Limits
- Matrix Spike (MS) Report; Recovery and Acceptance Limits

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Ben Felgendrejeris	Senior Acid Sulfate Soil Chemist	Brisbane Acid Sulphate Soils, Stafford, QLD

General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis. Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

Key :
- Anonymous = Refers to samples which are not specifically part of this work order but formed part of the QC process lot
- CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
- LOR = Limit of reporting
- RPD = Relative Percentage Difference
- # = Indicates failed QC

Laboratory Duplicate (DUP) Report

The quality control term Laboratory Duplicate refers to a randomly selected intralaboratory split. Laboratory duplicates provide information regarding method precision and sample heterogeneity. The permitted ranges for the Relative Percent Deviation (RPD) of Laboratory Duplicates are specified in ALS Method QWI-EN/38 and are dependent on the magnitude of results in comparison to the level of reporting: Result < 10 times LOR: No Limit; Result between 10 and 20 times LOR: 0% - 50%; Result > 20 times LOR: 0% - 20%.

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	**Sample ID**	**Method: Compound**	**CAS Number**	**LOR**	**Unit**	**Original Result**	**Duplicate Result**	**RPD (%)**	**Acceptable RPD (%)**
EA033-A: Actual Acidity (QC Lot: 4467835)									
EB2220449-016	Anonymous	EA033: sulfidic - Titratable Actual Acidity (s-23F)	----	0.02	% pyrite S	<0.02	<0.02	0.0	No Limit
		EA033: Titratable Actual Acidity (23F)	----	2	mole H+ / t	<2	<2	0.0	No Limit
		EA033: pH KCl (23A)	----	0.1	pH Unit	8.4	8.5	0.0	0% - 20%
EB2220520-063	BH15 0.50	EA033: sulfidic - Titratable Actual Acidity (s-23F)	----	0.02	% pyrite S	<0.02	<0.02	0.0	No Limit
		EA033: Titratable Actual Acidity (23F)	----	2	mole H+ / t	4	5	0.0	No Limit
		EA033: pH KCl (23A)	----	0.1	pH Unit	5.8	5.7	0.0	0% - 20%
EA033-B: Potential Acidity (QC Lot: 4467835)									
EB2220449-016	Anonymous	EA033: Chromium Reducible Sulfur (22B)	----	0.005	% S	0.042	0.045	7.2	No Limit
		EA033: acidity - Chromium Reducible Sulfur (a-22B)	----	10	mole H+ / t	26	28	7.2	No Limit
EB2220520-063	BH15 0.50	EA033: Chromium Reducible Sulfur (22B)	----	0.005	% S	0.016	0.015	0.0	No Limit
		EA033: acidity - Chromium Reducible Sulfur (a-22B)	----	10	mole H+ / t	<10	<10	0.0	No Limit
EA037: Ass Field Screening Analysis (QC Lot: 4465711)									
EB2220520-001	BH8 0.0	EA037: pH (F)	----	0.1	pH Unit	5.7	5.7	0.0	0% - 20%
		EA037: pH (Fox)	----	0.1	pH Unit	2.4	2.4	0.0	0% - 20%
EB2220520-011	BH9 0.50	EA037: pH (F)	----	0.1	pH Unit	6.2	6.3	0.0	0% - 20%
		EA037: pH (Fox)	----	0.1	pH Unit	3.8	3.8	0.0	0% - 20%
EA037: Ass Field Screening Analysis (QC Lot: 4465712)									
EB2220520-021	BH10 1.00	EA037: pH (F)	----	0.1	pH Unit	5.8	5.7	0.0	0% - 20%
		EA037: pH (Fox)	----	0.1	pH Unit	2.2	2.2	0.0	0% - 20%
EB2220520-031	BH11 1.50	EA037: pH (F)	----	0.1	pH Unit	5.3	5.2	1.9	0% - 20%
		EA037: pH (Fox)	----	0.1	pH Unit	2.2	2.2	0.0	0% - 20%

Sub-Matrix: **SOIL**

Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Laboratory Duplicate (DUP) Report					
				LOR	Unit	Original Result	Duplicate Result	RPD (%)	Acceptable RPD (%)
EA037: Ass Field Screening Analysis (QC Lot: 4465713)									
EB2220520-041	BH12 1.00	EA037: pH (F)	----	0.1	pH Unit	5.9	6.0	0.0	0% - 20%
		EA037: pH (Fox)	----	0.1	pH Unit	2.0	2.0	0.0	0% - 50%
EB2220520-051	BH13 1.50	EA037: pH (F)	----	0.1	pH Unit	5.9	5.9	0.0	0% - 20%
		EA037: pH (Fox)	----	0.1	pH Unit	2.0	2.0	0.0	0% - 20%
EA037: Ass Field Screening Analysis (QC Lot: 4465714)									
EB2220520-061	BH15 0.0	EA037: pH (F)	----	0.1	pH Unit	5.7	5.8	0.0	0% - 20%
		EA037: pH (Fox)	----	0.1	pH Unit	3.0	2.9	0.0	0% - 20%

Method Blank (MB) and Laboratory Control Sample (LCS) Report

The quality control term Method / Laboratory Blank refers to an analyte free matrix to which all reagents are added in the same volumes or proportions as used in standard sample preparation. The purpose of this QC parameter is to monitor potential laboratory contamination. The quality control term Laboratory Control Sample (LCS) refers to a certified reference material, or a known interference free matrix spiked with target analytes. The purpose of this QC parameter is to monitor method precision and accuracy independent of sample matrix. Dynamic Recovery Limits are based on statistical evaluation of processed LCS.

Sub-Matrix: **SOIL**

				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Acceptable Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	Low	High
EA033-A: Actual Acidity (QCLot: 4467835)								
EA033: pH KCl (23A)	----	----	pH Unit	----	4.4 pH Unit	102	91.0	107
EA033: Titratable Actual Acidity (23F)	----	2	mole H+ / t	<2	19 mole H+ / t	89.9	70.0	124
EA033: sulfidic - Titratable Actual Acidity (s-23F)	----	0.02	% pyrite S	<0.02	----	----	----	----
EA033-B: Potential Acidity (QCLot: 4467835)								
EA033: Chromium Reducible Sulfur (22B)	----	0.005	% S	<0.005	0.246 % S	91.4	77.0	121
EA033: acidity - Chromium Reducible Sulfur (a-22B)	----	10	mole H+ / t	<10	----	----	----	----

Matrix Spike (MS) Report

The quality control term Matrix Spike (MS) refers to an intralaboratory split sample spiked with a representative set of target analytes. The purpose of this QC parameter is to monitor potential matrix effects on analyte recoveries. Static Recovery Limits as per laboratory Data Quality Objectives (DQOs). Ideal recovery ranges stated may be waived in the event of sample matrix interference.

- **No Matrix Spike (MS) or Matrix Spike Duplicate (MSD) Results are required to be reported.**

ALS Environmental

QA/QC Compliance Assessment to assist with Quality Review

Work Order	: **EB2220520**	Page	: 1 of 5
Client	: **PRECISE ENVIRONMENTAL PTY LTD**	Laboratory	: Environmental Division Brisbane
Contact	: MR CHRIS BUTLER	Telephone	: +61-7-3243 7222
Project	: PE3394.22	Date Samples Received	: 14-Jul-2022
Site	: ----	Issue Date	: 21-Jul-2022
Sampler	: CHRIS BUTLER, SEAN GARDINER	No. of samples received	: 68
Order number	: PE3394.22	No. of samples analysed	: 68

This report is automatically generated by the ALS LIMS through interpretation of the ALS Quality Control Report and several Quality Assurance parameters measured by ALS. This automated reporting highlights any non-conformances, facilitates faster and more accurate data validation and is designed to assist internal expert and external Auditor review. Many components of this report contribute to the overall DQO assessment and reporting for guideline compliance.

Brief method summaries and references are also provided to assist in traceability.

Summary of Outliers

Outliers : Quality Control Samples

This report highlights outliers flagged in the Quality Control (QC) Report.

- **NO Method Blank value outliers occur.**
- **NO Duplicate outliers occur.**
- **NO Laboratory Control outliers occur.**
- **NO Matrix Spike outliers occur.**
- **For all regular sample matrices, NO surrogate recovery outliers occur.**

Outliers : Analysis Holding Time Compliance

- **NO Analysis Holding Time Outliers exist.**

Outliers : Frequency of Quality Control Samples

- **NO Quality Control Sample Frequency Outliers exist.**

Analysis Holding Time Compliance

If samples are identified below as having been analysed or extracted outside of recommended holding times, this should be taken into consideration when interpreting results.

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times (referencing USEPA SW 846, APHA, AS and NEPM) based on the sample container provided. Dates reported represent first date of extraction or analysis and preclude subsequent dilutions and reruns. A listing of breaches (if any) is provided herein.

Holding time for leachate methods (e.g. TCLP) vary according to the analytes reported. Assessment compares the leach date with the shortest analyte holding time for the equivalent soil method. These are: organics 14 days, mercury 28 days & other metals 180 days. A recorded breach does not guarantee a breach for all non-volatile parameters.

Holding times for ***VOC in soils*** vary according to analytes of interest. Vinyl Chloride and Styrene holding time is 7 days; others 14 days. A recorded breach does not guarantee a breach for all VOC analytes and should be verified in case the reported breach is a false positive or Vinyl Chloride and Styrene are not key analytes of interest/concern.

Matrix: **SOIL**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method	Sample Date	Extraction / Preparation			Analysis		
Container / Client Sample ID(s)		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA033-A: Actual Acidity							
Snap Lock Bag - frozen (EA033) BH11 - 0.0, BH11 - 0.50, BH11 - 1.00, BH11 - 1.50, BH11 - 2.50, BH15 - 0.0, BH15 - 0.50, BH15 - 1.00	**12-Jul-2022**	**20-Jul-2022**	12-Jul-2023	✓	**20-Jul-2022**	18-Oct-2022	✓
EA033-B: Potential Acidity							
Snap Lock Bag - frozen (EA033) BH11 - 0.0, BH11 - 0.50, BH11 - 1.00, BH11 - 1.50, BH11 - 2.50, BH15 - 0.0, BH15 - 0.50, BH15 - 1.00	**12-Jul-2022**	**20-Jul-2022**	12-Jul-2023	✓	**20-Jul-2022**	18-Oct-2022	✓
EA033-C: Acid Neutralising Capacity							
Snap Lock Bag - frozen (EA033) BH11 - 0.0, BH11 - 0.50, BH11 - 1.00, BH11 - 1.50, BH11 - 2.50, BH15 - 0.0, BH15 - 0.50, BH15 - 1.00	**12-Jul-2022**	**20-Jul-2022**	12-Jul-2023	✓	**20-Jul-2022**	18-Oct-2022	✓
EA033-D: Retained Acidity							
Snap Lock Bag - frozen (EA033) BH11 - 0.0, BH11 - 0.50, BH11 - 1.00, BH11 - 1.50, BH11 - 2.50, BH15 - 0.0, BH15 - 0.50, BH15 - 1.00	**12-Jul-2022**	**20-Jul-2022**	12-Jul-2023	✓	**20-Jul-2022**	18-Oct-2022	✓
EA033-E: Acid Base Accounting							
Snap Lock Bag - frozen (EA033) BH11 - 0.0, BH11 - 0.50, BH11 - 1.00, BH11 - 1.50, BH11 - 2.50, BH15 - 0.0, BH15 - 0.50, BH15 - 1.00	**12-Jul-2022**	**20-Jul-2022**	12-Jul-2023	✓	**20-Jul-2022**	18-Oct-2022	✓

Matrix: **SOIL**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method Container / Client Sample ID(s)		Sample Date	Extraction / Preparation			Analysis		
			Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA037: Ass Field Screening Analysis								
Snap Lock Bag - frozen (EA037)								
BH8 - 0.0,	BH8 - 0.25,	**12-Jul-2022**	**19-Jul-2022**	08-Jan-2023	✓	**19-Jul-2022**	08-Jan-2023	✓
BH8 - 0.50,	BH8 - 0.75,							
BH8 - 1.00,	BH8 - 1.25,							
BH8 - 1.50,	BH8 - 1.75,							
BH9 - 0.0,	BH9 - 0.25,							
BH9 - 0.50,	BH9 - 0.75,							
BH9 - 1.00,	BH9 - 1.25,							
BH9 - 1.50,	BH9 - 1.75,							
BH10 - 0.0,	BH10 - 0.25,							
BH10 - 0.50,	BH10 - 0.75,							
BH11 - 0.0,	BH10 - 1.00, BH10 - 1.25,							
BH10 - 1.50,	BH10 - 1.75,							
BH11 - 0.25,								
BH11 - 0.50,	BH11 - 0.75,							
BH11 - 1.00,	BH11 - 1.25,							
BH11 - 1.50,	BH11 - 1.75,							
BH11 - 2.00,	BH11 - 2.25,							
BH11 - 2.50,	BH11 - 2.75,							
BH12 - 0.0,	BH12 - 0.25,							
BH12 - 0.50,	BH12 - 0.75,							
BH12 - 1.00,	BH12 - 1.25,							
BH12 - 1.50,	BH12 - 1.75,							
BH13 - 0.0,	BH13 - 0.25,							
BH13 - 0.50,	BH13 - 0.75,							
BH13 - 1.00,	BH13 - 1.25,							
BH13 - 1.50,	BH13 - 1.75,							
BH14 - 0.0,	BH14 - 0.25,							
BH14 - 0.50,	BH14 - 0.75,							
BH14 - 1.00,	BH14 - 1.25,							
BH14 - 1.50,	BH14 - 1.75,							
BH15 - 0.0,	BH15 - 0.25,							
BH15 - 0.50,	BH15 - 0.75,							
BH15 - 1.00,	BH15 - 1.25,							
BH15 - 1.50,	BH15 - 1.75							

Quality Control Parameter Frequency Compliance

The following report summarises the frequency of laboratory QC samples analysed within the analytical lot(s) in which the submitted sample(s) was(were) processed. Actual rate should be greater than or equal to the expected rate. A listing of breaches is provided in the Summary of Outliers.

Matrix: **SOIL**

Evaluation: × = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Laboratory Duplicates (DUP)							
ASS Field Screening Analysis	EA037	7	68	**10.29**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Chromium Suite for Acid Sulphate Soils	EA033	2	14	**14.29**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Chromium Suite for Acid Sulphate Soils	EA033	1	14	**7.14**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Chromium Suite for Acid Sulphate Soils	EA033	1	14	**7.14**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard

Brief Method Summaries

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the US EPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request. The following report provides brief descriptions of the analytical procedures employed for results reported in the Certificate of Analysis. Sources from which ALS methods have been developed are provided within the Method Descriptions.

Analytical Methods	Method	Matrix	Method Descriptions
Chromium Suite for Acid Sulphate Soils	EA033	SOIL	In house: Referenced to Ahern et al 2004. This method covers the determination of Chromium Reducible Sulfur (SCR); pHKCl; titratable actual acidity (TAA); acid neutralising capacity by back titration (ANC); and net acid soluble sulfur (SNAS) which incorporates peroxide sulfur. It applies to soils and sediments (including sands) derived from coastal regions. Liming Rate is based on results for samples as submitted and incorporates a minimum safety factor of 1.5.
ASS Field Screening Analysis	* EA037	SOIL	In house: Referenced to Acid Sulfate Soils Laboratory Methods Guidelines. As received samples are tested for pH field and pH fox and assessed for a reaction rating.

Preparation Methods	Method	Matrix	Method Descriptions
Drying only	EN020D	SOIL	In house
Drying at 85 degrees, bagging and labelling (ASS)	EN020PR	SOIL	In house

ALS Environmental

SAMPLE RECEIPT NOTIFICATION (SRN)

Work Order : **EB2220427**

Client	: **PRECISE ENVIRONMENTAL PTY LTD**	Laboratory	: Environmental Division Brisbane
Contact	: MR CHRIS BUTLER	Contact	: Nidhi Bhimani
Address	: PO BOX 4424 ROBINA TOWN CENTRE QLD, AUSTRALIA 4230	Address	: 2 Byth Street Stafford QLD Australia 4053
E-mail	: mail@preciseenvironmental.com.au	E-mail	: nidhi.bhimani@alsglobal.com
Telephone	: ----	Telephone	: +61-7-3243 7222
Facsimile	: ----	Facsimile	: +61-7-3243 7218
Project	: PE3394.22	Page	: 1 of 3
Order number	: PE3394.22	Quote number	: EB2017PREENV0003 (EN/222)
C-O-C number	: ----	QC Level	: NEPM 2013 B3 & ALS QC Standard
Site	: ----		
Sampler	: CHRIS BUTLER, SEAN GARDINER		

Dates

Date Samples Received	: 14-Jul-2022 11:35	Issue Date	: 14-Jul-2022
Client Requested Due Date	: 20-Jul-2022	Scheduled Reporting Date	: **20-Jul-2022**

Delivery Details

Mode of Delivery	: Carrier	Security Seal	: Intact.
No. of coolers/boxes	: 4	Temperature	: 3.8, 5.0, 3.4, 4.4°C - Ice present
Receipt Detail	: HARD ESKY	No. of samples received / analysed	: 64 / 64

General Comments

- This report contains the following information:
  - Sample Container(s)/Preservation Non-Compliances
  - Summary of Sample(s) and Requested Analysis
  - Proactive Holding Time Report
  - Requested Deliverables
- **Please be advised that sample "BH4 0.75, BH5 2.00 and BH5 2.25" was not received at the laboratory (denoted SNR on the scanned COC).**
- **SPLIT WORK ORDER: It should be noted that ALS has split this work order over the following work orders EB2220520 and EB2220427 due to the size of the sample numbers. For any further information regarding this processing of samples please contact ALS client services division on ALSEnviro.Brisbane@alsglobal.com**
- Discounted Package Prices apply only when specific ALS Group Codes ('W', 'S', 'NT' suites) are referenced on COCs.
- Please direct any turn around / technical queries to the laboratory contact designated above.
- Sample Disposal - Aqueous (3 weeks), Solid (2 months ± 1 week) from receipt of samples.
- Analysis will be conducted by ALS Environmental, Brisbane, NATA accreditation no. 825, Site No. 818 (Micro site no. 18958).
- **Breaches in recommended extraction / analysis holding times (if any) are displayed overleaf in the Proactive Holding Time Report table.**
- Please be aware that APHA/NEPM recommends water and soil samples be chilled to less than or equal to 6°C for chemical analysis, and less than or equal to 10°C but unfrozen for Microbiological analysis. Where samples are received above this temperature, it should be taken into consideration when interpreting results. Refer to ALS EnviroMail 85 for ALS recommendations of the best practice for chilling samples after sampling and for maintaining a cool temperature during transit.
- **Please refer to the Proactive Holding Time Report table below which summarises breaches of recommended holding times that have occurred prior to samples/instructions being received at the laboratory. The laboratory will process these samples unless instructions are received from you indicating you do not wish to proceed. The absence of this summary table indicates that all samples have been received within the recommended holding times for the analysis requested.**

Sample Container(s)/Preservation Non-Compliances

All comparisons are made against pretreatment/preservation AS, APHA, USEPA standards.

- **No sample container / preservation non-compliance exists.**

Summary of Sample(s) and Requested Analysis

Some items described below may be part of a laboratory process necessary for the execution of client requested tasks. Packages may contain additional analyses, such as the determination of moisture content and preparation tasks, that are included in the package.
If no sampling time is provided, the sampling time will default 00:00 on the date of sampling. If no sampling date is provided, the sampling date will be assumed by the laboratory and displayed in brackets without a time component

Matrix: **SOIL**

Laboratory sample ID	*Sampling date / time*	*Sample ID*	SOIL - EA033 Chromium Suite for Acid Sulphate Soils	SOIL - EA037 ASS Field Screening Analysis
EB2220427-001	12-Jul-2022 00:00	BH1 0.0	✓	✓
EB2220427-002	12-Jul-2022 00:00	BH1 0.25		✓
EB2220427-003	12-Jul-2022 00:00	BH1 0.50	✓	✓
EB2220427-004	12-Jul-2022 00:00	BH1 0.75		✓
EB2220427-005	12-Jul-2022 00:00	BH1 1.00	✓	✓
EB2220427-006	12-Jul-2022 00:00	BH1 1.25		✓
EB2220427-007	12-Jul-2022 00:00	BH1 1.50	✓	✓
EB2220427-008	12-Jul-2022 00:00	BH1 1.75		✓
EB2220427-009	12-Jul-2022 00:00	BH1 2.00		✓
EB2220427-010	12-Jul-2022 00:00	BH1 2.25		✓
EB2220427-011	12-Jul-2022 00:00	BH1 2.50	✓	✓
EB2220427-012	12-Jul-2022 00:00	BH1 2.75		✓
EB2220427-013	12-Jul-2022 00:00	BH2 0.0		✓
EB2220427-014	12-Jul-2022 00:00	BH2 0.25		✓
EB2220427-015	12-Jul-2022 00:00	BH2 0.50		✓
EB2220427-016	12-Jul-2022 00:00	BH2 0.75		✓
EB2220427-017	12-Jul-2022 00:00	BH2 1.00		✓
EB2220427-018	12-Jul-2022 00:00	BH2 1.25		✓
EB2220427-019	12-Jul-2022 00:00	BH2 1.50		✓
EB2220427-020	12-Jul-2022 00:00	BH2 1.75		✓
EB2220427-021	12-Jul-2022 00:00	BH3 0.0		✓
EB2220427-022	12-Jul-2022 00:00	BH3 0.25		✓
EB2220427-023	12-Jul-2022 00:00	BH3 0.50		✓
EB2220427-024	12-Jul-2022 00:00	BH3 0.75		✓
EB2220427-025	12-Jul-2022 00:00	BH3 1.00		✓
EB2220427-026	12-Jul-2022 00:00	BH3 1.25		✓
EB2220427-027	12-Jul-2022 00:00	BH3 1.50		✓
EB2220427-028	12-Jul-2022 00:00	BH3 1.75		✓
EB2220427-029	12-Jul-2022 00:00	BH4 0.0	✓	✓
EB2220427-030	12-Jul-2022 00:00	BH4 0.25		✓
EB2220427-031	12-Jul-2022 00:00	BH4 0.50	✓	✓
EB2220427-033	12-Jul-2022 00:00	BH4 1.00	✓	✓
EB2220427-034	12-Jul-2022 00:00	BH4 1.25		✓
EB2220427-035	12-Jul-2022 00:00	BH4 1.50	✓	✓
EB2220427-036	12-Jul-2022 00:00	BH4 1.75		✓

			SOIL - EA033 Chromium Suite for Acid Sulphate Soils	SOIL - EA037 ASS Field Screening Analysis
EB2220427-037	12-Jul-2022 00:00	BH4 2.00		✓
EB2220427-038	12-Jul-2022 00:00	BH4 2.25	✓	✓
EB2220427-039	12-Jul-2022 00:00	BH5 0.0		✓
EB2220427-040	12-Jul-2022 00:00	BH5 0.50		✓
EB2220427-041	12-Jul-2022 00:00	BH5 0.75		✓
EB2220427-042	12-Jul-2022 00:00	BH5 1.00		✓
EB2220427-043	12-Jul-2022 00:00	BH5 1.25		✓
EB2220427-044	12-Jul-2022 00:00	BH5 1.50		✓
EB2220427-045	12-Jul-2022 00:00	BH5 1.75		✓
EB2220427-048	12-Jul-2022 00:00	BH6 0.0	✓	✓
EB2220427-049	12-Jul-2022 00:00	BH6 0.25		✓
EB2220427-050	12-Jul-2022 00:00	BH6 0.50	✓	✓
EB2220427-051	12-Jul-2022 00:00	BH6 0.75		✓
EB2220427-052	12-Jul-2022 00:00	BH6 1.00	✓	✓
EB2220427-053	12-Jul-2022 00:00	BH6 1.25		✓
EB2220427-054	12-Jul-2022 00:00	BH6 1.50	✓	✓
EB2220427-055	12-Jul-2022 00:00	BH6 1.75		✓
EB2220427-056	12-Jul-2022 00:00	BH6 2.00		✓
EB2220427-057	12-Jul-2022 00:00	BH6 2.25		✓
EB2220427-058	12-Jul-2022 00:00	BH6 2.50	✓	✓
EB2220427-059	12-Jul-2022 00:00	BH6 2.75		✓
EB2220427-060	12-Jul-2022 00:00	BH7 0.0		✓
EB2220427-061	12-Jul-2022 00:00	BH7 0.25		✓
EB2220427-062	12-Jul-2022 00:00	BH7 0.50		✓
EB2220427-063	12-Jul-2022 00:00	BH7 0.75		✓
EB2220427-064	12-Jul-2022 00:00	BH7 1.00		✓
EB2220427-065	12-Jul-2022 00:00	BH7 1.25		✓
EB2220427-066	12-Jul-2022 00:00	BH7 1.50		✓
EB2220427-067	12-Jul-2022 00:00	BH7 1.75		✓

Proactive Holding Time Report

Sample(s) have been received within the recommended holding times for the requested analysis.

Requested Deliverables

RESULTS & INVOICE

- *AU Certificate of Analysis - NATA (COA)	Email	mail@preciseenvironmental.com.au
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	mail@preciseenvironmental.com.au
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	mail@preciseenvironmental.com.au
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	mail@preciseenvironmental.com.au
- A4 - AU Tax Invoice (INV)	Email	mail@preciseenvironmental.com.au
- Chain of Custody (CoC) (COC)	Email	mail@preciseenvironmental.com.au
- EDI Format - XTab (XTAB)	Email	mail@preciseenvironmental.com.au

SAMPLE RECEIPT INFORMATION & BOTTLE TYPE

160

WORKORDER No:

To be completed by Sample Receipt 13/07/22

Sorting Times (Only record for BP, Mobil & URS)		**Temperature Details** (record if NOT on COC)		**Packaging**			**Courier Details** (Mandatory for Quarantine)	**Samples checked, labelled and put in trays by:**
Time Sorting Commenced:		Sample Temp	°C	**Security Seal Intact?** *Circle below*	**Packaging Type**	**No.**	Con Note: Jet	Initial:
Time Placed in Fridge:		Chilling Method - Circle		YES (Security seal intact)	Hard Esky m	4	@ 12:40, 13/7/22	
Sorting to Fridge Target Time <1 Hour		Ice / Ice Bricks / No Chilling		NO (Security seal broken)	Foam Esky		*Cells shaded grey don't need to be completed on this form if they are entered directly into LIMS/ANGEL by Sample Receipt staff.*	
				NA (No security seal used)	Other			

Sample Receipt Advice Comments - To be completed by Sorting Staff

VOC analysis may be compromised as sample containers contained **headspace** *(list)*:

Details of any samples damaged during transit:

Other Information (eg. Were bottles received that weren't completely filled) (eg. If sample temperature is above 6'C add further detail here - *Internal use only - Not for SRN*):

3.8 / 5.0 / 3.4 / 4.4

Precise Enviro ; PE3394.22

Environmental Division
Brisbane
Work Order Reference
EB2220427

Telephone : + 61-7-3243 7222

Metals Bottles: F = Field filtered. T = Total. N/S = Not Specified.
Cyanide Bottles: Tr = Treated, meaning the client has ticked the pre-treated box on the bottle. Un = Untreated, meaning the box is not ticked.
Ferrous Iron, Hexavalent Chromium & Geosmin and MIB: F = Field filtered. N/S = Not Specified.
Soil Bags: S = Small. M = Medium (~500mL asbestos or PSD bag). L = Large (~6kg FMT bag)

Lab No.	-S Soil Jar 125mL 250mL (Frozen Wet Dry)	-S Bag Plastic White Green	Nat Green 1L	Nat Green 500mL	Nat Green 250mL	Nat White 500mL 1L	UT Nutrients Light Green (T)	UT Nutrients Turquoise (F)	-G Green Vial (Geos & MIB)	-O Glass Orange 100 mL	-O Glass Orange 500 mL	Glass Purp (O&G) 250ML 1L	-P Plastic Purp 250mL 125mL 60mL	Plastic Grey (PFOS / PFOA) 60ml 250ml	Bacto Black / Thio Grey 250mL 500mL	-RF -RT 60mL Nitric Red STD F	STD T	ORC F	ORC T	-RGF -RGT 60mL Lab Acidified STD F	STD T	ORC F	ORC T	NaOH Hexa Chrome Blue 60mL F	T	-B NaOH CN Blue 60mL 250mL	0.5L Glass Brown CIRCLE Lab Preserved Or Pre-preserved	Fluoro Yellow (Sulfide) 250mL UHS F	T	Fluoro Orange 125mL (Sulfite)	-M HCl Fe^{2+} Maroon 60mL F	T	-TOC -DOC Vial H_2SO_4 Purple 40mL TOC	DOC	-VOC Vial H_2SO_4 Purple 40mL (VOC)	H.S Y/N	EDA Vial 40mL	Endo-Toxin Tube	DUST CuSO4 UnPres 2.5L 4L	Other
	This line allows for an initial indication of bottle types received without specifying the exact number for each sample. When using this function tick the boxes matching the containers received for this work order.																																							
1																																								
2																																								
3																																								
4																																								
5																																								
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CHAIN OF CUSTODY CHAIN OF CUSTODY

ALS Laboratory: please tick → ALS Laboratory: please tick →

☐ Sydney: 277 Woodpark Rd, Smithfield NSW 2176 Ph: 02 8784 8555 E: samples.sydney@alsenviro.com
☐ Newcastle: 5 Rosegum Rd, Warabrook NSW 2304 Ph: 02 4968 9433 E: samples.newcastle@alsenviro.com
☐ Brisbane: 32 Shand St, Stafford QLD 4053 Ph: 07 3243 7222 E: samples.brisbane@alsenviro.com
☐ Townsville: 14-15 Desma Ct, Bohle QLD 4818 Ph: 07 4796 0600 E: townsville.environmental@alsenviro.com
☐ Melbourne: 2-4 Westall Rd, Springvale VIC 3171 Ph: 03 8549 9600 E: samples.melbourne@alsenviro.com
☐ Adelaide: 2-1 Burma Rd, Pooraka SA 5095 Ph: 08 8359 0890 E: adelaide@alsenviro.com
☐ Perth: 10 Hod Way, Mala... Ph: 08 9209 7655 E: sample...
☐ Launceston: 27 Wellingt... Ph: 03 6331 2158 E: launce...

Environmental Division
Brisbane
Work Order Reference
EB2220427

Telephone : + 61-7-3243 7222

CLIENT:	PRECISE ENVIRONMENTAL	TURNAROUND REQUIREMENTS : (Standard TAT may be longer for some tests e.g. Ultra Trace Organics)	☐ Standard TAT (List due date): ☐ Non Standard or urgent TAT (List due date):
OFFICE:	7/14 FREMANTLE ST, BURLEIGH HEADS 4220		
PROJECT:	PE3394.22	ALS QUOTE NO.:	BN031/16 v4
ORDER NUMBER:	PE3394.22	COC SEQUENCE NUMBER (Circle)	COC: 1 2 3 4 5 6 7 / OF: 1 2 3 4 5 6 7
PROJECT MANAGER:	CHRIS BUTLER	CONTACT: 0431 565 210	
SAMPLER:	CHRIS BUTLER / SEAN GARDINER	SAMPLER MOBILE: 0409 827 396	
COC emailed to ALS? (YES / NO)		EDD FORMAT (or default):	
Email Reports to: mail@preciseenvironmental.com.au			
Mail Invoice to: PO Box 4424, Robina Town Centre 4230			

RELINQUISHED BY:	RECEIVED BY:	RELINQUISHED BY:
CHRIS BUTLER		
DATE/TIME: C. Butler 13.07.22 9AM	DATE/TIME:	DATE/TIME:

FOR LABORATORY USE ONLY: Custody Seal Intact? Free ice / frozen ice bricks present upon receipt? Random Sample Temperature on Receipt: Other comment:

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

ALS USE ONLY	SAMPLE DETAILS Water(W)	MATRIX: Solid(S)			CONTAINER INFORMATION		ANALYSIS REQUIRED including SUITES (NB. Suite Codes must be listed to attract suite price) Where Metals are required, specify Total (unfiltered bottle required) or Dissolved (field filtered bottle required).								Additional Information
LAB ID	SAMPLE ID	SAMPLE DESCRIPTION	DATE / TIME	MATRIX	TYPE & PRESERVATIVE (refer to codes below)	TOTAL BOTTLES	EA037 (pHF and pHFOX)	EA033 (Chromium suite)							Comments on likely contaminant levels, dilutions, or samples requiring specific QC analysis etc.
1	BH1	0.0	12.07.22	s	BAG/<4°C	1	x	x							
2	BH1	0.25	12.07.22	s	BAG/<4°C	1	x								
3	BH1	0.50	12.07.22	s	BAG/<4°C	1	x	x							
4	BH1	0.75	12.07.22	s	BAG/<4°C	1	x								
5	BH1	1.00	12.07.22	s	BAG/<4°C	1	x	x							
6	BH1	1.25	12.07.22	s	BAG/<4°C	1	x								
7	BH1	1.50	12.07.22	s	BAG/<4°C	1	x	x							
8	BH1	1.75	12.07.22	s	BAG/<4°C	1	x								
9	BH1	2.00	12.07.22	s	BAG/<4°C	1	x								
10	BH1	2.25	12.07.22	s	BAG/<4°C	1	x								
11	BH1	2.50	12.07.22	s	BAG/<4°C	1	x	x							
12	BH1	2.75	12.07.22	s	BAG/<4°C	1	x								
					TOTAL	12									

SPLIT BATCH
Test
Assoc. Batch No.
EB2220520

Water Container Codes: P = Unpreserved Plastic; N = Nitric Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide/Cd Preserved; S = Sodium Hydroxide Preserved Plastic; AG = Amber Glass Unpreserved; AP - Airfreight Unpreserved Plastic
V = VOA Vial HCl Preserved; VB = VOA Vial Sodium Bisulphate Preserved; VS = VOA Vial Sulfuric Preserved; AV = Airfreight Unpreserved Vial SG = Sulfuric Preserved Amber Glass; H = HCl preserved Plastic; HS = HCl preserved Speciation bottle; SP = Sulfuric Preserved Plastic; F = Formaldehyde Preserved Glass;
Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; ASS = Plastic Bag for Acid Sulphate Soils; B = Unpreserved Bag

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☐ Melbourne: 2-4 Westall Rd, Springvale VIC 3171 Ph 03 8549 9600 E: samples.melbourne@alsenviro.com
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☐ Perth: 10 Hod Way, Malaga WA 6090 Ph: 08 9209 7655 E: samples.perth@alsenviro.com
☐ Launceston: 27 Wellington St, Launceston TAS 7250 Ph: 03 6331 2158 E: launceston@alsenviro.com

CLIENT:	PRECISE ENVIRONMENTAL
OFFICE:	7/14 FREMANTLE ST, BURLEIGH HEADS 4220
PROJECT:	PE3394.22
ORDER NUMBER:	PE3394.22
PROJECT MANAGER:	CHRIS BUTLER — CONTACT: 0431 565 210
SAMPLER:	CHRIS BUTLER / SEAN GARDINER — SAMPLER MOBILE: 0409 827 396
COC emailed to ALS? (YES / NO)	EDD FORMAT (or default):
Email Reports to: mail@preciseenvironmental.com.au	
Mail Invoice to: PO Box 4424, Robina Town Centre 4230	

TURNAROUND REQUIREMENTS : (Standard TAT may be longer for some tests e.g. Ultra Trace Organics)
☐ Standard TAT (List due date):
☐ Non Standard or urgent TAT (List due date):

ALS QUOTE NO.: BN031/16 v4

COC SEQUENCE NUMBER (Circle)
COC: 1 2 3 4 5 6 7
OF: 1 2 3 4 5 6 7

FOR LABORATORY USE ONLY (Circle)
Custody Seal Intact? Yes No N/A
Free ice / frozen ice bricks present upon receipt? Yes No N/A
Random Sample Temperature on Receipt: °C
Other comment:

RELINQUISHED BY:	RECEIVED BY:	RELINQUISHED BY:	RECEIVED BY:
CHRIS BUTLER			
DATE/TIME: C Butler 13.07.22 9AM	DATE/TIME:	DATE/TIME:	DATE/TIME:

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

ALS USE ONLY	SAMPLE DETAILS MATRIX: Solid(S) Water(W)				CONTAINER INFORMATION		ANALYSIS REQUIRED including SUITES (NB. Suite Codes must be listed to attract suite price) Where Metals are required, specify Total (unfiltered bottle required) or Dissolved (field filtered bottle required).								Additional Information
LAB ID	SAMPLE ID	SAMPLE DESCRIPTION	DATE / TIME	MATRIX	TYPE & PRESERVATIVE (refer to codes below)	TOTAL BOTTLES	EA037 (pHF and pHFOX)	EA033 (Chromium suite)							Comments on likely contaminant levels, dilutions, or samples requiring specific QC analysis etc.
13	BH2	0.0	12.07.22	S	BAG/<4°C	1	X								
14	BH2	0.25	12.07.22	S	BAG/<4°C	1	X								
15	BH2	0.50	12.07.22	S	BAG/<4°C	1	X								
16	BH2	0.75	12.07.22	S	BAG/<4°C	1	X								
17	BH2	1.00	12.07.22	S	BAG/<4°C	1	X								
18	BH2	1.25	12.07.22	S	BAG/<4°C	1	X								
19	BH2	1.50	12.07.22	S	BAG/<4°C	1	X								
20	BH2	1.75	12.07.22	S	BAG/<4°C	1	X								
					TOTAL	8									

Water Container Codes: P = Unpreserved Plastic; N = Nitric Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide/Cd Preserved; S = Sodium Hydroxide Preserved Plastic; AG = Amber Glass Unpreserved; AP - Airfreight Unpreserved Plastic
V = VOA Vial HCl Preserved; VB = VOA Vial Sodium Bisulphate Preserved; VS = VOA Vial Sulfuric Preserved; AV = Airfreight Unpreserved Vial SG = Sulfuric Preserved Amber Glass; H = HCl preserved Plastic; HS = HCl preserved Speciation bottle; SP = Sulfuric Preserved Plastic; F = Formaldehyde Preserved Glass;
Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; ASS = Plastic Bag for Acid Sulphate Soils; B = Unpreserved Bag.

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☐ Townsville: 14-15 Desma Ct, Bohle QLD 4818 Ph: 07 4796 0600 E: townsville.environmental@alsenviro.com
☐ Melbourne: 2-4 Westall Rd, Springvale VIC 3171 Ph: 03 8549 9600 E: samples.melbourne@alsenviro.com
☐ Adelaide: 2-1 Burma Rd, Pooraka SA 5095 Ph: 08 8359 0890 E: adelaide@alsenviro.com
☐ Perth: 10 Hod Way, Malaga WA 6090 Ph: 08 9209 7655 E: samples.perth@alsenviro.com
☐ Launceston: 27 Wellington St, Launceston TAS 7250 Ph: 03 6331 2158 E: launceston@alsenviro.com

CLIENT:	PRECISE ENVIRONMENTAL	TURNAROUND REQUIREMENTS : (Standard TAT may be longer for some tests e.g., Ultra Trace Organics)	☐ Standard TAT (List due date): ☐ Non Standard or urgent TAT (List due date):
OFFICE:	7/14 FREMANTLE ST, BURLEIGH HEADS 4220		
PROJECT:	PE3394.22	ALS QUOTE NO.:	BN031/16 v4
ORDER NUMBER:	PE3394.22	COC SEQUENCE NUMBER (Circle)	COC: 1 2 3 4 5 6 7 / OF: 1 2 3 4 5 6 7
PROJECT MANAGER:	CHRIS BUTLER	CONTACT: 0431 565 210	
SAMPLER:	CHRIS BUTLER / SEAN GARDINER	SAMPLER MOBILE: 0409 827 396	
COC emailed to ALS? (YES / NO)		EDD FORMAT (or default):	
Email Reports to: mail@preciseenvironmental.com.au			
Mail Invoice to: PO Box 4424, Robina Town Centre 4230			

FOR LABORATORY USE ONLY (Circle)
Custody Seal Intact? Yes No N/A
Free ice / frozen ice bricks present upon receipt? Yes No N/A
Random Sample Temperature on Receipt: °C
Other comment:

RELINQUISHED BY:	RECEIVED BY:	RELINQUISHED BY:	RECEIVED BY:
CHRIS BUTLER			
DATE/TIME: C Butler	DATE/TIME:	DATE/TIME:	DATE/TIME:
13.07.22 9AM			

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

ALS USE ONLY	SAMPLE DETAILS MATRIX: Solid(S) Water(W)				CONTAINER INFORMATION		ANALYSIS REQUIRED including SUITES (NB. Suite Codes must be listed to attract suite price) Where Metals are required, specify Total (unfiltered bottle required) or Dissolved (field filtered bottle required).								Additional Information
LAB ID	SAMPLE ID	SAMPLE DESCRIPTION	DATE / TIME	MATRIX	TYPE & PRESERVATIVE (refer to codes below)	TOTAL BOTTLES	EA037 (pHF and pHFOX)	EA033 (Chromium suite)							Comments on likely contaminant levels, dilutions, or samples requiring specific QC analysis etc.
21	BH3	0.0	12.07.22	s	BAG/<4°C	1	x								
22	BH3	0.25	12.07.22	s	BAG/<4°C	1	x								
23	BH3	0.50	12.07.22	s	BAG/<4°C	1	x								
24	BH3	0.75	12.07.22	s	BAG/<4°C	1	x								
25	BH3	1.00	12.07.22	s	BAG/<4°C	1	x								
26	BH3	1.25	12.07.22	s	BAG/<4°C	1	x								
27	BH3	1.50	12.07.22	s	BAG/<4°C	1	x								
28	BH3	1.75	12.07.22	s	BAG/<4°C	1	x								
					TOTAL	8									

Water Container Codes: P = Unpreserved Plastic; N = Nitric Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide/Cd Preserved; S = Sodium Hydroxide Preserved Plastic; AG = Amber Glass Unpreserved; AP - Airfreight Unpreserved Plastic
V = VOA Vial HCl Preserved; VB = VOA Vial Sodium Bisulphate Preserved; VS = VOA Vial Sulfuric Preserved; AV = Airfreight Unpreserved Vial SG = Sulfuric Preserved Amber Glass; H = HCl preserved Plastic; HS = HCl preserved Speciation bottle; SP = Sulfuric Preserved Plastic; F = Formaldehyde Preserved Glass;
Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; ASS = Plastic Bag for Acid Sulphate Soils; B = Unpreserved Bag.

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CLIENT:	PRECISE ENVIRONMENTAL	TURNAROUND REQUIREMENTS : (Standard TAT may be longer for some tests e.g., Ultra Trace Organics)	☐ Standard TAT (List due date): ☐ Non Standard or urgent TAT (List due date):
OFFICE:	7/14 FREMANTLE ST, BURLEIGH HEADS 4220		
PROJECT:	PE3394.22	ALS QUOTE NO.:	BN031/16 v4
ORDER NUMBER:	PE3394.22	COC SEQUENCE NUMBER (Circle)	COC: 1 2 3 4 5 6 7 / OF: 1 2 3 4 5 6 7
PROJECT MANAGER:	CHRIS BUTLER	CONTACT: 0431 565 210	
SAMPLER:	CHRIS BUTLER / SEAN GARDINER	SAMPLER MOBILE: 0409 827 396	
COC emailed to ALS? (YES / NO)		EDD FORMAT (or default):	
Email Reports to: mail@preciseenvironmental.com.au			
Mail Invoice to: PO Box 4424, Robina Town Centre 4230			

FOR LABORATORY USE ONLY (Circle)
Custody Seal Intact? Yes No N/A
Free ice / frozen ice bricks present upon receipt? Yes No N/A
Random Sample Temperature on Receipt: °C
Other comment:

RELINQUISHED BY:	RECEIVED BY:	RELINQUISHED BY:	RECEIVED BY:
CHRIS BUTLER			
DATE/TIME: C. Butler 13.07.22 9AM	DATE/TIME:	DATE/TIME:	DATE/TIME:

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

ALS USE ONLY	SAMPLE DETAILS Water(W) MATRIX: Solid(S)				CONTAINER INFORMATION		ANALYSIS REQUIRED including SUITES (NB. Suite Codes must be listed to attract suite price) Where Metals are required, specify Total (unfiltered bottle required) or Dissolved (field filtered bottle required).								Additional Information
LAB ID	SAMPLE ID	SAMPLE DESCRIPTION	DATE / TIME	MATRIX	TYPE & PRESERVATIVE (refer to codes below)	TOTAL BOTTLES	EA037 (pHF and pHFOX)	EA033 (Chromium suite)							Comments on likely contaminant levels, dilutions, or samples requiring specific QC analysis etc.
29	BH4	0.0	12.07.22	S	BAG/<4°C	1	X	X							
30	BH4	0.25	12.07.22	S	BAG/<4°C	1	X								
31	BH4	0.50	12.07.22	S	BAG/<4°C	1	X	X							
32	BH4	0.75	12.07.22	S	BAG/<4°C	1	X								
33	BH4	1.00	12.07.22	S	BAG/<4°C	1	X	X							
34	BH4	1.25	12.07.22	S	BAG/<4°C	1	X								
35	BH4	1.50	12.07.22	S	BAG/<4°C	1	X	X							
36	BH4	1.75	12.07.22	S	BAG/<4°C	1	X								
37	BH4	2.00	12.07.22	S	BAG/<4°C	1	X								
38	BH4	2.25	12.07.22	S	BAG/<4°C	1	X	X							
					TOTAL	10									

Water Container Codes: P = Unpreserved Plastic; N = Nitric Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide/Cd Preserved; S = Sodium Hydroxide Preserved Plastic; AG = Amber Glass Unpreserved; AP - Airfreight Unpreserved Plastic
V = VOA Vial HCl Preserved; VB = VOA Vial Sodium Bisulphate Preserved; VS = VOA Vial Sulfuric Preserved; AV = Airfreight Unpreserved Vial SG = Sulfuric Preserved Amber Glass; H = HCl preserved Plastic; HS = HCl preserved Speciation bottle; SP = Sulfuric Preserved Plastic; F = Formaldehyde Preserved Glass;
Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; ASS = Plastic Bag for Acid Sulphate Soils; B = Unpreserved Bag

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CLIENT:	PRECISE ENVIRONMENTAL
OFFICE:	7/14 FREMANTLE ST, BURLEIGH HEADS 4220
PROJECT:	PE3394.22
ORDER NUMBER:	PE3394.22
PROJECT MANAGER:	CHRIS BUTLER — CONTACT: 0431 565 210
SAMPLER:	CHRIS BUTLER / SEAN GARDINER — SAMPLER MOBILE: 0409 827 396
COC emailed to ALS? (YES / NO)	EDD FORMAT (or default):
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TURNAROUND REQUIREMENTS : (Standard TAT may be longer for some tests e.g.. Ultra Trace Organics)
☐ Standard TAT (List due date):
☐ Non Standard or urgent TAT (List due date):

ALS QUOTE NO.: BN031/16 v4

COC SEQUENCE NUMBER (Circle)
COC: 1 2 3 4 5 6 7
OF: 1 2 3 4 5 6 7

FOR LABORATORY USE ONLY (Circle)
Custody Seal Intact? Yes No N/A
Free ice / frozen ice bricks present upon receipt? Yes No N/A
Random Sample Temperature on Receipt:
Other comment:

RELINQUISHED BY:	RECEIVED BY:	RELINQUISHED BY:	RECEIVED BY:
CHRIS BUTLER			
DATE/TIME: C. Butler	DATE/TIME:	DATE/TIME:	DATE/TIME:
13.07.22 9AM			

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

SAMPLE DETAILS — MATRIX: Solid(S) Water(W)

CONTAINER INFORMATION

ANALYSIS REQUIRED including SUITES (NB. Suite Codes must be listed to attract suite price)
Where Metals are required, specify Total (unfiltered bottle required) or Dissolved (field filtered bottle required).

Additional Information: Comments on likely contaminant levels, dilutions, or samples requiring specific QC analysis etc.

ALS USE ONLY LAB ID	SAMPLE ID	SAMPLE DESCRIPTION	DATE / TIME	MATRIX	TYPE & PRESERVATIVE (refer to codes below)	TOTAL BOTTLES	EA037 (pHF and pHFOX)	EA033 (Chromium suite)						Additional Information
39	BH5	0.0	12.07.22	S	BAG/<4°C	1	X							
40	BH5	0.50	12.07.22	S	BAG/<4°C	1	X							
41	BH5	0.75	12.07.22	S	BAG/<4°C	1	X							
42	BH5	1.00	12.07.22	S	BAG/<4°C	1	X							
43	BH5	1.25	12.07.22	S	BAG/<4°C	1	X							
44	BH5	1.50	12.07.22	S	BAG/<4°C	1	X							
45	BH5	1.75	12.07.22	S	BAG/<4°C	1	X							
46	BH5	2.00	12.07.22	S	BAG/<4°C	1	X							
47	BH5	2.25	12.07.22	S	BAG/<4°C	1	X							
					TOTAL	9								

Water Container Codes: P = Unpreserved Plastic; N = Nitric Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide/Cd Preserved; S = Sodium Hydroxide Preserved Plastic; AG = Amber Glass Unpreserved; AP - Airfreight Unpreserved Plastic
V = VOA Vial HCl Preserved; VB = VOA Vial Sodium Bisulphate Preserved; VS = VOA Vial Sulfuric Preserved; AV = Airfreight Unpreserved Vial SG = Sulfuric Preserved Amber Glass; H = HCl preserved Plastic; HS = HCl preserved Speciation bottle; SP = Sulfuric Preserved Plastic; F = Formaldehyde Preserved Glass;
Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; ASS = Plastic Bag for Acid Sulphate Soils; B = Unpreserved Bag.

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OFFICE:	7/14 FREMANTLE ST, BURLEIGH HEADS 4220		
PROJECT:	PE3394.22	ALS QUOTE NO.:	BN031/16 v4
ORDER NUMBER:	PE3394.22	COC SEQUENCE NUMBER (Circle)	COC: 1 2 3 4 5 6 7
PROJECT MANAGER:	CHRIS BUTLER	CONTACT: 0431 565 210	OF: 1 2 3 4 5 6 7
SAMPLER:	CHRIS BUTLER / SEAN GARDINER	SAMPLER MOBILE: 0409 827 396	
COC emailed to ALS? (YES / NO)		EDD FORMAT (or default):	
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Mail Invoice to: PO Box 4424, Robina Town Centre 4230			

FOR LABORATORY USE ONLY (Circle)
Custody Seal Intact? Yes No N/A
Free ice / frozen ice bricks present upon receipt? Yes No N/A
Random Sample Temperature on Receipt: °C
Other comment:

RELINQUISHED BY:	RECEIVED BY:	RELINQUISHED BY:	RECEIVED BY:
CHRIS BUTLER			
DATE/TIME: 13.07.22 9AM	DATE/TIME:	DATE/TIME:	DATE/TIME:

C Butler

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

ALS USE ONLY	SAMPLE DETAILS MATRIX: Solid(S) Water(W)				CONTAINER INFORMATION		ANALYSIS REQUIRED including SUITES (NB. Suite Codes must be listed to attract suite price) Where Metals are required, specify Total (unfiltered bottle required) or Dissolved (field filtered bottle required).								Additional Information
LAB ID	SAMPLE ID	SAMPLE DESCRIPTION	DATE / TIME	MATRIX	TYPE & PRESERVATIVE (refer to codes below)	TOTAL BOTTLES	EA037 (pHF and pHFOX)	EA033 (Chromium suite)							Comments on likely contaminant levels, dilutions, or samples requiring specific QC analysis etc.
48	BH6	0.0	12.07.22	S	BAG/<4°C	1	X	X							
49	BH6	0.25	12.07.22	S	BAG/<4°C	1	X								
50	BH6	0.50	12.07.22	S	BAG/<4°C	1	X	X							
51	BH6	0.75	12.07.22	S	BAG/<4°C	1	X								
52	BH6	1.00	12.07.22	S	BAG/<4°C	1	X	X							
53	BH6	1.25	12.07.22	S	BAG/<4°C	1	X								
54	BH6	1.50	12.07.22	S	BAG/<4°C	1	X	X							
55	BH6	1.75	12.07.22	S	BAG/<4°C	1	X								
56	BH6	2.00	12.07.22	S	BAG/<4°C	1	X								
57	BH6	2.25	12.07.22	S	BAG/<4°C	1	X								
58	BH6	2.50	12.07.22	S	BAG/<4°C	1	X	X							
59	BH6	2.75	12.07.22	S	BAG/<4°C	1	X								
					TOTAL	12									

Water Container Codes: P = Unpreserved Plastic; N = Nitric Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide/Cd Preserved; S = Sodium Hydroxide Preserved Plastic; AG = Amber Glass Unpreserved; AP - Airfreight Unpreserved Plastic
V = VOA Vial HCl Preserved; VB = VOA Vial Sodium Bisulphate Preserved; VS = VOA Vial Sulfuric Preserved; AV = Airfreight Unpreserved Vial SG = Sulfuric Preserved Amber Glass; H = HCl preserved Plastic; HS = HCl preserved Speciation bottle; SP = Sulfuric Preserved Plastic; F = Formaldehyde Preserved Glass;
Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; ASS = Plastic Bag for Acid Sulphate Soils; B = Unpreserved Bag.

CHAIN OF CUSTODY CHAIN OF CUSTODY

ALS Laboratory: please tick → ALS Laboratory: please tick →

☐ Sydney: 277 Woodpark Rd, Smithfield NSW 2176 Ph: 02 8784 8555 E:samples.sydney@alsenviro.com
☐ Newcastle: 5 Rosegum Rd, Warabrook NSW 2304 Ph: 02 4968 9433 E:samples.newcastle@alsenviro.com
☐ Brisbane: 32 Shand St, Stafford QLD 4053 Ph:07 3243 7222 E:samples.brisbane@alsenviro.com
☐ Townsville: 14-15 Desma Ct, Bohle QLD 4818 Ph:07 4796 0600 E: townsville.environmental@alsenviro.com
☐ Melbourne: 2-4 Westall Rd, Springvale VIC 3171 Ph:03 8549 9600 E: samples.melbourne@alsenviro.com
☐ Adelaide: 2-1 Burma Rd, Pooraka SA 5095 Ph: 08 8359 0890 E:adelaide@alsenviro.com
☐ Perth: 10 Hod Way, Malaga WA 6090 Ph: 08 9209 7655 E: samples.perth@alsenviro.com
☐ Launceston: 27 Wellington St, Launceston TAS 7250 Ph: 03 6331 2158 E: launceston@alsenviro.com

CLIENT:	PRECISE ENVIRONMENTAL	TURNAROUND REQUIREMENTS : (Standard TAT may be longer for some tests e.g.. Ultra Trace Organics)	☐ Standard TAT (List due date): ☐ Non Standard or urgent TAT (List due date):
OFFICE:	7/14 FREMANTLE ST, BURLEIGH HEADS 4220		
PROJECT:	PE3394.22	ALS QUOTE NO.:	BN031/16 v4
ORDER NUMBER:	PE3394.22	COC SEQUENCE NUMBER (Circle)	COC: 1 2 3 4 5 6 7 / OF: 1 2 3 4 5 6 7
PROJECT MANAGER:	CHRIS BUTLER	CONTACT: 0431 565 210	
SAMPLER:	CHRIS BUTLER / SEAN GARDINER	SAMPLER MOBILE: 0409 827 396	
COC emailed to ALS? (YES / NO)		EDD FORMAT (or default):	
Email Reports to: mail@preciseenvironmental.com.au			
Mail Invoice to: PO Box 4424, Robina Town Centre 4230			

FOR LABORATORY USE ONLY (Circle): Custody Seal Intact? Yes No N/A; Free ice / frozen ice bricks present upon receipt? Yes No N/A; Random Sample Temperature on Receipt: °C; Other comment:

RELINQUISHED BY:	RECEIVED BY:	RELINQUISHED BY:	RECEIVED BY:
CHRIS BUTLER			
DATE/TIME: 13.07.22 9AM (signed) C. Butler	DATE/TIME:	DATE/TIME:	DATE/TIME:

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

ALS USE ONLY	SAMPLE DETAILS Water(W)			MATRIX: Solid(S)	CONTAINER INFORMATION		ANALYSIS REQUIRED including SUITES (NB. Suite Codes must be listed to attract suite price) Where Metals are required, specify Total (unfiltered bottle required) or Dissolved (field filtered bottle required).								Additional Information
LAB ID	SAMPLE ID	SAMPLE DESCRIPTION	DATE / TIME	MATRIX	TYPE & PRESERVATIVE (refer to codes below)	TOTAL BOTTLES	EA037 (pHF and pHFOX)	EA033 (Chromium suite)							Comments on likely contaminant levels, dilutions, or samples requiring specific QC analysis etc.
60	BH7	0.0	12.07.22	S	BAG/<4°C	1	X								
61	BH7	0.25	12.07.22	S	BAG/<4°C	1	X								
62	BH7	0.50	12.07.22	S	BAG/<4°C	1	X								
63	BH7	0.75	12.07.22	S	BAG/<4°C	1	X								
64	BH7	1.00	12.07.22	S	BAG/<4°C	1	X								
65	BH7	1.25	12.07.22	S	BAG/<4°C	1	X								
66	BH7	1.50	12.07.22	S	BAG/<4°C	1	X								
67	BH7	1.75	12.07.22	S	BAG/<4°C	1	X								
					TOTAL	8									

Water Container Codes: P = Unpreserved Plastic; N = Nitric Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide/Cd Preserved; S = Sodium Hydroxide Preserved Plastic; AG = Amber Glass Unpreserved; AP - Airfreight Unpreserved Plastic
V = VOA Vial HCl Preserved; VB = VOA Vial Sodium Bisulphate Preserved; VS = VOA Vial Sulfuric Preserved; AV = Airfreight Unpreserved Vial SG = Sulfuric Preserved Amber Glass; H = HCl preserved Plastic; HS = HCl preserved Speciation bottle; SP = Sulfuric Preserved Plastic; F = Formaldehyde Preserved Glass;
Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; ASS = Plastic Bag for Acid Sulphate Soils; B = Unpreserved Bag.

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☐ Brisbane: 32 Shand St, Stafford QLD 4053 Ph: 07 3243 7222 E: samples.brisbane@alsenviro.com
☐ Townsville: 14-15 Desma Ct, Bohle QLD 4818 Ph: 07 4796 0600 E: townsville.environmental@alsenviro.com
☐ Melbourne: 2-4 Westall Rd, Springvale VIC 3171 Ph: 03 8549 9600 E: samples.melbourne@alsenviro.com
☐ Adelaide: 2-1 Burma Rd, Pooraka SA 5095 Ph: 08 8359 0890 E: adelaide@alsenviro.com
☐ Perth: 10 Hod Way, Mala Ph: 08 9209 7655 E: sample
☐ Launceston: 27 Welling Ph: 03 6331 2158 E: launce

Environmental Divis
Brisbane
Work Order Referenc
EB222042

Telephone : + 61-7-3243 7222

CLIENT:	PRECISE ENVIRONMENTAL	TURNAROUND REQUIREMENTS : (Standard TAT may be longer for some tests e.g. Ultra Trace Organics)	☐ Standard TAT (List due date): ☐ Non Standard or urgent TAT (List due date):
OFFICE:	7/14 FREMANTLE ST, BURLEIGH HEADS 4220	ALS QUOTE NO.:	BN031/16 v4
PROJECT:	PE3394.22	COC SEQUENCE NUMBER (Circle)	COC: 1 2 3 4 5 6 7 / OF: 1 2 3 4 5 6 7
ORDER NUMBER:	PE3394.22		
PROJECT MANAGER:	CHRIS BUTLER	CONTACT: 0431 565 210	
SAMPLER:	CHRIS BUTLER / SEAN GARDINER	SAMPLER MOBILE: 0409 827 396	
COC emailed to ALS? (YES / NO)		EDD FORMAT (or default):	
Email Reports to: mail@preciseenvironmental.com.au			
Mail Invoice to: PO Box 4424, Robina Town Centre 4230			

RELINQUISHED BY:	RECEIVED BY:	RELINQUISHED BY:
CHRIS BUTLER		
DATE/TIME: C. Butler 13.07.22 9AM	DATE/TIME:	DATE/TIME:

FOR LABORATORY USE ONLY: Custody Seal Intact? Free ice / frozen ice bricks present upon receipt? Random Sample Temperature on Receipt: Other comment:

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

SAMPLE DETAILS — MATRIX: Solid(S) Water(W)

CONTAINER INFORMATION

ANALYSIS REQUIRED including SUITES (NB. Suite Codes must be listed to attract suite price) Where Metals are required, specify Total (unfiltered bottle required) or Dissolved (field filtered bottle required).

LAB ID (ALS USE ONLY)	SAMPLE ID	SAMPLE DESCRIPTION	DATE / TIME	MATRIX	TYPE & PRESERVATIVE (refer to codes below)	TOTAL BOTTLES	EA037 (pHF and pHFOX)	EA033 (Chromium suite)	Additional Information: Comments on likely contaminant levels, dilutions, or samples requiring specific QC analysis etc.
1	BH1	0.0	12.07.22	S	BAG/<4°C	1	X	X	
2	BH1	0.25	12.07.22	S	BAG/<4°C	1	X		
3	BH1	0.50	12.07.22	S	BAG/<4°C	1	X	X	
4	BH1	0.75	12.07.22	S	BAG/<4°C	1	X		
5	BH1	1.00	12.07.22	S	BAG/<4°C	1	X	X	
6	BH1	1.25	12.07.22	S	BAG/<4°C	1	X		
7	BH1	1.50	12.07.22	S	BAG/<4°C	1	X	X	
8	BH1	1.75	12.07.22	S	BAG/<4°C	1	X		
9	BH1	2.00	12.07.22	S	BAG/<4°C	1	X		
10	BH1	2.25	12.07.22	S	BAG/<4°C	1	X		
11	BH1	2.50	12.07.22	S	BAG/<4°C	1	X	X	
12	BH1	2.75	12.07.22	S	BAG/<4°C	1	X		
					TOTAL	12			

SPLIT BATCH
Test
Assoc. Batch No.
EB2220520

SCANNED

Water Container Codes: P = Unpreserved Plastic; N = Nitric Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide/Cd Preserved; S = Sodium Hydroxide Preserved Plastic; AG = Amber Glass Unpreserved; AP - Airfreight Unpreserved Plastic
V = VOA Vial HCl Preserved; VB = VOA Vial Sodium Bisulphate Preserved; VS = VOA Vial Sulfuric Preserved; AV = Airfreight Unpreserved Vial SG = Sulfuric Preserved Amber Glass; H = HCl preserved Plastic; HS = HCl preserved Speciation bottle; SP = Sulfuric Preserved Plastic; F = Formaldehyde Preserved Glass;
Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; ASS = Plastic Bag for Acid Sulphate Soils; B = Unpreserved Bag

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☐ Adelaide: 2-1 Burma Rd, Pooraka SA 5095 Ph: 08 8359 0890 E: adelaide@alsenviro.com
☐ Perth: 10 Hod Way, Malaga WA 6090 Ph: 08 9209 7655 E: samples.perth@alsenviro.com
☐ Launceston: 27 Wellington St, Launceston TAS 7250 Ph: 03 6331 2158 E: launceston@alsenviro.com

CLIENT:	PRECISE ENVIRONMENTAL	TURNAROUND REQUIREMENTS : (Standard TAT may be longer for some tests e.g.. Ultra Trace Organics)	☐ Standard TAT (List due date): ☐ Non Standard or urgent TAT (List due date):
OFFICE:	7/14 FREMANTLE ST, BURLEIGH HEADS 4220		
PROJECT:	PE3394.22	ALS QUOTE NO.:	BN031/16 v4
ORDER NUMBER:	PE3394.22	COC SEQUENCE NUMBER (Circle)	COC: 1 2 3 4 5 6 7
PROJECT MANAGER:	CHRIS BUTLER	CONTACT: 0431 565 210	OF: 1 2 3 4 5 6 7
SAMPLER:	CHRIS BUTLER / SEAN GARDINER	SAMPLER MOBILE: 0409 827 396	
COC emailed to ALS? (YES / NO)		EDD FORMAT (or default):	
Email Reports to: mail@preciseenvironmental.com.au			
Mail Invoice to: PO Box 4424, Robina Town Centre 4230			

FOR LABORATORY USE ONLY (Circle)
Custody Seal Intact? Yes No
Free ice / frozen ice bricks present upon receipt? Yes No
Random Sample Temperature on Receipt:
Other comment:

RELINQUISHED BY:	RECEIVED BY:	RELINQUISHED BY:	RECEIVED BY:
CHRIS BUTLER			
DATE/TIME: C. Butler	DATE/TIME:	DATE/TIME:	DATE/TIME:
13.07.22 9AM			

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

ALS USE ONLY	SAMPLE DETAILS Water(W)	MATRIX: Solid(S)			CONTAINER INFORMATION		ANALYSIS REQUIRED including SUITES (NB. Suite Codes must be listed to attract suite price) Where Metals are required, specify Total (unfiltered bottle required) or Dissolved (field filtered bottle required).									Additional Information
LAB ID	SAMPLE ID	SAMPLE DESCRIPTION	DATE / TIME	MATRIX	TYPE & PRESERVATIVE (refer to codes below)	TOTAL BOTTLES	EA037 (pHF and pHFOX)	EA033 (Chromium suite)								Comments on likely contaminant levels, dilutions, or samples requiring specific QC analysis etc.
13	BH2	0.0	12.07.22	S	BAG/<4°C	1	X									
14	BH2	0.25	12.07.22	S	BAG/<4°C	1	X									
15	BH2	0.50	12.07.22	S	BAG/<4°C	1	X									
16	BH2	0.75	12.07.22	S	BAG/<4°C	1	X									
17	BH2	1.00	12.07.22	S	BAG/<4°C	1	X									
18	BH2	1.25	12.07.22	S	BAG/<4°C	1	X									
19	BH2	1.50	12.07.22	S	BAG/<4°C	1	X									
20	BH2	1.75	12.07.22	S	BAG/<4°C	1	X									
					TOTAL	8										

Water Container Codes: P = Unpreserved Plastic; N = Nitric Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide/Cd Preserved; S = Sodium Hydroxide Preserved Plastic; AG = Amber Glass Unpreserved; AP - Airfreight Unpreserved Plastic
V = VOA Vial HCl Preserved; VB = VOA Vial Sodium Bisulphate Preserved; VS = VOA Vial Sulfuric Preserved; AV = Airfreight Unpreserved Vial SG = Sulfuric Preserved Amber Glass; H = HCl preserved Plastic; HS = HCl preserved Speciation bottle; SP = Sulfuric Preserved Plastic; F = Formaldehyde Preserved Glass;
Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; ASS = Plastic Bag for Acid Sulphate Soils; B = Unpreserved Bag.

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☐ Perth: 10 Hod Way, Malaga WA 6090 Ph: 08 9209 7655 E: samples.perth@alsenviro.com
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CLIENT:	PRECISE ENVIRONMENTAL	TURNAROUND REQUIREMENTS : (Standard TAT may be longer for some tests e.g., Ultra Trace Organics)	☐ Standard TAT (List due date): ☐ Non Standard or urgent TAT (List due date):
OFFICE:	7/14 FREMANTLE ST, BURLEIGH HEADS 4220		
PROJECT:	PE3394.22	ALS QUOTE NO.:	BN031/16 v4
ORDER NUMBER:	PE3394.22		
PROJECT MANAGER:	CHRIS BUTLER	CONTACT: 0431 565 210	
SAMPLER:	CHRIS BUTLER / SEAN GARDINER	SAMPLER MOBILE: 0409 827 396	
COC emailed to ALS? (YES / NO)		EDD FORMAT (or default):	
Email Reports to: mail@preciseenvironmental.com.au			
Mail Invoice to: PO Box 4424, Robina Town Centre 4230			

COC SEQUENCE NUMBER (Circle)
COC: 1 2 3 4 5 6 7
OF: 1 2 3 4 5 6 7

RELINQUISHED BY:	RECEIVED BY:	RELINQUISHED BY:	RECEIVED BY:
CHRIS BUTLER			
DATE/TIME: C Butler 13.07.22 9AM	DATE/TIME:	DATE/TIME:	DATE/TIME:

FOR LABORATORY USE ONLY (Circle)
Custody Seal Intact? Yes No
Free ice / frozen ice bricks present upon receipt? Yes No
Random Sample Temperature on Receipt:
Other comment:

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

ALS USE ONLY | SAMPLE DETAILS MATRIX: Solid(S) Water(W) | CONTAINER INFORMATION | ANALYSIS REQUIRED including SUITES (NB. Suite Codes must be listed to attract suite price) Where Metals are required, specify Total (unfiltered bottle required) or Dissolved (field filtered bottle required). | Additional Information

LAB ID	SAMPLE ID	SAMPLE DESCRIPTION	DATE / TIME	MATRIX	TYPE & PRESERVATIVE (refer to codes below)	TOTAL BOTTLES	EA037 (pHF and pHFOX)	EA033 (Chromium suite)							Comments on likely contaminant levels, dilutions, or samples requiring specific QC analysis etc.
21	BH3	0.0	12.07.22	S	BAG/<4°C	1	X								
22	BH3	0.25	12.07.22	S	BAG/<4°C	1	X								
23	BH3	0.50	12.07.22	S	BAG/<4°C	1	X								
24	BH3	0.75	12.07.22	S	BAG/<4°C	1	X								
25	BH3	1.00	12.07.22	S	BAG/<4°C	1	X								
26	BH3	1.25	12.07.22	S	BAG/<4°C	1	X								
27	BH3	1.50	12.07.22	S	BAG/<4°C	1	X								
28	BH3	1.75	12.07.22	S	BAG/<4°C	1	X								
					TOTAL	8									

Water Container Codes: P = Unpreserved Plastic; N = Nitric Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide/Cd Preserved; S = Sodium Hydroxide Preserved Plastic; AG = Amber Glass Unpreserved; AP - Airfreight Unpreserved Plastic
V = VOA Vial HCl Preserved; VB = VOA Vial Sodium Bisulphate Preserved; VS = VOA Vial Sulfuric Preserved; AV = Airfreight Unpreserved Vial SG = Sulfuric Preserved Amber Glass; H = HCl preserved Plastic; HS = HCl preserved Speciation bottle; SP = Sulfuric Preserved Plastic; F = Formaldehyde Preserved Glass;
Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; ASS = Plastic Bag for Acid Sulphate Soils; B = Unpreserved Bag.

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CLIENT:	PRECISE ENVIRONMENTAL
OFFICE:	7/14 FREMANTLE ST, BURLEIGH HEADS 4220
PROJECT:	PE3394.22
ORDER NUMBER:	PE3394.22
PROJECT MANAGER:	CHRIS BUTLER — CONTACT: 0431 565 210
SAMPLER:	CHRIS BUTLER / SEAN GARDINER — SAMPLER MOBILE: 0409 827 396
COC emailed to ALS? (YES / NO)	EDD FORMAT (or default):
Email Reports to:	mail@preciseenvironmental.com.au
Mail Invoice to:	PO Box 4424, Robina Town Centre 4230

TURNAROUND REQUIREMENTS: (Standard TAT may be longer for some tests e.g., Ultra Trace Organics)
☐ Standard TAT (List due date):
☐ Non Standard or urgent TAT (List due date):

ALS QUOTE NO.: BN031/16 v4

COC SEQUENCE NUMBER (Circle)
COC: 1 2 3 4 5 6 7
OF: 1 2 3 4 5 6 7

FOR LABORATORY USE ONLY (Circle)
Custody Seal Intact? Yes No
Free ice / frozen ice bricks present upon receipt? Yes No
Random Sample Temperature on Receipt:
Other comment:

RELINQUISHED BY:	RECEIVED BY:	RELINQUISHED BY:	RECEIVED BY:
CHRIS BUTLER			
DATE/TIME: C Butler	DATE/TIME:	DATE/TIME:	DATE/TIME:
13.07.22 9AM			

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

ALS USE ONLY	SAMPLE DETAILS	Water(W)	MATRIX: Solid(S)		CONTAINER INFORMATION		ANALYSIS REQUIRED including SUITES (NB. Suite Codes must be listed to attract suite price) Where Metals are required, specify Total (unfiltered bottle required) or Dissolved (field filtered bottle required).								Additional Information
LAB ID	SAMPLE ID	SAMPLE DESCRIPTION	DATE / TIME	MATRIX	TYPE & PRESERVATIVE (refer to codes below)	TOTAL BOTTLES	EA037 (pHF and pHFOX)	EA033 (Chromium suite)							Comments on likely contaminant levels, dilutions, or samples requiring specific QC analysis etc.
29	BH4	0.0	12.07.22	S	BAG/<4°C	1	X	X							
30	BH4	0.25	12.07.22	S	BAG/<4°C	1	X								
31	BH4	0.50	12.07.22	S	BAG/<4°C	1	X	X							
SNR	BH4	0.75	12.07.22	S	BAG/<4°C	1	X								
33	BH4	1.00	12.07.22	S	BAG/<4°C	1	X	X							
34	BH4	1.25	12.07.22	S	BAG/<4°C	1	X								
35	BH4	1.50	12.07.22	S	BAG/<4°C	1	X	X							
36	BH4	1.75	12.07.22	S	BAG/<4°C	1	X								
37	BH4	2.00	12.07.22	S	BAG/<4°C	1	X								
38	BH4	2.25	12.07.22	S	BAG/<4°C	1	X	X							
					TOTAL	10									

Water Container Codes: P = Unpreserved Plastic; N = Nitric Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide/Cd Preserved; S = Sodium Hydroxide Preserved Plastic; AG = Amber Glass Unpreserved; AP - Airfreight Unpreserved Plastic
V = VOA Vial HCl Preserved; VB = VOA Vial Sodium Bisulphate Preserved; VS = VOA Vial Sulfuric Preserved; AV = Airfreight Unpreserved Vial SG = Sulfuric Preserved Amber Glass; H = HCl preserved Plastic; HS = HCl preserved Speciation bottle; SP = Sulfuric Preserved Plastic; F = Formaldehyde Preserved Glass;
Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; ASS = Plastic Bag for Acid Sulphate Soils; B = Unpreserved Bag.

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☐ Newcastle: 5 Rosegum Rd, Warabrook NSW 2304 Ph: 02 4968 9433 E: samples.newcastle@alsenviro.com
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☐ Townsville: 14-15 Desma Ct, Bohle QLD 4818 Ph: 07 4796 0600 E: townsville.environmental@alsenviro.com
☐ Melbourne: 2-4 Westall Rd, Springvale VIC 3171 Ph: 03 8549 9600 E: samples.melbourne@alsenviro.com
☐ Adelaide: 2-1 Burma Rd, Pooraka SA 5095 Ph: 08 8359 0890 E: adelaide@alsenviro.com
☐ Perth: 10 Hod Way, Malaga WA 6090 Ph: 08 9209 7655 E: samples.perth@alsenviro.com
☐ Launceston: 27 Wellington St, Launceston TAS 7250 Ph: 03 6331 2158 E: launceston@alsenviro.com

CLIENT:	PRECISE ENVIRONMENTAL
OFFICE:	7/14 FREMANTLE ST, BURLEIGH HEADS 4220
PROJECT:	PE3394.22
ORDER NUMBER:	PE3394.22
PROJECT MANAGER:	CHRIS BUTLER — CONTACT: 0431 565 210
SAMPLER:	CHRIS BUTLER / SEAN GARDINER — SAMPLER MOBILE: 0409 827 396
COC emailed to ALS? (YES / NO)	EDD FORMAT (or default):
Email Reports to: mail@preciseenvironmental.com.au	
Mail Invoice to: PO Box 4424, Robina Town Centre 4230	

TURNAROUND REQUIREMENTS: (Standard TAT may be longer for some tests e.g., Ultra Trace Organics)
☐ Standard TAT (List due date):
☐ Non Standard or urgent TAT (List due date):

ALS QUOTE NO.: BN031/16 v4

COC SEQUENCE NUMBER (Circle)
COC: 1 2 3 4 5 6 7
OF: 1 2 3 4 5 6 7

FOR LABORATORY USE ONLY (Circle)
Custody Seal Intact? Yes No
Free ice / frozen ice bricks present upon receipt? Yes No
Random Sample Temperature on Receipt:
Other comment:

RELINQUISHED BY:	RECEIVED BY:	RELINQUISHED BY:	RECEIVED BY:
CHRIS BUTLER			
DATE/TIME: C. Butler	DATE/TIME:	DATE/TIME:	DATE/TIME:
13.07.22 9AM			

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

ALS USE ONLY	SAMPLE DETAILS MATRIX: Solid(S) Water(W)				CONTAINER INFORMATION		ANALYSIS REQUIRED including SUITES (NB. Suite Codes must be listed to attract suite price) Where Metals are required, specify Total (unfiltered bottle required) or Dissolved (field filtered bottle required).									Additional Information
LAB ID	SAMPLE ID	SAMPLE DESCRIPTION	DATE / TIME	MATRIX	TYPE & PRESERVATIVE (refer to codes below)	TOTAL BOTTLES	EA037 (pHF and pHFOX)	EA033 (Chromium suite)								Comments on likely contaminant levels, dilutions, or samples requiring specific QC analysis etc.
39	BH5	0.0	12.07.22	S	BAG/<4°C	1	X									
40	BH5	0.50	12.07.22	S	BAG/<4°C	1	X									
41	BH5	0.75	12.07.22	S	BAG/<4°C	1	X									
42	BH5	1.00	12.07.22	S	BAG/<4°C	1	X									
43	BH5	1.25	12.07.22	S	BAG/<4°C	1	X									
44	BH5	1.50	12.07.22	S	BAG/<4°C	1	X									
45	BH5	1.75	12.07.22	S	BAG/<4°C	1	X									
SNR	BH5	2.00	12.07.22	S	BAG/<4°C	1	X									
SNR	BH5	2.25	12.07.22	S	BAG/<4°C	1	X									
					TOTAL	9										

Water Container Codes: P = Unpreserved Plastic; N = Nitric Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide/Cd Preserved; S = Sodium Hydroxide Preserved Plastic; AG = Amber Glass Unpreserved; AP - Airfreight Unpreserved Plastic
V = VOA Vial HCl Preserved; VB = VOA Vial Sodium Bisulphate Preserved; VS = VOA Vial Sulfuric Preserved; AV = Airfreight Unpreserved Vial SG = Sulfuric Preserved Amber Glass; H = HCl preserved Plastic; HS = HCl preserved Speciation bottle; SP = Sulfuric Preserved Plastic; F = Formaldehyde Preserved Glass;
Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; ASS = Plastic Bag for Acid Sulphate Soils; B = Unpreserved Bag.

CHAIN OF CUSTODY CHAIN OF CUSTODY

ALS Laboratory: please tick → ALS Laboratory: please tick →

☐ Sydney: 277 Woodpark Rd, Smithfield NSW 2176 Ph: 02 8784 8555 E:samples.sydney@alsenviro.com
☐ Newcastle: 5 Rosegum Rd, Warabrook NSW 2304 Ph:02 4968 9433 E:samples.newcastle@alsenviro.com
☐ Brisbane: 32 Shand St, Stafford QLD 4053 Ph:07 3243 7222 E:samples.brisbane@alsenviro.com
☐ Townsville: 14-15 Desma Ct, Bohle QLD 4818 Ph:07 4796 0600 E: townsville.environmental@alsenviro.com
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☐ Perth: 10 Hod Way, Malaga WA 6090 Ph: 08 9209 7655 E: samples.perth@alsenviro.com
☐ Launceston: 27 Wellington St, Launceston TAS 7250 Ph: 03 6331 2158 E: launceston@alsenviro.com

CLIENT:	PRECISE ENVIRONMENTAL
OFFICE:	7/14 FREMANTLE ST, BURLEIGH HEADS 4220
PROJECT:	PE3394.22
ORDER NUMBER:	PE3394.22
PROJECT MANAGER:	CHRIS BUTLER — CONTACT: 0431 565 210
SAMPLER:	CHRIS BUTLER / SEAN GARDINER — SAMPLER MOBILE: 0409 827 396
COC emailed to ALS? (YES / NO)	EDD FORMAT (or default):
Email Reports to: mail@preciseenvironmental.com.au	
Mail Invoice to: PO Box 4424, Robina Town Centre 4230	

TURNAROUND REQUIREMENTS: (Standard TAT may be longer for some tests e.g., Ultra Trace Organics)
☐ Standard TAT (List due date):
☐ Non Standard or urgent TAT (List due date):

ALS QUOTE NO.: BN031/16 v4

COC SEQUENCE NUMBER (Circle)
COC: 1 2 3 4 5 6 7
OF: 1 2 3 4 5 6 7

FOR LABORATORY USE ONLY (Circle)
Custody Seal Intact? Yes No
Free ice / frozen ice bricks present upon receipt? Yes No
Random Sample Temperature on Receipt: °C
Other comment:

RELINQUISHED BY:	RECEIVED BY:	RELINQUISHED BY:	RECEIVED BY:
CHRIS BUTLER C. Butler			
DATE/TIME: 13.07.22 9AM	DATE/TIME:	DATE/TIME:	DATE/TIME:

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

ALS USE ONLY	SAMPLE DETAILS Water(W) MATRIX: Solid(S)				CONTAINER INFORMATION		ANALYSIS REQUIRED including SUITES (NB. Suite Codes must be listed to attract suite price) Where Metals are required, specify Total (unfiltered bottle required) or Dissolved (field filtered bottle required).								Additional Information
LAB ID	SAMPLE ID	SAMPLE DESCRIPTION	DATE / TIME	MATRIX	TYPE & PRESERVATIVE (refer to codes below)	TOTAL BOTTLES	EA037 (pHF and pHFOX)	EA033 (Chromium suite)							Comments on likely contaminant levels, dilutions, or samples requiring specific QC analysis etc.
48	BH6	0.0	12.07.22	S	BAG/<4°C	1	X	X							
49	BH6	0.25	12.07.22	S	BAG/<4°C	1	X								
50	BH6	0.50	12.07.22	S	BAG/<4°C	1	X	X							
51	BH6	0.75	12.07.22	S	BAG/<4°C	1	X								
52	BH6	1.00	12.07.22	S	BAG/<4°C	1	X	X							
53	BH6	1.25	12.07.22	S	BAG/<4°C	1	X								
54	BH6	1.50	12.07.22	S	BAG/<4°C	1	X	X							
55	BH6	1.75	12.07.22	S	BAG/<4°C	1	X								
56	BH6	2.00	12.07.22	S	BAG/<4°C	1	X								
57	BH6	2.25	12.07.22	S	BAG/<4°C	1	X								
58	BH6	2.50	12.07.22	S	BAG/<4°C	1	X	X							
59	BH6	2.75	12.07.22	S	BAG/<4°C	1	X								
					TOTAL	12									

Water Container Codes: P = Unpreserved Plastic; N = Nitric Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide/Cd Preserved; S = Sodium Hydroxide Preserved Plastic; AG = Amber Glass Unpreserved; AP - Airfreight Unpreserved Plastic
V = VOA Vial HCl Preserved; VB = VOA Vial Sodium Bisulphate Preserved; VS = VOA Vial Sulfuric Preserved; AV = Airfreight Unpreserved Vial SG = Sulfuric Preserved Amber Glass; H = HCl preserved Plastic; HS = HCl preserved Speciation bottle; SP = Sulfuric Preserved Plastic; F = Formaldehyde Preserved Glass;
Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; ASS = Plastic Bag for Acid Sulphate Soils; B = Unpreserved Bag.

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ALS Laboratory: please tick → ALS Laboratory: please tick →

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☐ Adelaide: 2-1 Burma Rd, Pooraka SA 5095 Ph: 08 8359 0890 E: adelaide@alsenviro.com
☐ Perth: 10 Hod Way, Malaga WA 6090 Ph: 08 9209 7655 E: samples.perth@alsenviro.com
☐ Launceston: 27 Wellington St, Launceston TAS 7250 Ph: 03 6331 2158 E: launceston@alsenviro.com

CLIENT:	PRECISE ENVIRONMENTAL	TURNAROUND REQUIREMENTS : (Standard TAT may be longer for some tests e.g., Ultra Trace Organics)	☐ Standard TAT (List due date): ☐ Non Standard or urgent TAT (List due date):		FOR LABORATORY USE ONLY (Circle) Custody Seal Intact? Yes No; Free ice / frozen ice bricks present upon receipt? Yes No; Random Sample Temperature on Receipt: °C; Other comment:
OFFICE:	7/14 FREMANTLE ST, BURLEIGH HEADS 4220				
PROJECT:	PE3394.22	ALS QUOTE NO.:	BN031/16 v4	COC SEQUENCE NUMBER (Circle)	
ORDER NUMBER:	PE3394.22			COC: 1 2 3 4 5 6 7	
PROJECT MANAGER:	CHRIS BUTLER	CONTACT: 0431 565 210		OF: 1 2 3 4 5 6 7	
SAMPLER:	CHRIS BUTLER / SEAN GARDINER	SAMPLER MOBILE: 0409 827 396	RELINQUISHED BY:	RECEIVED BY:	RELINQUISHED BY: / RECEIVED BY:
COC emailed to ALS? (YES / NO)		EDD FORMAT (or default):	CHRIS BUTLER		
Email Reports to: mail@preciseenvironmental.com.au			DATE/TIME: C Butler	DATE/TIME:	DATE/TIME: / DATE/TIME:
Mail Invoice to: PO Box 4424, Robina Town Centre 4230			13.07.22 9AM		

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

ALS USE ONLY	SAMPLE DETAILS	Water(W)	MATRIX: Solid(S)		CONTAINER INFORMATION		ANALYSIS REQUIRED including SUITES (NB. Suite Codes must be listed to attract suite price) Where Metals are required, specify Total (unfiltered bottle required) or Dissolved (field filtered bottle required).		Additional Information
LAB ID	SAMPLE ID	SAMPLE DESCRIPTION	DATE / TIME	MATRIX	TYPE & PRESERVATIVE (refer to codes below)	TOTAL BOTTLES	EA037 (pHF and pHFOX)	EA033 (Chromium suite)	Comments on likely contaminant levels, dilutions, or samples requiring specific QC analysis etc.
60	BH7	0.0	12.07.22	S	BAG/<4°C	1	X		
61	BH7	0.25	12.07.22	S	BAG/<4°C	1	X		
62	BH7	0.50	12.07.22	S	BAG/<4°C	1	X		
63	BH7	0.75	12.07.22	S	BAG/<4°C	1	X		
64	BH7	1.00	12.07.22	S	BAG/<4°C	1	X		
65	BH7	1.25	12.07.22	S	BAG/<4°C	1	X		
66	BH7	1.50	12.07.22	S	BAG/<4°C	1	X		
67	BH7	1.75	12.07.22	S	BAG/<4°C	1	X		
					TOTAL	8			

Water Container Codes: P = Unpreserved Plastic; N = Nitric Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide/Cd Preserved; S = Sodium Hydroxide Preserved Plastic; AG = Amber Glass Unpreserved; AP - Airfreight Unpreserved Plastic
V = VOA Vial HCl Preserved; VB = VOA Vial Sodium Bisulphate Preserved; VS = VOA Vial Sulfuric Preserved; AV = Airfreight Unpreserved Vial SG = Sulfuric Preserved Amber Glass; H = HCl preserved Plastic; HS = HCl preserved Speciation bottle; SP = Sulfuric Preserved Plastic; F = Formaldehyde Preserved Glass;
Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; ASS = Plastic Bag for Acid Sulphate Soils; B = Unpreserved Bag.

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **EB2220427**	Page	: 1 of 15
Client	: **PRECISE ENVIRONMENTAL PTY LTD**	Laboratory	: Environmental Division Brisbane
Contact	: MR CHRIS BUTLER	Contact	: Nidhi Bhimani
Address	: PO BOX 4424 ROBINA TOWN CENTRE QLD, AUSTRALIA 4230	Address	: 2 Byth Street Stafford QLD Australia 4053
Telephone	: ----	Telephone	: +61-7-3243 7222
Project	: PE3394.22	Date Samples Received	: 14-Jul-2022 11:35
Order number	: PE3394.22	Date Analysis Commenced	: 18-Jul-2022
C-O-C number	: ----	Issue Date	: 20-Jul-2022 11:24
Sampler	: CHRIS BUTLER, SEAN GARDINER		
Site	: ----		
Quote number	: EN/222		
No. of samples received	: 64		
No. of samples analysed	: 64		

Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Ben Felgendrejeris	Senior Acid Sulfate Soil Chemist	Brisbane Acid Sulphate Soils, Stafford, QLD

General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contract for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

- **SPLIT WORK ORDER: It should be noted that ALS has split this work order over the following work orders EB2220520 and EB2220427 due to the size of the sample numbers. For any further information regarding this processing of samples please contact ALS client services division on ALSEnviro.Brisbane@alsglobal.com**
- ASS: EA033 (CRS Suite):Retained Acidity not required because pH KCl greater than or equal to 4.5
- ASS: EA033 (CRS Suite): ANC not required because pH KCl less than 6.5
- ASS: EA037 (Rapid Field and F(ox) screening): pH F(ox) Reaction Rate: 1 - Slight; 2 - Moderate; 3 - Strong; 4 - Extreme
- ASS: EA033 (CRS Suite): Liming rate is calculated and reported on a dry weight basis assuming use of fine agricultural lime ($CaCO_3$) and using a safety factor of 1.5 to allow for non-homogeneous mixing and poor reactivity of lime. For conversion of Liming Rate from 'kg/t dry weight' to 'kg/m3 in-situ soil', multiply 'reported results' x 'wet bulk density of soil in t/m3'.
- EA037 ASS Field Screening: NATA accreditation does not cover performance of this service.

Analytical Results

Sub-Matrix: **SOIL** (Matrix: **SOIL**)			Sample ID	BH1 0.0	BH1 0.25	BH1 0.50	BH1 0.75	BH1 1.00
			Sampling date / time	12-Jul-2022 00:00	12-Jul-2022 00:00	12-Jul-2022 00:00	12-Jul-2022 00:00	12-Jul-2022 00:00
Compound	CAS Number	LOR	Unit	EB2220427-001	EB2220427-002	EB2220427-003	EB2220427-004	EB2220427-005
				Result	Result	Result	Result	Result
EA033-A: Actual Acidity								
pH KCl (23A)	----	0.1	pH Unit	5.1	----	5.8	----	5.7
Titratable Actual Acidity (23F)	----	2	mole H+ / t	31	----	4	----	4
sulfidic - Titratable Actual Acidity (s-23F)	----	0.02	% pyrite S	0.05	----	<0.02	----	<0.02
EA033-B: Potential Acidity								
Chromium Reducible Sulfur (22B)	----	0.005	% S	0.019	----	0.014	----	0.014
acidity - Chromium Reducible Sulfur (a-22B)	----	10	mole H+ / t	12	----	<10	----	<10
EA033-E: Acid Base Accounting								
ANC Fineness Factor	----	0.5	-	1.5	----	1.5	----	1.5
Net Acidity (sulfur units)	----	0.02	% S	0.07	----	0.02	----	0.02
Net Acidity (acidity units)	----	10	mole H+ / t	43	----	13	----	13
Liming Rate	----	1	kg CaCO3/t	3	----	<1	----	<1
Net Acidity excluding ANC (sulfur units)	----	0.02	% S	0.07	----	0.02	----	0.02
Net Acidity excluding ANC (acidity units)	----	10	mole H+ / t	43	----	13	----	13
Liming Rate excluding ANC	----	1	kg CaCO3/t	3	----	<1	----	<1
EA037: Ass Field Screening Analysis								
ø pH (F)	----	0.1	pH Unit	5.9	6.1	6.0	6.3	6.1
ø pH (Fox)	----	0.1	pH Unit	2.9	3.1	4.9	5.4	4.8
ø Reaction Rate	----	1	-	2	2	1	1	1

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	BH1 1.25	BH1 1.50	BH1 1.75	BH1 2.00	BH1 2.25
			Sampling date / time	12-Jul-2022 00:00	12-Jul-2022 00:00	12-Jul-2022 00:00	12-Jul-2022 00:00	12-Jul-2022 00:00
Compound	CAS Number	LOR	Unit	EB2220427-006	EB2220427-007	EB2220427-008	EB2220427-009	EB2220427-010
				Result	Result	Result	Result	Result
EA033-A: Actual Acidity								
pH KCl (23A)	----	0.1	pH Unit	----	5.4	----	----	----
Titratable Actual Acidity (23F)	----	2	mole H+ / t	----	6	----	----	----
sulfidic - Titratable Actual Acidity (s-23F)	----	0.02	% pyrite S	----	<0.02	----	----	----
EA033-B: Potential Acidity								
Chromium Reducible Sulfur (22B)	----	0.005	% S	----	0.197	----	----	----
acidity - Chromium Reducible Sulfur (a-22B)	----	10	mole H+ / t	----	123	----	----	----
EA033-E: Acid Base Accounting								
ANC Fineness Factor	----	0.5	-	----	1.5	----	----	----
Net Acidity (sulfur units)	----	0.02	% S	----	0.21	----	----	----
Net Acidity (acidity units)	----	10	mole H+ / t	----	129	----	----	----
Liming Rate	----	1	kg CaCO3/t	----	10	----	----	----
Net Acidity excluding ANC (sulfur units)	----	0.02	% S	----	0.21	----	----	----
Net Acidity excluding ANC (acidity units)	----	10	mole H+ / t	----	129	----	----	----
Liming Rate excluding ANC	----	1	kg CaCO3/t	----	10	----	----	----
EA037: Ass Field Screening Analysis								
ø pH (F)	----	0.1	pH Unit	5.9	6.1	6.0	6.3	6.3
ø pH (Fox)	----	0.1	pH Unit	4.5	1.8	1.8	1.8	2.3
ø Reaction Rate	----	1	-	1	4	4	4	4

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	BH1 2.50	BH1 2.75	BH2 0.0	BH2 0.25	BH2 0.50
			Sampling date / time	12-Jul-2022 00:00	12-Jul-2022 00:00	12-Jul-2022 00:00	12-Jul-2022 00:00	12-Jul-2022 00:00
Compound	CAS Number	LOR	Unit	EB2220427-011	EB2220427-012	EB2220427-013	EB2220427-014	EB2220427-015
				Result	Result	Result	Result	Result
EA033-A: Actual Acidity								
pH KCl (23A)	----	0.1	pH Unit	5.6	----	----	----	----
Titratable Actual Acidity (23F)	----	2	mole H+ / t	4	----	----	----	----
sulfidic - Titratable Actual Acidity (s-23F)	----	0.02	% pyrite S	<0.02	----	----	----	----
EA033-B: Potential Acidity								
Chromium Reducible Sulfur (22B)	----	0.005	% S	0.194	----	----	----	----
acidity - Chromium Reducible Sulfur (a-22B)	----	10	mole H+ / t	121	----	----	----	----
EA033-E: Acid Base Accounting								
ANC Fineness Factor	----	0.5	-	1.5	----	----	----	----
Net Acidity (sulfur units)	----	0.02	% S	0.20	----	----	----	----
Net Acidity (acidity units)	----	10	mole H+ / t	125	----	----	----	----
Liming Rate	----	1	kg CaCO3/t	9	----	----	----	----
Net Acidity excluding ANC (sulfur units)	----	0.02	% S	0.20	----	----	----	----
Net Acidity excluding ANC (acidity units)	----	10	mole H+ / t	125	----	----	----	----
Liming Rate excluding ANC	----	1	kg CaCO3/t	9	----	----	----	----
EA037: Ass Field Screening Analysis								
ø pH (F)	----	0.1	pH Unit	7.4	7.7	6.6	6.6	6.6
ø pH (Fox)	----	0.1	pH Unit	2.0	3.7	3.3	3.8	5.1
ø Reaction Rate	----	1	-	4	2	3	2	1

Analytical Results

Sub-Matrix: **SOIL** (Matrix: **SOIL**)			Sample ID	BH2 0.75	BH2 1.00	BH2 1.25	BH2 1.50	BH2 1.75
			Sampling date / time	12-Jul-2022 00:00	12-Jul-2022 00:00	12-Jul-2022 00:00	12-Jul-2022 00:00	12-Jul-2022 00:00
Compound	CAS Number	LOR	Unit	EB2220427-016	EB2220427-017	EB2220427-018	EB2220427-019	EB2220427-020
				Result	Result	Result	Result	Result
EA037: Ass Field Screening Analysis								
ø pH (F)	----	0.1	pH Unit	6.3	6.4	6.3	6.1	6.3
ø pH (Fox)	----	0.1	pH Unit	4.9	4.3	2.1	1.8	2.1
ø Reaction Rate	----	1	-	1	2	4	4	4

Analytical Results

Sub-Matrix: **SOIL**
(Matrix: **SOIL**)

Compound	CAS Number	LOR	Unit	BH3 0.0	BH3 0.25	BH3 0.50	BH3 0.75	BH3 1.00
			Sampling date / time	12-Jul-2022 00:00	12-Jul-2022 00:00	12-Jul-2022 00:00	12-Jul-2022 00:00	12-Jul-2022 00:00
				EB2220427-021	EB2220427-022	EB2220427-023	EB2220427-024	EB2220427-025
				Result	Result	Result	Result	Result
EA037: Ass Field Screening Analysis								
ø pH (F)	----	0.1	pH Unit	6.1	6.2	6.4	6.4	6.3
ø pH (Fox)	----	0.1	pH Unit	2.8	3.6	4.6	5.0	4.2
ø Reaction Rate	----	1	-	3	2	2	1	2

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	BH3 1.25	BH3 1.50	BH3 1.75	BH4 0.0	BH4 0.25
			Sampling date / time	12-Jul-2022 00:00	12-Jul-2022 00:00	12-Jul-2022 00:00	12-Jul-2022 00:00	12-Jul-2022 00:00
Compound	CAS Number	LOR	Unit	EB2220427-026	EB2220427-027	EB2220427-028	EB2220427-029	EB2220427-030
				Result	Result	Result	Result	Result
EA033-A: Actual Acidity								
pH KCl (23A)	----	0.1	pH Unit	----	----	----	5.4	----
Titratable Actual Acidity (23F)	----	2	mole H+ / t	----	----	----	17	----
sulfidic - Titratable Actual Acidity (s-23F)	----	0.02	% pyrite S	----	----	----	0.03	----
EA033-B: Potential Acidity								
Chromium Reducible Sulfur (22B)	----	0.005	% S	----	----	----	0.039	----
acidity - Chromium Reducible Sulfur (a-22B)	----	10	mole H+ / t	----	----	----	24	----
EA033-E: Acid Base Accounting								
ANC Fineness Factor	----	0.5	-	----	----	----	1.5	----
Net Acidity (sulfur units)	----	0.02	% S	----	----	----	0.07	----
Net Acidity (acidity units)	----	10	mole H+ / t	----	----	----	41	----
Liming Rate	----	1	kg CaCO3/t	----	----	----	3	----
Net Acidity excluding ANC (sulfur units)	----	0.02	% S	----	----	----	0.07	----
Net Acidity excluding ANC (acidity units)	----	10	mole H+ / t	----	----	----	41	----
Liming Rate excluding ANC	----	1	kg CaCO3/t	----	----	----	3	----
EA037: Ass Field Screening Analysis								
ø pH (F)	----	0.1	pH Unit	6.3	6.4	7.1	6.6	6.8
ø pH (Fox)	----	0.1	pH Unit	1.8	1.8	1.8	2.7	3.2
ø Reaction Rate	----	1	-	4	4	4	3	3

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	BH4 0.50	BH4 1.00	BH4 1.25	BH4 1.50	BH4 1.75
			Sampling date / time	12-Jul-2022 00:00	12-Jul-2022 00:00	12-Jul-2022 00:00	12-Jul-2022 00:00	12-Jul-2022 00:00
Compound	CAS Number	LOR	Unit	EB2220427-031	EB2220427-033	EB2220427-034	EB2220427-035	EB2220427-036
				Result	Result	Result	Result	Result
EA033-A: Actual Acidity								
pH KCl (23A)	----	0.1	pH Unit	5.8	5.9	----	5.7	----
Titratable Actual Acidity (23F)	----	2	mole H+ / t	9	2	----	3	----
sulfidic - Titratable Actual Acidity (s-23F)	----	0.02	% pyrite S	<0.02	<0.02	----	<0.02	----
EA033-B: Potential Acidity								
Chromium Reducible Sulfur (22B)	----	0.005	% S	0.027	0.223	----	0.187	----
acidity - Chromium Reducible Sulfur (a-22B)	----	10	mole H+ / t	17	139	----	116	----
EA033-E: Acid Base Accounting								
ANC Fineness Factor	----	0.5	-	1.5	1.5	----	1.5	----
Net Acidity (sulfur units)	----	0.02	% S	0.04	0.23	----	0.19	----
Net Acidity (acidity units)	----	10	mole H+ / t	26	142	----	120	----
Liming Rate	----	1	kg CaCO3/t	2	11	----	9	----
Net Acidity excluding ANC (sulfur units)	----	0.02	% S	0.04	0.23	----	0.19	----
Net Acidity excluding ANC (acidity units)	----	10	mole H+ / t	26	142	----	120	----
Liming Rate excluding ANC	----	1	kg CaCO3/t	2	11	----	9	----
EA037: Ass Field Screening Analysis								
ø pH (F)	----	0.1	pH Unit	7.2	7.2	7.2	7.0	6.9
ø pH (Fox)	----	0.1	pH Unit	4.1	1.4	1.6	2.0	1.6
ø Reaction Rate	----	1	-	2	4	4	4	4

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	BH4 2.00	BH4 2.25	BH5 0.0	BH5 0.50	BH5 0.75
			Sampling date / time	12-Jul-2022 00:00	12-Jul-2022 00:00	12-Jul-2022 00:00	12-Jul-2022 00:00	12-Jul-2022 00:00
Compound	CAS Number	LOR	Unit	EB2220427-037	EB2220427-038	EB2220427-039	EB2220427-040	EB2220427-041
				Result	Result	Result	Result	Result
EA033-A: Actual Acidity								
pH KCl (23A)	----	0.1	pH Unit	----	6.0	----	----	----
Titratable Actual Acidity (23F)	----	2	mole H+ / t	----	<2	----	----	----
sulfidic - Titratable Actual Acidity (s-23F)	----	0.02	% pyrite S	----	<0.02	----	----	----
EA033-B: Potential Acidity								
Chromium Reducible Sulfur (22B)	----	0.005	% S	----	0.151	----	----	----
acidity - Chromium Reducible Sulfur (a-22B)	----	10	mole H+ / t	----	94	----	----	----
EA033-E: Acid Base Accounting								
ANC Fineness Factor	----	0.5	-	----	1.5	----	----	----
Net Acidity (sulfur units)	----	0.02	% S	----	0.15	----	----	----
Net Acidity (acidity units)	----	10	mole H+ / t	----	94	----	----	----
Liming Rate	----	1	kg CaCO3/t	----	7	----	----	----
Net Acidity excluding ANC (sulfur units)	----	0.02	% S	----	0.15	----	----	----
Net Acidity excluding ANC (acidity units)	----	10	mole H+ / t	----	94	----	----	----
Liming Rate excluding ANC	----	1	kg CaCO3/t	----	7	----	----	----
EA037: Ass Field Screening Analysis								
ø pH (F)	----	0.1	pH Unit	6.8	7.4	6.5	6.7	6.4
ø pH (Fox)	----	0.1	pH Unit	1.9	1.9	4.6	5.3	5.3
ø Reaction Rate	----	1	-	4	4	3	1	1

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	BH5 1.00	BH5 1.25	BH5 1.50	BH5 1.75	BH6 0.0
			Sampling date / time	12-Jul-2022 00:00	12-Jul-2022 00:00	12-Jul-2022 00:00	12-Jul-2022 00:00	12-Jul-2022 00:00
Compound	CAS Number	LOR	Unit	EB2220427-042	EB2220427-043	EB2220427-044	EB2220427-045	EB2220427-048
				Result	Result	Result	Result	Result
EA033-A: Actual Acidity								
pH KCl (23A)	----	0.1	pH Unit	----	----	----	----	5.3
Titratable Actual Acidity (23F)	----	2	mole H+ / t	----	----	----	----	12
sulfidic - Titratable Actual Acidity (s-23F)	----	0.02	% pyrite S	----	----	----	----	<0.02
EA033-B: Potential Acidity								
Chromium Reducible Sulfur (22B)	----	0.005	% S	----	----	----	----	0.022
acidity - Chromium Reducible Sulfur (a-22B)	----	10	mole H+ / t	----	----	----	----	14
EA033-E: Acid Base Accounting								
ANC Fineness Factor	----	0.5	-	----	----	----	----	1.5
Net Acidity (sulfur units)	----	0.02	% S	----	----	----	----	0.04
Net Acidity (acidity units)	----	10	mole H+ / t	----	----	----	----	26
Liming Rate	----	1	kg CaCO3/t	----	----	----	----	2
Net Acidity excluding ANC (sulfur units)	----	0.02	% S	----	----	----	----	0.04
Net Acidity excluding ANC (acidity units)	----	10	mole H+ / t	----	----	----	----	26
Liming Rate excluding ANC	----	1	kg CaCO3/t	----	----	----	----	2
EA037: Ass Field Screening Analysis								
ø pH (F)	----	0.1	pH Unit	5.6	5.1	5.0	5.4	5.6
ø pH (Fox)	----	0.1	pH Unit	3.3	1.8	2.0	1.8	2.9
ø Reaction Rate	----	1	-	2	4	4	4	3

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	BH6 0.25	BH6 0.50	BH6 0.75	BH6 1.00	BH6 1.25
			Sampling date / time	12-Jul-2022 00:00	12-Jul-2022 00:00	12-Jul-2022 00:00	12-Jul-2022 00:00	12-Jul-2022 00:00
Compound	CAS Number	LOR	Unit	EB2220427-049	EB2220427-050	EB2220427-051	EB2220427-052	EB2220427-053
				Result	Result	Result	Result	Result
EA033-A: Actual Acidity								
pH KCl (23A)	----	0.1	pH Unit	----	4.7	----	5.2	----
Titratable Actual Acidity (23F)	----	2	mole H+ / t	----	45	----	15	----
sulfidic - Titratable Actual Acidity (s-23F)	----	0.02	% pyrite S	----	0.07	----	0.02	----
EA033-B: Potential Acidity								
Chromium Reducible Sulfur (22B)	----	0.005	% S	----	0.027	----	0.020	----
acidity - Chromium Reducible Sulfur (a-22B)	----	10	mole H+ / t	----	16	----	12	----
EA033-E: Acid Base Accounting								
ANC Fineness Factor	----	0.5	-	----	1.5	----	1.5	----
Net Acidity (sulfur units)	----	0.02	% S	----	0.10	----	0.04	----
Net Acidity (acidity units)	----	10	mole H+ / t	----	61	----	27	----
Liming Rate	----	1	kg CaCO3/t	----	5	----	2	----
Net Acidity excluding ANC (sulfur units)	----	0.02	% S	----	0.10	----	0.04	----
Net Acidity excluding ANC (acidity units)	----	10	mole H+ / t	----	61	----	27	----
Liming Rate excluding ANC	----	1	kg CaCO3/t	----	5	----	2	----
EA037: Ass Field Screening Analysis								
ø pH (F)	----	0.1	pH Unit	5.7	5.6	5.8	6.1	5.7
ø pH (Fox)	----	0.1	pH Unit	2.6	2.5	3.1	4.1	3.0
ø Reaction Rate	----	1	-	3	3	3	2	2

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	BH6 1.50	BH6 1.75	BH6 2.00	BH6 2.25	BH6 2.50
			Sampling date / time	12-Jul-2022 00:00	12-Jul-2022 00:00	12-Jul-2022 00:00	12-Jul-2022 00:00	12-Jul-2022 00:00
Compound	CAS Number	LOR	Unit	EB2220427-054	EB2220427-055	EB2220427-056	EB2220427-057	EB2220427-058
				Result	Result	Result	Result	Result
EA033-A: Actual Acidity								
pH KCl (23A)	----	0.1	pH Unit	5.3	----	----	----	5.4
Titratable Actual Acidity (23F)	----	2	mole H+ / t	10	----	----	----	8
sulfidic - Titratable Actual Acidity (s-23F)	----	0.02	% pyrite S	<0.02	----	----	----	<0.02
EA033-B: Potential Acidity								
Chromium Reducible Sulfur (22B)	----	0.005	% S	0.141	----	----	----	0.161
acidity - Chromium Reducible Sulfur (a-22B)	----	10	mole H+ / t	88	----	----	----	100
EA033-E: Acid Base Accounting								
ANC Fineness Factor	----	0.5	-	1.5	----	----	----	1.5
Net Acidity (sulfur units)	----	0.02	% S	0.16	----	----	----	0.17
Net Acidity (acidity units)	----	10	mole H+ / t	97	----	----	----	108
Liming Rate	----	1	kg CaCO3/t	7	----	----	----	8
Net Acidity excluding ANC (sulfur units)	----	0.02	% S	0.16	----	----	----	0.17
Net Acidity excluding ANC (acidity units)	----	10	mole H+ / t	97	----	----	----	108
Liming Rate excluding ANC	----	1	kg CaCO3/t	7	----	----	----	8
EA037: Ass Field Screening Analysis								
ø pH (F)	----	0.1	pH Unit	6.0	6.2	6.3	6.3	6.2
ø pH (Fox)	----	0.1	pH Unit	1.9	1.8	2.0	2.0	2.1
ø Reaction Rate	----	1	-	4	4	4	4	4

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	BH6 2.75	BH7 0.0	BH7 0.25	BH7 0.50	BH7 0.75
			Sampling date / time	12-Jul-2022 00:00	12-Jul-2022 00:00	12-Jul-2022 00:00	12-Jul-2022 00:00	12-Jul-2022 00:00
Compound	CAS Number	LOR	Unit	EB2220427-059	EB2220427-060	EB2220427-061	EB2220427-062	EB2220427-063
				Result	Result	Result	Result	Result
EA037: Ass Field Screening Analysis								
ø pH (F)	----	0.1	pH Unit	5.6	5.4	5.8	5.4	6.0
ø pH (Fox)	----	0.1	pH Unit	1.8	3.5	3.8	4.7	4.6
ø Reaction Rate	----	1	-	4	3	2	2	2

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	BH7 1.00	BH7 1.25	BH7 1.50	BH7 1.75	----
			Sampling date / time	12-Jul-2022 00:00	12-Jul-2022 00:00	12-Jul-2022 00:00	12-Jul-2022 00:00	----
Compound	CAS Number	LOR	Unit	EB2220427-064	EB2220427-065	EB2220427-066	EB2220427-067	--------
				Result	Result	Result	Result	----
EA037: Ass Field Screening Analysis								
ø pH (F)	----	0.1	pH Unit	5.5	5.6	5.9	6.0	----
ø pH (Fox)	----	0.1	pH Unit	2.1	1.7	1.8	1.6	----
ø Reaction Rate	----	1	-	4	4	4	4	----

ALS Environmental

QUALITY CONTROL REPORT

Work Order	: **EB2220427**	Page	: 1 of 4
Client	: **PRECISE ENVIRONMENTAL PTY LTD**	Laboratory	: Environmental Division Brisbane
Contact	: MR CHRIS BUTLER	Contact	: Nidhi Bhimani
Address	: PO BOX 4424 ROBINA TOWN CENTRE QLD, AUSTRALIA 4230	Address	: 2 Byth Street Stafford QLD Australia 4053
Telephone	: ----	Telephone	: +61-7-3243 7222
Project	: PE3394.22	Date Samples Received	: 14-Jul-2022
Order number	: PE3394.22	Date Analysis Commenced	: 18-Jul-2022
C-O-C number	: ----	Issue Date	: 20-Jul-2022
Sampler	: CHRIS BUTLER, SEAN GARDINER		
Site	: ----		
Quote number	: EN/222		
No. of samples received	: 64		
No. of samples analysed	: 64		

Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percentage Difference (RPD) and Acceptance Limits
- Method Blank (MB) and Laboratory Control Spike (LCS) Report; Recovery and Acceptance Limits
- Matrix Spike (MS) Report; Recovery and Acceptance Limits

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Ben Felgendrejeris	Senior Acid Sulfate Soil Chemist	Brisbane Acid Sulphate Soils, Stafford, QLD

General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis. Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

Key :
Anonymous = Refers to samples which are not specifically part of this work order but formed part of the QC process lot
CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
RPD = Relative Percentage Difference
# = Indicates failed QC

Laboratory Duplicate (DUP) Report

The quality control term Laboratory Duplicate refers to a randomly selected intralaboratory split. Laboratory duplicates provide information regarding method precision and sample heterogeneity. The permitted ranges for the Relative Percent Deviation (RPD) of Laboratory Duplicates are specified in ALS Method QWI-EN/38 and are dependent on the magnitude of results in comparison to the level of reporting: Result < 10 times LOR: No Limit; Result between 10 and 20 times LOR: 0% - 50%; Result > 20 times LOR: 0% - 20%.

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Acceptable RPD (%)
EA033-A: Actual Acidity (QC Lot: 4465208)									
EB2220272-010	Anonymous	EA033: sulfidic - Titratable Actual Acidity (s-23F)	----	0.02	% pyrite S	0.02	<0.02	0.0	No Limit
		EA033: Titratable Actual Acidity (23F)	----	2	mole H+ / t	14	12	17.2	No Limit
		EA033: pH KCl (23A)	----	0.1	pH Unit	5.2	5.2	0.0	0% - 20%
EB2220427-033	BH4 1.00	EA033: sulfidic - Titratable Actual Acidity (s-23F)	----	0.02	% pyrite S	<0.02	<0.02	0.0	No Limit
		EA033: Titratable Actual Acidity (23F)	----	2	mole H+ / t	2	2	0.0	No Limit
		EA033: pH KCl (23A)	----	0.1	pH Unit	5.9	5.9	0.0	0% - 20%
EA033-B: Potential Acidity (QC Lot: 4465208)									
EB2220272-010	Anonymous	EA033: Chromium Reducible Sulfur (22B)	----	0.005	% S	0.136	0.134	1.4	0% - 20%
		EA033: acidity - Chromium Reducible Sulfur (a-22B)	----	10	mole H+ / t	85	84	1.4	No Limit
EB2220427-033	BH4 1.00	EA033: Chromium Reducible Sulfur (22B)	----	0.005	% S	0.223	0.210	6.2	0% - 20%
		EA033: acidity - Chromium Reducible Sulfur (a-22B)	----	10	mole H+ / t	139	131	6.2	0% - 50%
EA037: Ass Field Screening Analysis (QC Lot: 4461683)									
EB2220427-001	BH1 0.0	EA037: pH (F)	----	0.1	pH Unit	5.9	6.0	0.0	0% - 20%
		EA037: pH (Fox)	----	0.1	pH Unit	2.9	2.9	0.0	0% - 20%
EB2220427-011	BH1 2.50	EA037: pH (F)	----	0.1	pH Unit	7.4	7.5	1.3	0% - 20%
		EA037: pH (Fox)	----	0.1	pH Unit	2.0	2.0	0.0	0% - 20%
EA037: Ass Field Screening Analysis (QC Lot: 4461684)									
EB2220427-021	BH3 0.0	EA037: pH (F)	----	0.1	pH Unit	6.1	6.0	0.0	0% - 20%
		EA037: pH (Fox)	----	0.1	pH Unit	2.8	2.7	0.0	0% - 20%
EB2220427-031	BH4 0.50	EA037: pH (F)	----	0.1	pH Unit	7.2	7.1	0.0	0% - 20%
		EA037: pH (Fox)	----	0.1	pH Unit	4.1	4.2	0.0	0% - 20%

Sub-Matrix: **SOIL**

Laboratory sample ID	Sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Acceptable RPD (%)
				Laboratory Duplicate (DUP) Report					
EA037: Ass Field Screening Analysis (QC Lot: 4461685)									
EB2220427-042	BH5 1.00	EA037: pH (F)	----	0.1	pH Unit	5.6	5.5	2.0	0% - 20%
		EA037: pH (Fox)	----	0.1	pH Unit	3.3	3.4	5.1	0% - 20%
EB2220427-054	BH6 1.50	EA037: pH (F)	----	0.1	pH Unit	6.0	6.1	2.2	0% - 20%
		EA037: pH (Fox)	----	0.1	pH Unit	1.9	1.9	0.0	0% - 50%
EA037: Ass Field Screening Analysis (QC Lot: 4461686)									
EB2220427-064	BH7 1.00	EA037: pH (F)	----	0.1	pH Unit	5.5	5.6	0.0	0% - 20%
		EA037: pH (Fox)	----	0.1	pH Unit	2.1	2.1	0.0	0% - 20%

Method Blank (MB) and Laboratory Control Sample (LCS) Report

The quality control term Method / Laboratory Blank refers to an analyte free matrix to which all reagents are added in the same volumes or proportions as used in standard sample preparation. The purpose of this QC parameter is to monitor potential laboratory contamination. The quality control term Laboratory Control Sample (LCS) refers to a certified reference material, or a known interference free matrix spiked with target analytes. The purpose of this QC parameter is to monitor method precision and accuracy independent of sample matrix. Dynamic Recovery Limits are based on statistical evaluation of processed LCS.

Sub-Matrix: **SOIL**

				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Acceptable Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	Low	High
EA033-A: Actual Acidity (QCLot: 4465208)								
EA033: pH KCl (23A)	----	----	pH Unit	----	4.4 pH Unit	102	91.0	107
EA033: Titratable Actual Acidity (23F)	----	2	mole H+ / t	<2	19 mole H+ / t	88.7	70.0	124
EA033: sulfidic - Titratable Actual Acidity (s-23F)	----	0.02	% pyrite S	<0.02	----	----	----	----
EA033-B: Potential Acidity (QCLot: 4465208)								
EA033: Chromium Reducible Sulfur (22B)	----	0.005	% S	<0.005	0.246 % S	92.2	77.0	121
EA033: acidity - Chromium Reducible Sulfur (a-22B)	----	10	mole H+ / t	<10	----	----	----	----

Matrix Spike (MS) Report

The quality control term Matrix Spike (MS) refers to an intralaboratory split sample spiked with a representative set of target analytes. The purpose of this QC parameter is to monitor potential matrix effects on analyte recoveries. Static Recovery Limits as per laboratory Data Quality Objectives (DQOs). Ideal recovery ranges stated may be waived in the event of sample matrix interference.

- **No Matrix Spike (MS) or Matrix Spike Duplicate (MSD) Results are required to be reported.**

ALS Environmental

QA/QC Compliance Assessment to assist with Quality Review

Work Order	: **EB2220427**	Page	: 1 of 6
Client	: **PRECISE ENVIRONMENTAL PTY LTD**	Laboratory	: Environmental Division Brisbane
Contact	: MR CHRIS BUTLER	Telephone	: +61-7-3243 7222
Project	: PE3394.22	Date Samples Received	: 14-Jul-2022
Site	: ----	Issue Date	: 20-Jul-2022
Sampler	: CHRIS BUTLER, SEAN GARDINER	No. of samples received	: 64
Order number	: PE3394.22	No. of samples analysed	: 64

This report is automatically generated by the ALS LIMS through interpretation of the ALS Quality Control Report and several Quality Assurance parameters measured by ALS. This automated reporting highlights any non-conformances, facilitates faster and more accurate data validation and is designed to assist internal expert and external Auditor review. Many components of this report contribute to the overall DQO assessment and reporting for guideline compliance.

Brief method summaries and references are also provided to assist in traceability.

Summary of Outliers

Outliers : Quality Control Samples

This report highlights outliers flagged in the Quality Control (QC) Report.

- **NO Method Blank value outliers occur.**
- **NO Duplicate outliers occur.**
- **NO Laboratory Control outliers occur.**
- **NO Matrix Spike outliers occur.**
- **For all regular sample matrices, NO surrogate recovery outliers occur.**

Outliers : Analysis Holding Time Compliance

- **NO Analysis Holding Time Outliers exist.**

Outliers : Frequency of Quality Control Samples

- **NO Quality Control Sample Frequency Outliers exist.**

Analysis Holding Time Compliance

If samples are identified below as having been analysed or extracted outside of recommended holding times, this should be taken into consideration when interpreting results.

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times (referencing USEPA SW 846, APHA, AS and NEPM) based on the sample container provided. Dates reported represent first date of extraction or analysis and preclude subsequent dilutions and reruns. A listing of breaches (if any) is provided herein.

Holding time for leachate methods (e.g. TCLP) vary according to the analytes reported. Assessment compares the leach date with the shortest analyte holding time for the equivalent soil method. These are: organics 14 days, mercury 28 days & other metals 180 days. A recorded breach does not guarantee a breach for all non-volatile parameters.

Holding times for ***VOC in soils*** vary according to analytes of interest. Vinyl Chloride and Styrene holding time is 7 days; others 14 days. A recorded breach does not guarantee a breach for all VOC analytes and should be verified in case the reported breach is a false positive or Vinyl Chloride and Styrene are not key analytes of interest/concern.

Matrix: **SOIL**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method		Sample Date	Extraction / Preparation			Analysis		
Container / Client Sample ID(s)			Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA033-A: Actual Acidity								
Snap Lock Bag - frozen (EA033)								
BH1 - 0.0,	BH1 - 0.50,	**12-Jul-2022**	**19-Jul-2022**	12-Jul-2023	✓	**19-Jul-2022**	17-Oct-2022	✓
BH1 - 1.00,	BH1 - 1.50,							
BH1 - 2.50,	BH4 - 0.0,							
BH4 - 0.50,	BH4 - 1.00,							
BH4 - 1.50,	BH4 - 2.25,							
BH6 - 0.0,	BH6 - 0.50,							
BH6 - 1.00,	BH6 - 1.50,							
BH6 - 2.50								
EA033-B: Potential Acidity								
Snap Lock Bag - frozen (EA033)								
BH1 - 0.0,	BH1 - 0.50,	**12-Jul-2022**	**19-Jul-2022**	12-Jul-2023	✓	**19-Jul-2022**	17-Oct-2022	✓
BH1 - 1.00,	BH1 - 1.50,							
BH1 - 2.50,	BH4 - 0.0,							
BH4 - 0.50,	BH4 - 1.00,							
BH4 - 1.50,	BH4 - 2.25,							
BH6 - 0.0,	BH6 - 0.50,							
BH6 - 1.00,	BH6 - 1.50,							
BH6 - 2.50								
EA033-C: Acid Neutralising Capacity								
Snap Lock Bag - frozen (EA033)								
BH1 - 0.0,	BH1 - 0.50,	**12-Jul-2022**	**19-Jul-2022**	12-Jul-2023	✓	**19-Jul-2022**	17-Oct-2022	✓
BH1 - 1.00,	BH1 - 1.50,							
BH1 - 2.50,	BH4 - 0.0,							
BH4 - 0.50,	BH4 - 1.00,							
BH4 - 1.50,	BH4 - 2.25,							
BH6 - 0.0,	BH6 - 0.50,							
BH6 - 1.00,	BH6 - 1.50,							
BH6 - 2.50								

Matrix: **SOIL**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method	Sample Date	Extraction / Preparation			Analysis		
Container / Client Sample ID(s)		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA033-D: Retained Acidity							
Snap Lock Bag - frozen (EA033)							
BH1 - 0.0, BH1 - 0.50, BH1 - 1.00, BH1 - 1.50, BH1 - 2.50, BH4 - 0.0, BH4 - 0.50, BH4 - 1.00, BH4 - 1.50, BH4 - 2.25, BH6 - 0.0, BH6 - 0.50, BH6 - 1.00, BH6 - 1.50, BH6 - 2.50	**12-Jul-2022**	**19-Jul-2022**	12-Jul-2023	✓	**19-Jul-2022**	17-Oct-2022	✓
EA033-E: Acid Base Accounting							
Snap Lock Bag - frozen (EA033)							
BH1 - 0.0, BH1 - 0.50, BH1 - 1.00, BH1 - 1.50, BH1 - 2.50, BH4 - 0.0, BH4 - 0.50, BH4 - 1.00, BH4 - 1.50, BH4 - 2.25, BH6 - 0.0, BH6 - 0.50, BH6 - 1.00, BH6 - 1.50, BH6 - 2.50	**12-Jul-2022**	**19-Jul-2022**	12-Jul-2023	✓	**19-Jul-2022**	17-Oct-2022	✓

Matrix: **SOIL**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)		Sample Date	Extraction / Preparation			Analysis		
			Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA037: Ass Field Screening Analysis								
Snap Lock Bag - frozen (EA037)								
BH1 - 0.0,	BH1 - 0.25,	**12-Jul-2022**	**18-Jul-2022**	08-Jan-2023	✓	**18-Jul-2022**	08-Jan-2023	✓
BH1 - 0.50,	BH1 - 0.75,							
BH1 - 1.00,	BH1 - 1.25,							
BH1 - 1.50,	BH1 - 1.75,							
BH1 - 2.00,	BH1 - 2.25,							
BH1 - 2.50,	BH1 - 2.75,							
BH2 - 0.0,	BH2 - 0.25,							
BH2 - 0.50,	BH2 - 0.75,							
BH2 - 1.00,	BH2 - 1.25,							
BH2 - 1.50,	BH2 - 1.75,							
BH3 - 0.0,	BH3 - 0.25,							
BH3 - 0.50,	BH3 - 0.75,							
BH3 - 1.00,	BH3 - 1.25,							
BH3 - 1.50,	BH3 - 1.75,							
BH4 - 0.0,	BH4 - 0.25,							
BH4 - 0.50,	BH4 - 1.00,							
BH4 - 1.25,	BH4 - 1.50,							
BH4 - 1.75,	BH4 - 2.00,							
BH4 - 2.25,	BH5 - 0.0,							
BH5 - 0.50,	BH5 - 0.75,							
BH5 - 1.00,	BH5 - 1.25,							
BH5 - 1.50,	BH5 - 1.75,							
BH6 - 0.0,	BH6 - 0.25,							
BH6 - 0.50,	BH6 - 0.75,							
BH6 - 1.00,	BH6 - 1.25,							
BH6 - 1.50,	BH6 - 1.75,							
BH6 - 2.00,	BH6 - 2.25,							
BH6 - 2.50,	BH6 - 2.75,							
BH7 - 0.0,	BH7 - 0.25,							
BH7 - 0.50,	BH7 - 0.75,							
BH7 - 1.00,	BH7 - 1.25,							
BH7 - 1.50,	BH7 - 1.75							

Quality Control Parameter Frequency Compliance

The following report summarises the frequency of laboratory QC samples analysed within the analytical lot(s) in which the submitted sample(s) was(were) processed. Actual rate should be greater than or equal to the expected rate. A listing of breaches is provided in the Summary of Outliers.

Matrix: **SOIL**

Evaluation: × = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Laboratory Duplicates (DUP)							
ASS Field Screening Analysis	EA037	7	64	**10.94**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Chromium Suite for Acid Sulphate Soils	EA033	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Chromium Suite for Acid Sulphate Soils	EA033	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Chromium Suite for Acid Sulphate Soils	EA033	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard

Brief Method Summaries

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the US EPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request. The following report provides brief descriptions of the analytical procedures employed for results reported in the Certificate of Analysis. Sources from which ALS methods have been developed are provided within the Method Descriptions.

Analytical Methods	Method	Matrix	Method Descriptions
Chromium Suite for Acid Sulphate Soils	EA033	SOIL	In house: Referenced to Ahern et al 2004. This method covers the determination of Chromium Reducible Sulfur (SCR); pHKCl; titratable actual acidity (TAA); acid neutralising capacity by back titration (ANC); and net acid soluble sulfur (SNAS) which incorporates peroxide sulfur. It applies to soils and sediments (including sands) derived from coastal regions. Liming Rate is based on results for samples as submitted and incorporates a minimum safety factor of 1.5.
ASS Field Screening Analysis	* EA037	SOIL	In house: Referenced to Acid Sulfate Soils Laboratory Methods Guidelines. As received samples are tested for pH field and pH fox and assessed for a reaction rating.

Preparation Methods	Method	Matrix	Method Descriptions
Drying only	EN020D	SOIL	In house
Drying at 85 degrees, bagging and labelling (ASS)	EN020PR	SOIL	In house

ALS Environmental

SAMPLE RECEIPT NOTIFICATION (SRN)

Work Order : **EB2222068**

Client	: **PRECISE ENVIRONMENTAL PTY LTD**	Laboratory	: Environmental Division Brisbane
Contact	: RESULTS & INVOICE	Contact	: Nidhi Bhimani
Address	: PO BOX 4424 ROBINA TOWN CENTRE QLD, AUSTRALIA 4230	Address	: 2 Byth Street Stafford QLD Australia 4053
E-mail	: mail@preciseenvironmental.com.au	E-mail	: nidhi.bhimani@alsglobal.com
Telephone	: +61 07 5593 7848	Telephone	: +61-7-3243 7222
Facsimile	: +61 07 5593 7020	Facsimile	: +61-7-3243 7218
Project	: PE3394.22	Page	: 1 of 2
Order number	: PE3394.22	Quote number	: EB2019PREENV0003 (BN/031/16 V5)
C-O-C number	: ----	QC Level	: NEPM 2013 B3 & ALS QC Standard
Site	: ----		
Sampler	: CHRIS BUTLER, SEAN GARDINER		

Dates

Date Samples Received	: 25-Jul-2022 15:29	Issue Date	: 28-Jul-2022
Client Requested Due Date	: 04-Aug-2022	Scheduled Reporting Date	: **04-Aug-2022**

Delivery Details

Mode of Delivery	: Samples On Hand	Security Seal	: Not Available
No. of coolers/boxes	: ----	Temperature	: ----
Receipt Detail	: REBATCH	No. of samples received / analysed	: 18 / 18

General Comments

- This report contains the following information:
  - Sample Container(s)/Preservation Non-Compliances
  - Summary of Sample(s) and Requested Analysis
  - Proactive Holding Time Report
  - Requested Deliverables
- **This work order was created to rebatch samples from EB2220427 and EB2220520.**
- Discounted Package Prices apply only when specific ALS Group Codes ('W', 'S', 'NT' suites) are referenced on COCs.
- Please direct any turn around / technical queries to the laboratory contact designated above.
- Sample Disposal - Aqueous (3 weeks), Solid (2 months ± 1 week) from receipt of samples.
- Analysis will be conducted by ALS Environmental, Brisbane, NATA accreditation no. 825, Site No. 818 (Micro site no. 18958).
- **Breaches in recommended extraction / analysis holding times (if any) are displayed overleaf in the Proactive Holding Time Report table.**
- Please be aware that APHA/NEPM recommends water and soil samples be chilled to less than or equal to 6°C for chemical analysis, and less than or equal to 10°C but unfrozen for Microbiological analysis. Where samples are received above this temperature, it should be taken into consideration when interpreting results. Refer to ALS EnviroMail 85 for ALS recommendations of the best practice for chilling samples after sampling and for maintaining a cool temperature during transit.
- **Please refer to the Proactive Holding Time Report table below which summarises breaches of recommended holding times that have occurred prior to samples/instructions being received at the laboratory. The laboratory will process these samples unless instructions are received from you indicating you do not wish to proceed. The absence of this summary table indicates that all samples have been received within the recommended holding times for the analysis requested.**

Sample Container(s)/Preservation Non-Compliances

All comparisons are made against pretreatment/preservation AS, APHA, USEPA standards.

- **No sample container / preservation non-compliance exists.**

Summary of Sample(s) and Requested Analysis

Some items described below may be part of a laboratory process necessary for the execution of client requested tasks. Packages may contain additional analyses, such as the determination of moisture content and preparation tasks, that are included in the package.
If no sampling time is provided, the sampling time will default 00:00 on the date of sampling. If no sampling date is provided, the sampling date will be assumed by the laboratory and displayed in brackets without a time component

Matrix: **SOIL**

Laboratory sample ID	*Sampling date / time*	*Sample ID*	SOIL - EA033 Chromium Suite for Acid Sulphate Soils
EB2222068-001	12-Jul-2022 00:00	BH2 0.0	✓
EB2222068-002	12-Jul-2022 00:00	BH3 0.0	✓
EB2222068-003	12-Jul-2022 00:00	BH7 0.0	✓
EB2222068-004	12-Jul-2022 00:00	BH8 0.0	✓
EB2222068-005	12-Jul-2022 00:00	BH8 0.25	✓
EB2222068-006	12-Jul-2022 00:00	BH8 0.50	✓
EB2222068-007	12-Jul-2022 00:00	BH9 0.0	✓
EB2222068-008	12-Jul-2022 00:00	BH9 0.50	✓
EB2222068-009	12-Jul-2022 00:00	BH9 1.00	✓
EB2222068-010	12-Jul-2022 00:00	BH9 1.50	✓
EB2222068-011	12-Jul-2022 00:00	BH10 0.0	✓
EB2222068-012	12-Jul-2022 00:00	BH11 0.75	✓
EB2222068-013	12-Jul-2022 00:00	BH12 0.0	✓
EB2222068-014	12-Jul-2022 00:00	BH13 0.0	✓
EB2222068-015	12-Jul-2022 00:00	BH14 0.0	✓
EB2222068-016	12-Jul-2022 00:00	BH14 0.50	✓
EB2222068-017	12-Jul-2022 00:00	BH14 1.00	✓
EB2222068-018	12-Jul-2022 00:00	BH14 1.50	✓

Proactive Holding Time Report

Sample(s) have been received within the recommended holding times for the requested analysis.

Requested Deliverables

RESULTS & INVOICE

- *AU Certificate of Analysis - NATA (COA)	Email	mail@preciseenvironmental.com.au
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	mail@preciseenvironmental.com.au
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	mail@preciseenvironmental.com.au
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	mail@preciseenvironmental.com.au
- A4 - AU Tax Invoice (INV)	Email	mail@preciseenvironmental.com.au
- Chain of Custody (CoC) (COC)	Email	mail@preciseenvironmental.com.au
- EDI Format - XTab (XTAB)	Email	mail@preciseenvironmental.com.au

Environmental Division
Brisbane
Work Order Reference
EB2222068

Telephone : + 61-7-3243 7222

CHAIN OF CUSTODY CHAIN OF CUSTODY

ALS Laboratory: please tick → ALS Laboratory: please tick →

☐ Sydney: 277 Woodpark Rd, Smithfield NSW 2176 Ph: 02 8784 8555 E:samples.sydney@alsenviro.com
☐ Newcastle: 5 Rosegum Rd, Warabrook NSW 2304 Ph:02 4968 9433 E:samples.newcastle@alsenviro.com
☐ Brisbane: 32 Shand St, Stafford QLD 4053 Ph:07 3243 7222 E:samples.brisbane@alsenviro.com
☐ Townsville: 14-15 Desma Ct, Bohle QLD 4818 Ph:07 4796 0600 E: townsville.environmental@alsenviro.com
☐ Melbourne: 2-4 Westall Rd, Springvale VIC 3171 Ph:03 8549 9600 E: samples.melbourne@alsenviro.com
☐ Adelaide: 2-1 Burma Rd, Pooraka SA 5095 Ph: 08 8359 0890 E:adelaide@alsenviro.com
☐ Pert Ph: 08
☐ Lau Ph: 03

CLIENT:	PRECISE ENVIRONMENTAL	TURNAROUND REQUIREMENTS : (Standard TAT may be longer for some tests e.g.. Ultra Trace Organics)	☐ Standard TAT (List due date): ☐ Non Standard or urgent TAT (List due date):
OFFICE:	7/14 FREMANTLE ST, BURLEIGH HEADS 4220		
PROJECT:	PE3394.22	ALS QUOTE NO.: BN031/16 v4	COC SEQUENCE NUMBER (Circle) COC: 1 2 3 4 5 6 7 OF: 1 2 3 4 5 6 7
ORDER NUMBER:	PE3394.22		
PROJECT MANAGER:	CHRIS BUTLER	CONTACT: 0431 565 210	
SAMPLER:	CHRIS BUTLER / SEAN GARDINER	SAMPLER MOBILE: 0409 827 396	RELINQUISHED BY: CHRIS BUTLER DATE/TIME: 25.07.22 3pm
COC emailed to ALS? (YES / NO)		EDD FORMAT (or default):	RECEIVED BY: DATE/TIME:
Email Reports to: mail@preciseenvironmental.com.au			RELINQ DATE/TIME:
Mail Invoice to: PO Box 4424, Robina Town Centre 4230			DATE/TIME:

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

ALS USE ONLY	SAMPLE DETAILS Water(W) MATRIX: Solid(S)				CONTAINER INFORMATION		ANALYSIS REQUIRED including SUITES (NB. Suite Codes must be listed to attract suite price) Where Metals are required, specify Total (unfiltered bottle required) or Dissolved (field filtered bottle required).								Additional Information
LAB ID	SAMPLE ID	SAMPLE DESCRIPTION	DATE / TIME	MATRIX	TYPE & PRESERVATIVE (refer to codes below)	TOTAL BOTTLES	EA037 (pHF and pHFOX)	EA033 (Chromium suite)							Comments on likely contaminant levels, dilutions, or samples requiring specific QC analysis etc.
1	BH2	0.0	12.07.22	S	BAG/<4°C	1		X							
2	BH3	0.0	12.07.22	S	BAG/<4°C	1		X							
3	BH7	0.0	12.07.22	S	BAG/<4°C	1		X							
4	BH8	0.0	12.07.22	S	BAG/<4°C	1		X							
5	BH8	0.25	12.07.22	S	BAG/<4°C	1		X							
6	BH8	0.50	12.07.22	S	BAG/<4°C	1		X							
7	BH9	0.0	12.07.22	S	BAG/<4°C	1		X							
8	BH9	0.50	12.07.22	S	BAG/<4°C	1		X							
9	BH9	1.00	12.07.22	S	BAG/<4°C	1		X							
10	BH9	1.50	12.07.22	S	BAG/<4°C	1		X							
↑															
					TOTAL	10									

Water Container Codes: P = Unpreserved Plastic; N = Nitric Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide/Cd Preserved; S = Sodium Hydroxide Preserved Plastic; AG = Amber Glass Unpreserved; AP - Airfreight Unpreserved Plastic
V = VOA Vial HCl Preserved; VB = VOA Vial Sodium Bisulphate Preserved; VS = VOA Vial Sulfuric Preserved; AV = Airfreight Unpreserved Vial SG = Sulfuric Preserved Amber Glass; H = HCl preserved Plastic; HS = HCl preserved Speciation bottle; SP = Sulfuric Preserved Plastic; F = Formaldehyde Preserved Glass;
Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; ASS = Plastic Bag for Acid Sulphate Soils; B = Unpreserved Bag.

CHAIN OF CUSTODY CHAIN OF CUSTODY

ALS Laboratory: please tick → ALS Laboratory: please tick →

☐ Sydney: 277 Woodpark Rd, Smithfield NSW 2176 Ph: 02 8784 8555 E:samples.sydney@alsenviro.com
☐ Newcastle: 5 Rosegum Rd, Warabrook NSW 2304 Ph:02 4968 9433 E:samples.newcastle@alsenviro.com
☐ Brisbane: 32 Shand St, Stafford QLD 4053 Ph:07 3243 7222 E:samples.brisbane@alsenviro.com
☐ Townsville: 14-15 Desma Ct, Bohle QLD 4818 Ph:07 4796 0600 E: townsville.environmental@alsenviro.com
☐ Melbourne: 2-4 Westall Rd, Springvale VIC 3171 Ph:03 8549 9600 E: samples.melbourne@alsenviro.com
☐ Adelaide: 2-1 Burma Rd, Pooraka SA 5095 Ph: 08 8359 0890 E:adelaide@alsenviro.com
☐ Perth: 10 Hod Way, Malaga WA 6090 Ph: 08 9209 7655 E: samples.perth@alsenviro.com
☐ Launceston: 27 Wellington St, Launceston TAS 7250 Ph: 03 6331 2158 E: launceston@alsenviro.com

CLIENT:	PRECISE ENVIRONMENTAL	TURNAROUND REQUIREMENTS : (Standard TAT may be longer for some tests e.g., Ultra Trace Organics)	☐ Standard TAT (List due date): ☐ Non Standard or urgent TAT (List due date):
OFFICE:	7/14 FREMANTLE ST, BURLEIGH HEADS 4220		
PROJECT:	PE3394.22	ALS QUOTE NO.:	BN031/16 v4
ORDER NUMBER:	PE3394.22	COC SEQUENCE NUMBER (Circle)	COC: 1 2 3 4 5 6 7 / OF: 1 2 3 4 5 6 7
PROJECT MANAGER:	CHRIS BUTLER	CONTACT: 0431 565 210	
SAMPLER:	CHRIS BUTLER / SEAN GARDINER	SAMPLER MOBILE: 0409 827 396	
COC emailed to ALS? (YES / NO)		EDD FORMAT (or default):	
Email Reports to: mail@preciseenvironmental.com.au			
Mail Invoice to: PO Box 4424, Robina Town Centre 4230			

FOR LABORATORY USE ONLY (Circle)

RELINQUISHED BY:	RECEIVED BY:	RELINQUISHED BY:	RECEIVED BY:
CHRIS BUTLER			
DATE/TIME: 25.07.22 3pm (signed) C. Butler	DATE/TIME:	DATE/TIME:	DATE/TIME:

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

ALS USE ONLY	SAMPLE DETAILS	Water(W)	MATRIX: Solid(S)		CONTAINER INFORMATION		ANALYSIS REQUIRED including SUITES (NB. Suite Codes must be listed to attract suite price) Where Metals are required, specify Total (unfiltered bottle required) or Dissolved (field filtered bottle required).								Additional Information
LAB ID	SAMPLE ID	SAMPLE DESCRIPTION	DATE / TIME	MATRIX	TYPE & PRESERVATIVE (refer to codes below)	TOTAL BOTTLES	EA037 (pHF and pHFOX)	EA033 (Chromium suite)							Comments on likely contaminant levels, dilutions, or samples requiring specific QC analysis etc.
11	BH10	0.0	12.07.22	S	BAG/<4°C	1		X							
12	BH11	0.75	12.07.22	S	BAG/<4°C	1		X							
13	BH12	0.0	12.07.22	S	BAG/<4°C	1		X							
14	BH13	0.0	12.07.22	S	BAG/<4°C	1		X							
15	BH14	0.0	12.07.22	S	BAG/<4°C	1		X							
16	BH14	0.50	12.07.22	S	BAG/<4°C	1		X							
17	BH14	1.00	12.07.22	S	BAG/<4°C	1		X							
18	BH14	1.50	12.07.22	S	BAG/<4°C	1		X							
					TOTAL	8									

Water Container Codes: P = Unpreserved Plastic; N = Nitric Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide/Cd Preserved; S = Sodium Hydroxide Preserved Plastic; AG = Amber Glass Unpreserved; AP - Airfreight Unpreserved Plastic
V = VOA Vial HCl Preserved; VB = VOA Vial Sodium Bisulphate Preserved; VS = VOA Vial Sulfuric Preserved; AV = Airfreight Unpreserved Vial SG = Sulfuric Preserved Amber Glass; H = HCl preserved Plastic; HS = HCl preserved Speciation bottle; SP = Sulfuric Preserved Plastic; F = Formaldehyde Preserved Glass;
Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; ASS = Plastic Bag for Acid Sulphate Soils; B = Unpreserved Bag.

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **EB2222068**	Page	: 1 of 6
Client	: **PRECISE ENVIRONMENTAL PTY LTD**	Laboratory	: Environmental Division Brisbane
Contact	: RESULTS & INVOICE	Contact	: Nidhi Bhimani
Address	: PO BOX 4424 ROBINA TOWN CENTRE QLD, AUSTRALIA 4230	Address	: 2 Byth Street Stafford QLD Australia 4053
Telephone	: +61 07 5593 7848	Telephone	: +61-7-3243 7222
Project	: PE3394.22	Date Samples Received	: 25-Jul-2022 15:29
Order number	: PE3394.22	Date Analysis Commenced	: 03-Aug-2022
C-O-C number	: ----	Issue Date	: 03-Aug-2022 15:26
Sampler	: CHRIS BUTLER, SEAN GARDINER		
Site	: ----		
Quote number	: BN/031/16 V5		
No. of samples received	: 18		
No. of samples analysed	: 18		

Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Ben Felgendrejeris	Senior Acid Sulfate Soil Chemist	Brisbane Acid Sulphate Soils, Stafford, QLD

General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contract for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

- ASS: EA033 (CRS Suite):Retained Acidity not required because pH KCl greater than or equal to 4.5
- ASS: EA033 (CRS Suite): ANC not required because pH KCl less than 6.5
- ASS: EA033 (CRS Suite): Liming rate is calculated and reported on a dry weight basis assuming use of fine agricultural lime (CaCO3) and using a safety factor of 1.5 to allow for non-homogeneous mixing and poor reactivity of lime. For conversion of Liming Rate from 'kg/t dry weight' to 'kg/m3 in-situ soil', multiply 'reported results' x 'wet bulk density of soil in t/m3'.

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	BH2 0.0	BH3 0.0	BH7 0.0	BH8 0.0	BH8 0.25
			Sampling date / time	12-Jul-2022 00:00	12-Jul-2022 00:00	12-Jul-2022 00:00	12-Jul-2022 00:00	12-Jul-2022 00:00
Compound	CAS Number	LOR	Unit	EB2222068-001	EB2222068-002	EB2222068-003	EB2222068-004	EB2222068-005
				Result	Result	Result	Result	Result
EA033-A: Actual Acidity								
pH KCl (23A)	----	0.1	pH Unit	4.9	4.5	4.6	4.8	4.7
Titratable Actual Acidity (23F)	----	2	mole H+ / t	66	128	106	40	44
sulfidic - Titratable Actual Acidity (s-23F)	----	0.02	% pyrite S	0.10	0.20	0.17	0.06	0.07
EA033-B: Potential Acidity								
Chromium Reducible Sulfur (22B)	----	0.005	% S	0.013	0.016	0.018	0.014	0.018
acidity - Chromium Reducible Sulfur (a-22B)	----	10	mole H+ / t	<10	10	11	<10	11
EA033-E: Acid Base Accounting								
ANC Fineness Factor	----	0.5	-	1.5	1.5	1.5	1.5	1.5
Net Acidity (sulfur units)	----	0.02	% S	0.12	0.22	0.19	0.08	0.09
Net Acidity (acidity units)	----	10	mole H+ / t	74	138	117	49	55
Liming Rate	----	1	kg CaCO3/t	6	10	9	4	4
Net Acidity excluding ANC (sulfur units)	----	0.02	% S	0.12	0.22	0.19	0.08	0.09
Net Acidity excluding ANC (acidity units)	----	10	mole H+ / t	74	138	117	49	55
Liming Rate excluding ANC	----	1	kg CaCO3/t	6	10	9	4	4

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	BH8 0.50	BH9 0.0	BH9 0.50	BH9 1.00	BH9 1.50
			Sampling date / time	12-Jul-2022 00:00	12-Jul-2022 00:00	12-Jul-2022 00:00	12-Jul-2022 00:00	12-Jul-2022 00:00
Compound	CAS Number	LOR	Unit	EB2222068-006	EB2222068-007	EB2222068-008	EB2222068-009	EB2222068-010
				Result	Result	Result	Result	Result
EA033-A: Actual Acidity								
pH KCl (23A)	----	0.1	pH Unit	5.8	4.6	5.8	5.6	5.2
Titratable Actual Acidity (23F)	----	2	mole H+ / t	<2	79	<2	3	7
sulfidic - Titratable Actual Acidity (s-23F)	----	0.02	% pyrite S	<0.02	0.13	<0.02	<0.02	<0.02
EA033-B: Potential Acidity								
Chromium Reducible Sulfur (22B)	----	0.005	% S	0.019	0.030	0.015	0.037	0.124
acidity - Chromium Reducible Sulfur (a-22B)	----	10	mole H+ / t	12	18	<10	23	77
EA033-E: Acid Base Accounting								
ANC Fineness Factor	----	0.5	-	1.5	1.5	1.5	1.5	1.5
Net Acidity (sulfur units)	----	0.02	% S	<0.02	0.16	<0.02	0.04	0.14
Net Acidity (acidity units)	----	10	mole H+ / t	12	98	<10	26	84
Liming Rate	----	1	kg CaCO3/t	<1	7	<1	2	6
Net Acidity excluding ANC (sulfur units)	----	0.02	% S	<0.02	0.16	<0.02	0.04	0.14
Net Acidity excluding ANC (acidity units)	----	10	mole H+ / t	12	98	<10	26	84
Liming Rate excluding ANC	----	1	kg CaCO3/t	<1	7	<1	2	6

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	BH10 0.0	BH11 0.75	BH12 0.0	BH13 0.0	BH14 0.0
			Sampling date / time	12-Jul-2022 00:00	12-Jul-2022 00:00	12-Jul-2022 00:00	12-Jul-2022 00:00	12-Jul-2022 00:00
Compound	CAS Number	LOR	Unit	EB2222068-011	EB2222068-012	EB2222068-013	EB2222068-014	EB2222068-015
				Result	Result	Result	Result	Result
EA033-A: Actual Acidity								
pH KCl (23A)	----	0.1	pH Unit	**4.8**	**4.8**	**4.6**	**4.6**	**4.5**
Titratable Actual Acidity (23F)	----	2	mole H+ / t	**42**	**49**	**66**	**87**	**124**
sulfidic - Titratable Actual Acidity (s-23F)	----	0.02	% pyrite S	**0.07**	**0.08**	**0.11**	**0.14**	**0.20**
EA033-B: Potential Acidity								
Chromium Reducible Sulfur (22B)	----	0.005	% S	**0.023**	**0.012**	**0.012**	**0.015**	**0.024**
acidity - Chromium Reducible Sulfur (a-22B)	----	10	mole H+ / t	**14**	<10	<10	<10	**15**
EA033-E: Acid Base Accounting								
ANC Fineness Factor	----	0.5	-	**1.5**	**1.5**	**1.5**	**1.5**	**1.5**
Net Acidity (sulfur units)	----	0.02	% S	**0.09**	**0.09**	**0.12**	**0.15**	**0.22**
Net Acidity (acidity units)	----	10	mole H+ / t	**56**	**57**	**74**	**96**	**138**
Liming Rate	----	1	kg CaCO3/t	**4**	**4**	**6**	**7**	**10**
Net Acidity excluding ANC (sulfur units)	----	0.02	% S	**0.09**	**0.09**	**0.12**	**0.15**	**0.22**
Net Acidity excluding ANC (acidity units)	----	10	mole H+ / t	**56**	**57**	**74**	**96**	**138**
Liming Rate excluding ANC	----	1	kg CaCO3/t	**4**	**4**	**6**	**7**	**10**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	BH14 0.50	BH14 1.00	BH14 1.50	----	----
			Sampling date / time	12-Jul-2022 00:00	12-Jul-2022 00:00	12-Jul-2022 00:00	----	----
Compound	CAS Number	LOR	Unit	EB2222068-016	EB2222068-017	EB2222068-018	--------	--------
				Result	Result	Result	----	----
EA033-A: Actual Acidity								
pH KCl (23A)	----	0.1	pH Unit	5.6	5.3	5.0	----	----
Titratable Actual Acidity (23F)	----	2	mole H+ / t	4	7	11	----	----
sulfidic - Titratable Actual Acidity (s-23F)	----	0.02	% pyrite S	<0.02	<0.02	<0.02	----	----
EA033-B: Potential Acidity								
Chromium Reducible Sulfur (22B)	----	0.005	% S	0.015	0.108	0.094	----	----
acidity - Chromium Reducible Sulfur (a-22B)	----	10	mole H+ / t	<10	67	58	----	----
EA033-E: Acid Base Accounting								
ANC Fineness Factor	----	0.5	-	1.5	1.5	1.5	----	----
Net Acidity (sulfur units)	----	0.02	% S	0.02	0.12	0.11	----	----
Net Acidity (acidity units)	----	10	mole H+ / t	13	74	69	----	----
Liming Rate	----	1	kg CaCO3/t	<1	6	5	----	----
Net Acidity excluding ANC (sulfur units)	----	0.02	% S	0.02	0.12	0.11	----	----
Net Acidity excluding ANC (acidity units)	----	10	mole H+ / t	13	74	69	----	----
Liming Rate excluding ANC	----	1	kg CaCO3/t	<1	6	5	----	----

ALS Environmental

QUALITY CONTROL REPORT

Work Order	: **EB2222068**	Page	: 1 of 4
Client	: **PRECISE ENVIRONMENTAL PTY LTD**	Laboratory	: Environmental Division Brisbane
Contact	: RESULTS & INVOICE	Contact	: Nidhi Bhimani
Address	: PO BOX 4424 ROBINA TOWN CENTRE QLD, AUSTRALIA 4230	Address	: 2 Byth Street Stafford QLD Australia 4053
Telephone	: +61 07 5593 7848	Telephone	: +61-7-3243 7222
Project	: PE3394.22	Date Samples Received	: 25-Jul-2022
Order number	: PE3394.22	Date Analysis Commenced	: 03-Aug-2022
C-O-C number	: ----	Issue Date	: 03-Aug-2022
Sampler	: CHRIS BUTLER, SEAN GARDINER		
Site	: ----		
Quote number	: BN/031/16 V5		
No. of samples received	: 18		
No. of samples analysed	: 18		

Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percentage Difference (RPD) and Acceptance Limits
- Method Blank (MB) and Laboratory Control Spike (LCS) Report; Recovery and Acceptance Limits
- Matrix Spike (MS) Report; Recovery and Acceptance Limits

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Ben Felgendrejeris	Senior Acid Sulfate Soil Chemist	Brisbane Acid Sulphate Soils, Stafford, QLD

General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis. Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

Key : Anonymous = Refers to samples which are not specifically part of this work order but formed part of the QC process lot
CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
RPD = Relative Percentage Difference
# = Indicates failed QC

Laboratory Duplicate (DUP) Report

The quality control term Laboratory Duplicate refers to a randomly selected intralaboratory split. Laboratory duplicates provide information regarding method precision and sample heterogeneity. The permitted ranges for the Relative Percent Deviation (RPD) of Laboratory Duplicates are specified in ALS Method QWI-EN/38 and are dependent on the magnitude of results in comparison to the level of reporting: Result < 10 times LOR: No Limit; Result between 10 and 20 times LOR: 0% - 50%; Result > 20 times LOR: 0% - 20%.

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report						
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Acceptable RPD (%)
EA033-A: Actual Acidity (QC Lot: 4494355)									
EB2221902-001	Anonymous	EA033: sulfidic - Titratable Actual Acidity (s-23F)	----	0.02	% pyrite S	0.08	0.08	0.0	No Limit
		EA033: Titratable Actual Acidity (23F)	----	2	mole H+ / t	48	47	0.0	0% - 20%
		EA033: pH KCl (23A)	----	0.1	pH Unit	4.5	4.5	0.0	0% - 20%
EB2222060-005	Anonymous	EA033: sulfidic - Titratable Actual Acidity (s-23F)	----	0.02	% pyrite S	0.03	0.03	0.0	No Limit
		EA033: Titratable Actual Acidity (23F)	----	2	mole H+ / t	19	18	0.0	No Limit
		EA033: pH KCl (23A)	----	0.1	pH Unit	4.9	4.9	0.0	0% - 20%
EA033-A: Actual Acidity (QC Lot: 4494356)									
EB2222068-010	BH9 1.50	EA033: sulfidic - Titratable Actual Acidity (s-23F)	----	0.02	% pyrite S	<0.02	<0.02	0.0	No Limit
		EA033: Titratable Actual Acidity (23F)	----	2	mole H+ / t	7	7	0.0	No Limit
		EA033: pH KCl (23A)	----	0.1	pH Unit	5.2	5.2	0.0	0% - 20%
EB2222247-002	Anonymous	EA033: sulfidic - Titratable Actual Acidity (s-23F)	----	0.02	% pyrite S	<0.02	<0.02	0.0	No Limit
		EA033: Titratable Actual Acidity (23F)	----	2	mole H+ / t	<2	<2	0.0	No Limit
		EA033: pH KCl (23A)	----	0.1	pH Unit	7.0	7.0	0.0	0% - 20%
EA033-B: Potential Acidity (QC Lot: 4494355)									
EB2221902-001	Anonymous	EA033: Chromium Reducible Sulfur (22B)	----	0.005	% S	0.033	0.030	7.8	No Limit
		EA033: acidity - Chromium Reducible Sulfur (a-22B)	----	10	mole H+ / t	20	19	7.8	No Limit
EB2222060-005	Anonymous	EA033: Chromium Reducible Sulfur (22B)	----	0.005	% S	0.025	0.024	0.0	No Limit
		EA033: acidity - Chromium Reducible Sulfur (a-22B)	----	10	mole H+ / t	15	15	0.0	No Limit
EA033-B: Potential Acidity (QC Lot: 4494356)									
EB2222068-010	BH9 1.50	EA033: Chromium Reducible Sulfur (22B)	----	0.005	% S	0.124	0.126	1.3	0% - 20%
		EA033: acidity - Chromium Reducible Sulfur (a-22B)	----	10	mole H+ / t	77	78	0.0	No Limit

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Acceptable RPD (%)
EA033-B: Potential Acidity (QC Lot: 4494356) - continued									
EB2222247-002	Anonymous	EA033: Chromium Reducible Sulfur (22B)	----	0.005	% S	0.025	0.024	0.0	No Limit
		EA033: acidity - Chromium Reducible Sulfur (a-22B)	----	10	mole H+ / t	16	15	0.0	No Limit

Method Blank (MB) and Laboratory Control Sample (LCS) Report

The quality control term Method / Laboratory Blank refers to an analyte free matrix to which all reagents are added in the same volumes or proportions as used in standard sample preparation. The purpose of this QC parameter is to monitor potential laboratory contamination. The quality control term Laboratory Control Sample (LCS) refers to a certified reference material, or a known interference free matrix spiked with target analytes. The purpose of this QC parameter is to monitor method precision and accuracy independent of sample matrix. Dynamic Recovery Limits are based on statistical evaluation of processed LCS.

Sub-Matrix: **SOIL**

				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Acceptable Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	Low	High
EA033-A: Actual Acidity (QCLot: 4494355)								
EA033: pH KCl (23A)	----	----	pH Unit	----	4.4 pH Unit	99.2	91.0	107
EA033: Titratable Actual Acidity (23F)	----	2	mole H+ / t	<2	16 mole H+ / t	102	70.0	124
EA033: sulfidic - Titratable Actual Acidity (s-23F)	----	0.02	% pyrite S	<0.02	----	----	----	----
EA033-A: Actual Acidity (QCLot: 4494356)								
EA033: pH KCl (23A)	----	----	pH Unit	----	4.4 pH Unit	99.2	91.0	107
EA033: Titratable Actual Acidity (23F)	----	2	mole H+ / t	<2	16 mole H+ / t	98.4	70.0	124
EA033: sulfidic - Titratable Actual Acidity (s-23F)	----	0.02	% pyrite S	<0.02	----	----	----	----
EA033-B: Potential Acidity (QCLot: 4494355)								
EA033: Chromium Reducible Sulfur (22B)	----	0.005	% S	<0.005	0.246 % S	92.4	77.0	121
EA033: acidity - Chromium Reducible Sulfur (a-22B)	----	10	mole H+ / t	<10	----	----	----	----
EA033-B: Potential Acidity (QCLot: 4494356)								
EA033: Chromium Reducible Sulfur (22B)	----	0.005	% S	<0.005	0.246 % S	88.7	77.0	121
EA033: acidity - Chromium Reducible Sulfur (a-22B)	----	10	mole H+ / t	<10	----	----	----	----

Matrix Spike (MS) Report

The quality control term Matrix Spike (MS) refers to an intralaboratory split sample spiked with a representative set of target analytes. The purpose of this QC parameter is to monitor potential matrix effects on analyte recoveries. Static Recovery Limits as per laboratory Data Quality Objectives (DQOs). Ideal recovery ranges stated may be waived in the event of sample matrix interference.

- **No Matrix Spike (MS) or Matrix Spike Duplicate (MSD) Results are required to be reported.**

ALS Environmental

QA/QC Compliance Assessment to assist with Quality Review

Work Order	: **EB2222068**	Page	: 1 of 5
Client	: **PRECISE ENVIRONMENTAL PTY LTD**	Laboratory	: Environmental Division Brisbane
Contact	: RESULTS & INVOICE	Telephone	: +61-7-3243 7222
Project	: PE3394.22	Date Samples Received	: 25-Jul-2022
Site	: ----	Issue Date	: 03-Aug-2022
Sampler	: CHRIS BUTLER, SEAN GARDINER	No. of samples received	: 18
Order number	: PE3394.22	No. of samples analysed	: 18

This report is automatically generated by the ALS LIMS through interpretation of the ALS Quality Control Report and several Quality Assurance parameters measured by ALS. This automated reporting highlights any non-conformances, facilitates faster and more accurate data validation and is designed to assist internal expert and external Auditor review. Many components of this report contribute to the overall DQO assessment and reporting for guideline compliance.

Brief method summaries and references are also provided to assist in traceability.

Summary of Outliers

Outliers : Quality Control Samples

This report highlights outliers flagged in the Quality Control (QC) Report.

- **NO Method Blank value outliers occur.**
- **NO Duplicate outliers occur.**
- **NO Laboratory Control outliers occur.**
- **NO Matrix Spike outliers occur.**
- **For all regular sample matrices, NO surrogate recovery outliers occur.**

Outliers : Analysis Holding Time Compliance

- **NO Analysis Holding Time Outliers exist.**

Outliers : Frequency of Quality Control Samples

- **NO Quality Control Sample Frequency Outliers exist.**

Analysis Holding Time Compliance

If samples are identified below as having been analysed or extracted outside of recommended holding times, this should be taken into consideration when interpreting results.

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times (referencing USEPA SW 846, APHA, AS and NEPM) based on the sample container provided. Dates reported represent first date of extraction or analysis and preclude subsequent dilutions and reruns. A listing of breaches (if any) is provided herein.

Holding time for leachate methods (e.g. TCLP) vary according to the analytes reported. Assessment compares the leach date with the shortest analyte holding time for the equivalent soil method. These are: organics 14 days, mercury 28 days & other metals 180 days. A recorded breach does not guarantee a breach for all non-volatile parameters.

Holding times for ***VOC in soils*** vary according to analytes of interest. Vinyl Chloride and Styrene holding time is 7 days; others 14 days. A recorded breach does not guarantee a breach for all VOC analytes and should be verified in case the reported breach is a false positive or Vinyl Chloride and Styrene are not key analytes of interest/concern.

Matrix: **SOIL**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method	Sample Date	Extraction / Preparation			Analysis		
Container / Client Sample ID(s)		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA033-A: Actual Acidity							
80* dried soil (EA033)							
BH2 - 0.0, BH3 - 0.0, BH7 - 0.0, BH8 - 0.0, BH8 - 0.25, BH8 - 0.50, BH9 - 0.0, BH9 - 0.50, BH9 - 1.00, BH9 - 1.50, BH10 - 0.0, BH11 - 0.75, BH12 - 0.0, BH13 - 0.0, BH14 - 0.0, BH14 - 0.50, BH14 - 1.00, BH14 - 1.50	**12-Jul-2022**	**03-Aug-2022**	12-Jul-2023	✓	**03-Aug-2022**	01-Nov-2022	✓
EA033-B: Potential Acidity							
80* dried soil (EA033)							
BH2 - 0.0, BH3 - 0.0, BH7 - 0.0, BH8 - 0.0, BH8 - 0.25, BH8 - 0.50, BH9 - 0.0, BH9 - 0.50, BH9 - 1.00, BH9 - 1.50, BH10 - 0.0, BH11 - 0.75, BH12 - 0.0, BH13 - 0.0, BH14 - 0.0, BH14 - 0.50, BH14 - 1.00, BH14 - 1.50	**12-Jul-2022**	**03-Aug-2022**	12-Jul-2023	✓	**03-Aug-2022**	01-Nov-2022	✓

Matrix: **SOIL**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method		Sample Date	Extraction / Preparation			Analysis		
Container / Client Sample ID(s)			Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA033-C: Acid Neutralising Capacity								
80* dried soil (EA033)								
BH2 - 0.0,	BH3 - 0.0,	**12-Jul-2022**	**03-Aug-2022**	12-Jul-2023	✓	**03-Aug-2022**	01-Nov-2022	✓
BH7 - 0.0,	BH8 - 0.0,							
BH8 - 0.25,	BH8 - 0.50,							
BH9 - 0.0,	BH9 - 0.50,							
BH9 - 1.00,	BH9 - 1.50,							
BH10 - 0.0,	BH11 - 0.75,							
BH12 - 0.0,	BH13 - 0.0,							
BH14 - 0.0,	BH14 - 0.50,							
BH14 - 1.00,	BH14 - 1.50							
EA033-D: Retained Acidity								
80* dried soil (EA033)								
BH2 - 0.0,	BH3 - 0.0,	**12-Jul-2022**	**03-Aug-2022**	12-Jul-2023	✓	**03-Aug-2022**	01-Nov-2022	✓
BH7 - 0.0,	BH8 - 0.0,							
BH8 - 0.25,	BH8 - 0.50,							
BH9 - 0.0,	BH9 - 0.50,							
BH9 - 1.00,	BH9 - 1.50,							
BH10 - 0.0,	BH11 - 0.75,							
BH12 - 0.0,	BH13 - 0.0,							
BH14 - 0.0,	BH14 - 0.50,							
BH14 - 1.00,	BH14 - 1.50							
EA033-E: Acid Base Accounting								
80* dried soil (EA033)								
BH2 - 0.0,	BH3 - 0.0,	**12-Jul-2022**	**03-Aug-2022**	12-Jul-2023	✓	**03-Aug-2022**	01-Nov-2022	✓
BH7 - 0.0,	BH8 - 0.0,							
BH8 - 0.25,	BH8 - 0.50,							
BH9 - 0.0,	BH9 - 0.50,							
BH9 - 1.00,	BH9 - 1.50,							
BH10 - 0.0,	BH11 - 0.75,							
BH12 - 0.0,	BH13 - 0.0,							
BH14 - 0.0,	BH14 - 0.50,							
BH14 - 1.00,	BH14 - 1.50							

Quality Control Parameter Frequency Compliance

The following report summarises the frequency of laboratory QC samples analysed within the analytical lot(s) in which the submitted sample(s) was(were) processed. Actual rate should be greater than or equal to the expected rate. A listing of breaches is provided in the Summary of Outliers.

Matrix: **SOIL**

Evaluation: × = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Laboratory Duplicates (DUP)							
Chromium Suite for Acid Sulphate Soils	EA033	4	32	**12.50**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Chromium Suite for Acid Sulphate Soils	EA033	2	32	**6.25**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Chromium Suite for Acid Sulphate Soils	EA033	2	32	**6.25**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard

Brief Method Summaries

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the US EPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request. The following report provides brief descriptions of the analytical procedures employed for results reported in the Certificate of Analysis. Sources from which ALS methods have been developed are provided within the Method Descriptions.

Analytical Methods	Method	Matrix	Method Descriptions
Chromium Suite for Acid Sulphate Soils	EA033	SOIL	In house: Referenced to Ahern et al 2004. This method covers the determination of Chromium Reducible Sulfur (SCR); pHKCl; titratable actual acidity (TAA); acid neutralising capacity by back titration (ANC); and net acid soluble sulfur (SNAS) which incorporates peroxide sulfur. It applies to soils and sediments (including sands) derived from coastal regions. Liming Rate is based on results for samples as submitted and incorporates a minimum safety factor of 1.5.

Preparation Methods	Method	Matrix	Method Descriptions
Drying at 85 degrees, bagging and labelling (ASS)	EN020PR	SOIL	In house

APPENDIX G – CROSS SECTION SCHEMATICS

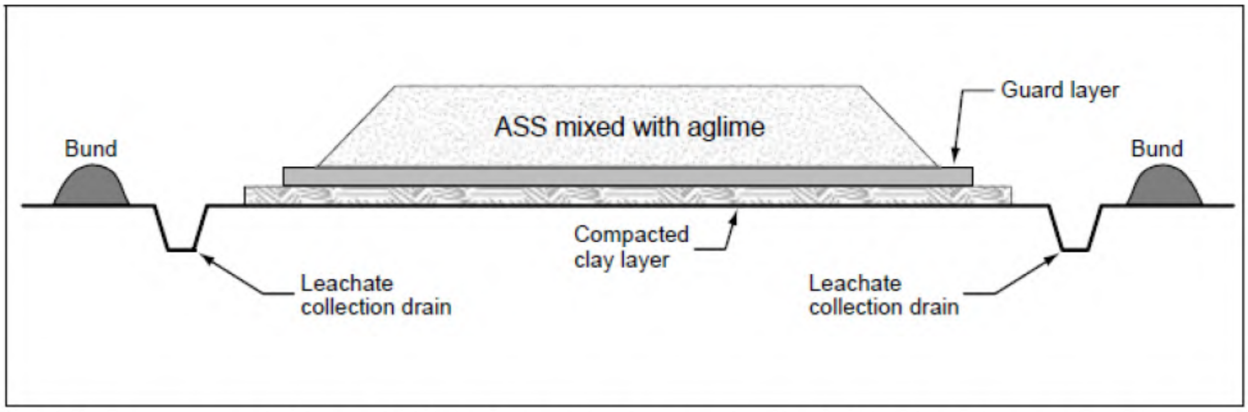

Figure 1. Schematic cross-section of a treatment pad, including a compacted clay layer, guard layer, leachate collection system and containment with bunding (Source: Soil Management Guidelines, DNRM, 2002).

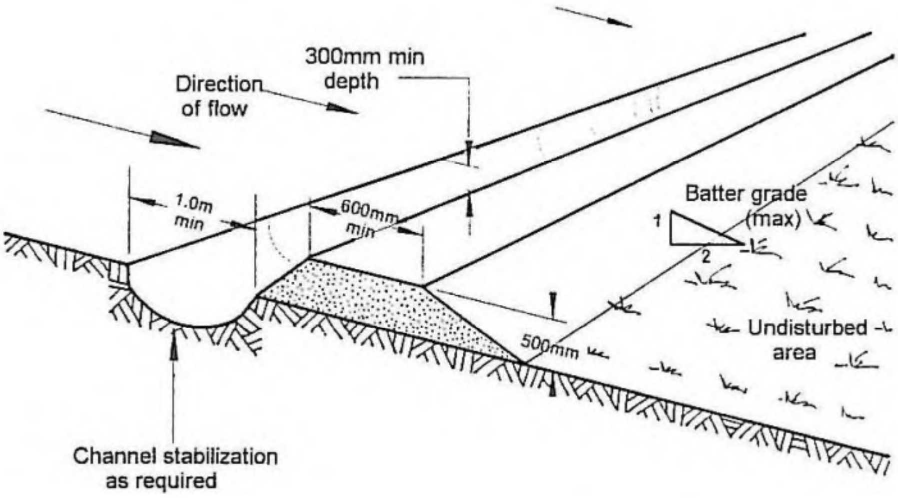

Figure 2. Cross-section of typical catch drain (Source: IE Aust, 1996).

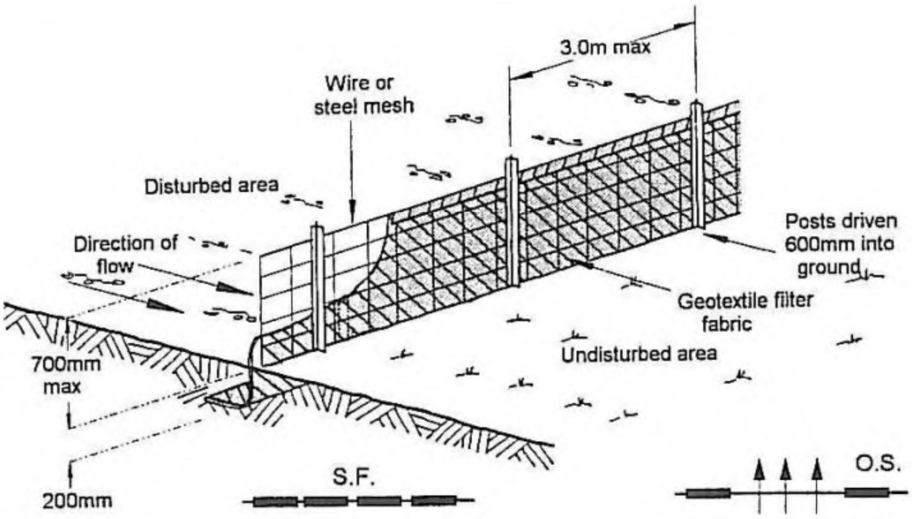

Figure 3. Cross-section of typical sediment fence (Source: IE Aust, 1996).

APPENDIX H – NSW WASTE CLASSIFICATION GUIDELINES

Waste classification guidelines

Part 4: Acid sulfate soils

www.epa.nsw.gov.au

Published by:

NSW Environment Protection Authority (EPA)
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PO Box A290
Sydney South NSW 1232

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See also www.epa.nsw.gov.au/pollution

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Phone: 131 555 (NSW only – environment information and publication requests)
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Speak and listen users: phone 1300 555 727, then ask for 131 555

Email: info@environment.nsw.gov.au
Website: www.epa.nsw.gov.au

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November 2014

Contents

Classifying wastes into groups that pose similar risks to the environment and human health facilitates their management and appropriate disposal. It is the responsibility of those who generate waste to classify that waste. To assist waste generators classify the wastes they produce, the EPA has developed the *Waste Classification Guidelines* ('the Guidelines') which are a step-by-step process for classifying waste.

Generators and waste facilities must carefully follow the procedures in these Guidelines to ensure they comply with applicable laws in classifying their waste and safeguard protection of the environment and human health.

The Guidelines are comprised of the following sections, of which this document is Part 4:

Overview of the Guidelines

Part 1: Classifying waste

Part 2: Immobilisation of waste

Part 3: Waste containing radioactive material

Part 4: Acid sulfate soils

All sections of the Guidelines are available for download from the EPA website at www.epa.nsw.gov.au/waste/classification.htm.

Introduction

Acid sulfate soils (ASS) are those naturally occurring sediments and soils which contain sulfides, mainly iron sulfide and iron disulfide or their precursors. Exposure of these sulfides in the soil to oxygen – often as a result of drainage or excavation – can produce sulfuric acid, which may have a significant impact on the environment. Leaching of sulfuric acid into waterways can cause serious water quality problems, resulting in fish kills and damage to infrastructure, such as floodgates and bridges.

ASS are most commonly found in NSW along the coast and they need to be managed appropriately to avoid major environmental damage.

The NSW *Acid Sulfate Soils Manual*[1] (the ASS Manual) provides 'best practice' guidance for planning, assessing and managing activities in areas prone to developing ASS. The manual is available from the NSW Department of Planning: phone 1300 305 695.

Using this part of the Guidelines

This part of the EPA Waste Classification Guidelines (the Guidelines) applies to acid sulfate soils which are unable to be managed on-site. In these cases, off-site disposal to landfill is often the most appropriate management option.

Waste generators need to assess the status of ASS at their point of generation, using the techniques outlined in the ASS Manual. The ASS Manual also provides guidance for on-site management, while this part of the Waste Classification Guidelines details disposal requirements for ASS that need to be transported and managed off-site.

This document has advice on dealing with both 'potential' ASS and 'actual' ASS. The two types are often found together in the same soil profile, with actual ASS generally overlying potential ASS horizons.

Potential acid sulfate soils

Potential ASS are soils that contain iron sulfides or sulfidic materials that have not been exposed to air and thus are not oxidised. The pH of these soils in their undisturbed state is 5.5 or more, making them neutral or slightly alkaline. If not managed appropriately, potential ASS pose a considerable environmental risk: disturbance and exposure to air may render them severely acidic.

Handling potential acid sulfate soils prior to disposal

Potential ASS must be kept wet at all times during excavation and subsequent handling, transport and storage, until they can be disposed of safely. They must be received at the proposed disposal point within 16 hours of being dug up.

[1] Stone Y, Ahem, CR and Blunden, B 1998. *Acid Sulphate Soils Manual 1998*. Acid Sulphate Soils Management Advisory Committee (ASSMAC), Wollongbar, NSW.

Disposal of potential acid sulfate soils *below* the water table

Potential ASS may be disposed of in water below the permanent water table, provided:

- this occurs before they have had a chance to oxidise, i.e. within 24 hours of excavation

and

- they meet the definition of ‘virgin excavated natural material’ (VENM) under the *Protection of the Environment Operations Act 1997*, even though they contain sulfidic ores or soils.

Landfills must be licensed by the EPA to dispose of potential ASS below the water table. EPA’s Environment Line has details on facilities able to accept this waste: phone 131 555.

Potential ASS must be disposed of within 8 hours of their receipt at a landfill and kept wet at all times until their burial at least two metres below the lowest historical level of the water table at the disposal site.

Documentation must be provided to the occupier of the landfill for each truckload of potential ASS received, indicating that the soil’s excavation, transport and handling have been in accordance with the ASS Manual, thus preventing the generation of acid.

The occupier of the disposal site must also test the pH of each load of soil received immediately prior to its placement under water using the test method(s) in the ASS Manual (Methods 21A and/or 21Af). These details, together with the pH of the soil recorded at the time of its extraction, must be retained by the occupier of the landfill site.

The disposal site’s licence will outline what documentation needs to be kept and for how long.

Soil that has dried out, undergone any oxidation of its sulfidic minerals, or which has a pH of less than 5.5 must be treated by neutralisation and disposed of at a landfill that can lawfully accept it (see **Disposal of actual acid sulfate soils** below).

The pH of the water at the landfill into which the potential ASS is placed must not be less than 6.0 at any time. Landfill licence conditions require the occupiers of potential ASS disposal sites to regularly monitor the pH of ground and surface waters at their premises.

Disposal of potential acid sulfate soils *above* the water table

Where potential ASS cannot be classified as VENM or a suitable underwater disposal site at a landfill is not available, the soil must be treated in accordance with the neutralising techniques in the ASS Manual. After treatment the soil should be chemically assessed in accordance with Step 5 in Part 1 of the Waste Classification Guidelines, available at www.epa.nsw.gov.au/waste/classification.htm. This will determine whether any other contaminants are present in the material. When the classification has been established, the soil should be disposed of to a landfill that can lawfully accept that class of waste.

Actual acid sulfate soils

Actual ASS contain highly acidic soil horizons or layers resulting from the aeration of soil materials that are rich in sulfides, primarily iron sulfide. This oxidation produces more hydrogen ions than the sediment is able to neutralise, resulting in soils with a pH of 5.5 or less when measured in dry season conditions. These soils can usually be identified by the presence of pale yellow mottles and coatings of jarosite.

Treatment of actual acid sulfate soils prior to disposal

Actual ASS must be treated by the generator of the waste before they can be considered for disposal. Treatment should be in accordance with the neutralising techniques outlined in the ASS Manual.

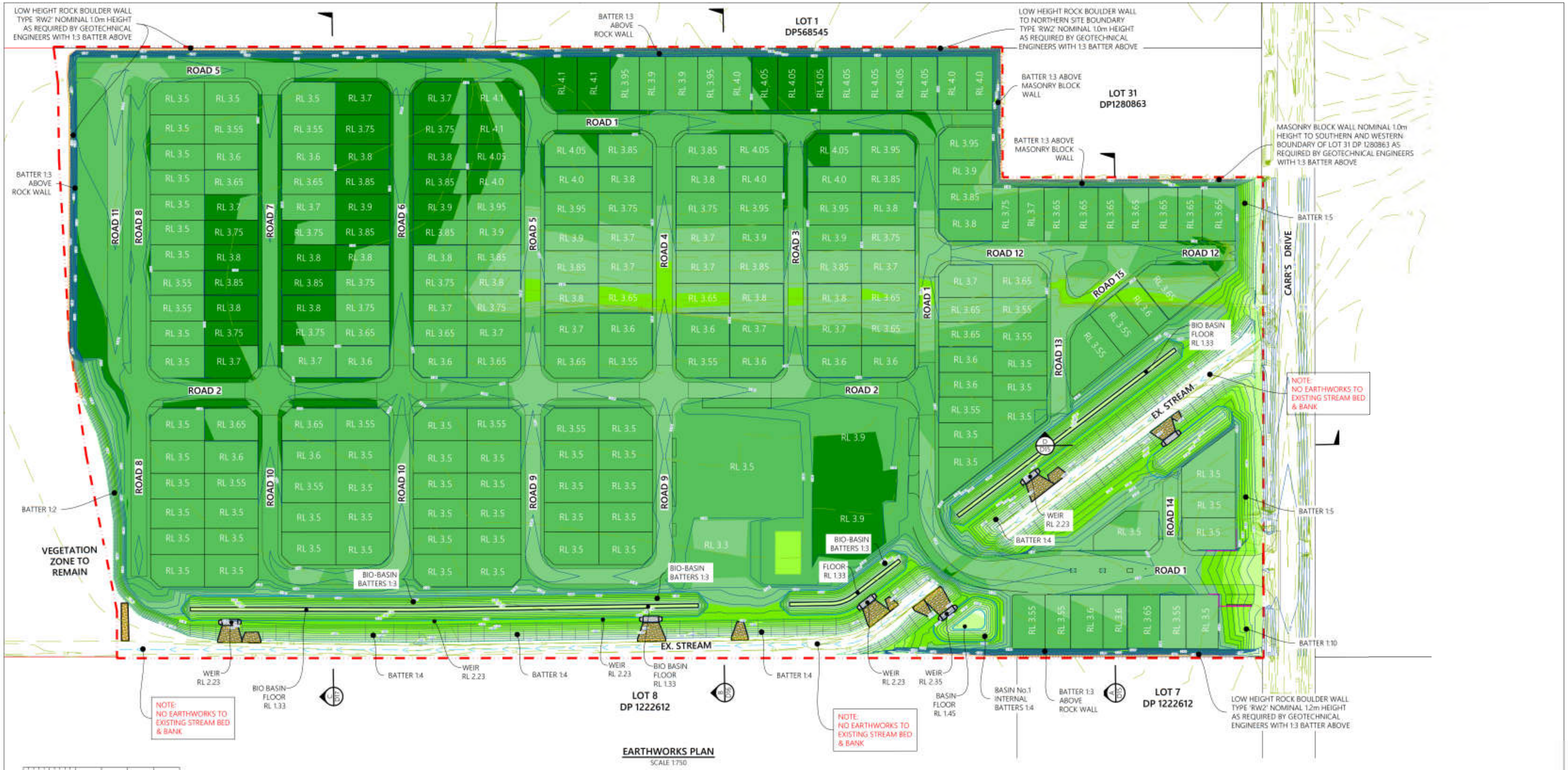
Disposal of actual acid sulfate soils

Following neutralisation, the generator of the waste must chemically assess the soil in accordance with Step 5 of Part 1 of the Waste Classification Guidelines. This will determine whether there are any other contaminants that may affect how the waste is classified for disposal.

Once classified, the waste must be taken to a landfill licensed to accept that class of waste.

Prior arrangements should be made with the occupier of the landfill to ensure that it is licensed to accept the waste. The landfill should be informed that the actual ASS has been treated in accordance with the neutralising techniques outlined in the ASS Manual and that the waste has also been classified in accordance with Part 1 of the Waste Classification Guidelines.

Appendix 5 Earthworks Plan



EARTHWORKS PLAN

SCALE 1:750

Horizontal Scale 1:750 (A1)
1:1500 (A3)

LEGEND

- FILL 0.0 - 0.5m DEPTH
- FILL 0.5 - 1.0m DEPTH
- FILL 1.0 - 1.5m DEPTH
- FILL 1.5 - 2.0m DEPTH
- FILL 2.0 - 2.5m DEPTH
- FILL 2.5 - 3.0m DEPTH
- FILL 3.0- 3.2m DEPTH
- EXISTING SITE CONTOURS 0.1m INTERVAL
- PROPOSED RE-GRADING CONTOURS 0.2m INTERVAL

PRELIMINARY EARTHWORKS ESTIMATE

EARTHWORKS CUT TO FILL FROM NOMINAL 100mm DEEP STRIPPED SURFACE. TOPSOIL DEPTH TO BE CONFIRMED AT DETAILED DESIGN STAGE.

VOLUMES INCLUDING NOMINAL INTERNAL ROADWAY BOXING 320mm DEEP

AREA OF EARTHWORKS =9.67Ha (EXCL. CARRS DRIVE RECONSTRUCTION)
TOPSOIL STRIPPED TO STOCKPILE = 9,670m³

GENERAL BULK EARTHWORKS
TOTAL CUT = 0m³
TOTAL FILL = 239,700m³ (IMPORTED FROM APPROVED SOURCE or QUARRY)

NOTES:
AMENDED LOWER CLARENCE FLOOD MODEL 2022 WITH 1% AEP FLOOD LEVEL RL=3.5m AHD

ALLOTMENT EARTHWORKS LEVELS TO BE NO LESS THAN THE 100 YEAR (1% AEP) FLOOD LEVEL RL=3.5m AHD.

PLANS TO BE PRINTED IN COLOUR

PRELIMINARY PLANS FOR DA PURPOSES ONLY NOT FOR CONSTRUCTION

ISSUE	DESCRIPTION	DATE
1	ISSUED FOR DEVELOPMENT APPLICATION - AMENDED SITE FORMATION HEIGHTS	23.01.2024
0	ISSUED FOR DEVELOPMENT APPLICATION	06.09.2022

DESIGNED:	T.RYDEN	DATE:	JAN 2024
DRAWN:	A.SCHMID	SCALE:	AS SHOWN
SURVEYING:	MACRO SURVEYING	SHEET SIZE:	A1

ISSUED FOR DEVELOPMENT APPROVAL
NOT FOR CONSTRUCTION

MDE Manage Design Engineer

CLIENT
CLIFTON YAMBA LAND PTY LTD

TITLE
110 & 120 CARRS DRIVE, YAMBA
DEVELOPMENT APPLICATION CIVIL WORKS PLANS

CLIFTON YAMBA

PROJECT
PROPOSED MHE DEVELOPMENT
110 & 120 CARRS DRIVE
YAMBA, NSW 2464
LOT 2 DP733507 & LOT 32 DP128863

DA CIVIL DRAWING

DRAWING TITLE: EARTHWORKS PLAN

DWG No: D14 | SHEET: 14 OF 43 | REV: 1

DESIGN GRADELINE: 33% | 0% | 0% | -2.5% | 2.5% | 0% | -6.96% | -6.95% | -19.83% | 19.84% | 0% | 26.48% | 11.7% | 0% | -1.52% | 0.34% | 2.5% | 0% | 0% | 33%

VERTICAL GEOMETRY

HORIZONTAL GEOMETRY

DATUM RL-14.0

CHAINAGES	CUT / FILL	DESIGN SURFACE	NATURAL SURFACE
0.000			1.152
1.019	-1.465	2.62	1.154
3.278	-2.441	3.6	1.159
10.000	-2.423	3.6	1.177
20.000	-2.348	3.6	1.252
23.478	-2.35	3.6	1.250
23.728	-2.468	3.717	1.249
30.000	-2.333	3.56	1.227
33.028	-2.269	3.484	1.215
40.000	-2.48	3.659	1.179
40.628	-2.498	3.674	1.176
40.878	-2.325	3.5	1.175
50.000	-2.394	3.5	1.106
52.440	-2.432	3.5	1.068
55.000	-2.293	3.321	1.028
60.000	-2.023	2.973	0.951
66.378	-1.605	2.53	0.925
67.888	-1.605	2.5	0.895
70.000	-1.213	2.081	0.868
75.909	0	0.909	0.909
80.000			0.583
84.119	0	0.727	0.727
90.000	-1.215	1.893	0.678
93.061	-1.811	2.5	0.689
94.571	-1.83	2.53	0.700
99.102	-0.588	1.33	0.742
100.000	-0.581	1.33	0.749
100.864	-0.574	1.33	0.756
106.528	-2.063	2.83	0.767
110.000	-2.456	3.236	0.781
112.681	-2.757	3.55	0.793
120.000	-2.723	3.55	0.827
130.000	-2.677	3.55	0.873
138.699	-1.844	3.55	1.706
138.742	-1.906	3.611	1.705
139.021	-2.009	3.708	1.699
140.000	-2.015	3.693	1.679
144.817	-2.347	3.62	1.274
145.000	-2.381	3.625	1.244
147.418	-2.707	3.681	0.974
150.000	-2.64	3.656	1.016
154.682	-2.579	3.672	1.093
159.182	-2.656	3.784	1.128
159.432	-2.522	3.65	1.128
160.000	-2.521	3.65	1.129
170.000	-2.543	3.65	1.107
175.000	-2.492	3.65	1.158
179.632	-2.436	3.65	1.214
180.000	-2.299	3.528	1.229
180.660	-1.920	3.212	1.250
180.660	-1.920	3.212	1.250

Horizontal 1:250 Vertical 1:250

BULK EARTHWORKS SECTION - A

DESIGN GRADELINE: 15.2% | -13.5% | 12.6% | 33% | 0% | -21.3% | -2.5% | -25% | 25% | 3% | -3%

VERTICAL GEOMETRY

HORIZONTAL GEOMETRY

DATUM RL-14.0

CHAINAGES	CUT / FILL	DESIGN SURFACE	NATURAL SURFACE
0.000			0.716
9.761	0.0	0.902	0.902
10.000	-0.103	1.021	0.918
19.761	-1.566	2.5	0.934
20.000	-1.563	2.5	0.937
21.737	-1.546	2.5	0.954
27.665	-0.686	1.7	1.014
29.311	-0.672	1.7	1.028
30.000	-0.754	1.787	1.033
37.216	-1.607	2.7	1.093
39.507	-2.388	3.5	1.112
40.000	-2.384	3.5	1.116
46.134	-2.333	3.5	1.167
50.000	-1.478	2.676	1.198
53.751	-0.652	1.878	1.225
56.251	-0.591	1.815	1.224
58.651	-0.214	1.215	1.001
59.408	-0.136	1.215	1.079
60.000	-0.24	1.363	1.123
61.808	-0.367	1.815	1.448
62.008	-0.351	1.815	1.464
66.308	-0.312	1.944	1.632
70.000	-0.35	1.833	1.483
70.308	-0.387	1.824	1.437

Horizontal 1:250 Vertical 1:250

BULK EARTHWORKS SECTION - D

ISSUE	DESCRIPTION	DATE
1	ISSUED FOR DEVELOPMENT APPLICATION - AMENDED SITE FORMATION HEIGHTS	23.01.2024
0	ISSUED FOR DEVELOPMENT APPLICATION	08.09.2022

DESIGNED: T.RYDEN | DATE: JAN 2024
DRAWN: A.SCHMID | SCALE: AS SHOWN
SURVEYING: MACRO SURVEYING | SHEET SIZE: A1

ISSUED FOR DEVELOPMENT APPROVAL
NOT FOR CONSTRUCTION

MDE Manage Design Engineer

CLIENT: CLIFTON YAMBA LAND PTY LTD

TITLE: 110 & 120 CARRS DRIVE, YAMBA
DEVELOPMENT APPLICATION CIVIL WORKS PLANS

CLIFTON YAMBA

PROJECT: PROPOSED MHE DEVELOPMENT
110 & 120 CARRS DRIVE
YAMBA, NSW 2464
LOT 2 DP733507 & LOT 32 DP128863

DA CIVIL DRAWING

DRAWING TITLE: EARTHWORKS SECTIONS - SHEET 1 OF 3

DWG No: D15 | SHEET: 15 OF 43 | REV: 1

DESIGN GRADELINE
VERTICAL GEOMETRY
HORIZONTAL GEOMETRY

25% | 2.5% | 5.2% | 5.25% | 3.7% | 1.93% | 0% | 7.07% | 0% | 2.25% | 5.24% | -2.5% | 2.5% | 0% | 0% | 0% | 0% | 0%

DATUM RL -13.0

CHAINAGES	CUT / FILL	DESIGN SURFACE	NATURAL SURFACE
0.000			
6.956	0.0	0.805	0.805
10.000	-0.685	1.496	0.810
14.018	-1.677	2.5	0.823
15.202	-1.703	2.529	0.826
20.000	-1.938	2.779	0.841
22.854	-2.079	2.929	0.850
25.586	-2.172	3.03	0.858
26.327	-2.34	3.2	0.860
30.000	-2.399	3.271	0.872
31.497	-2.424	3.3	0.876
40.000	-2.398	3.3	0.902
50.000	-2.367	3.3	0.933
51.497	-2.363	3.3	0.937
54.326	-2.554	3.5	0.946
60.000	-2.536	3.5	0.964
70.000	-2.506	3.5	0.994
80.000	-2.475	3.5	1.025
88.326	-2.477	3.5	1.023
90.000	-2.516	3.538	1.022
92.664	-2.572	3.597	1.025
95.012	-2.686	3.721	1.035
95.125	-2.681	3.716	1.035
95.262	-2.67	3.706	1.036
100.000	-2.533	3.588	1.055
101.962	-2.476	3.539	1.063
106.662	-2.578	3.656	1.078
106.912	-2.471	3.55	1.079
110.000	-2.461	3.55	1.089
118.912	-2.433	3.55	1.117
119.412	-2.482	3.6	1.118
120.000	-2.48	3.6	1.120
130.000	-2.058	3.6	1.542
131.412	-1.99	3.6	1.610
131.912	-2.015	3.65	1.635
140.000	-1.908	3.65	1.742
142.712	-1.957	3.65	1.693
143.212	-2.016	3.7	1.684
150.000	-2.14	3.7	1.560
160.000	-2.322	3.7	1.378
165.112	-2.408	3.7	1.292
165.612	-2.467	3.75	1.283
170.000	-2.538	3.75	1.212
175.000	-2.61	3.75	1.140

Horizontal 1:250 Vertical 1:250

BULK EARTHWORKS SECTION - B

DESIGN GRADELINE
VERTICAL GEOMETRY
HORIZONTAL GEOMETRY

0% | 0% | 0% | -2.5% | 2.5% | 0% | -33%

DATUM RL -13.0

CHAINAGES	CUT / FILL	DESIGN SURFACE	NATURAL SURFACE
175.000	-2.61	3.75	1.140
177.612	-2.604	3.75	1.146
178.112	-2.653	3.8	1.147
180.000	-2.65	3.8	1.150
187.512	-2.635	3.8	1.165
188.012	-2.684	3.85	1.166
190.000	-2.68	3.85	1.170
200.000	-2.66	3.85	1.190
200.012	-2.66	3.85	1.190
200.262	-2.937	4.127	1.190
204.762	-2.816	4.015	1.199
209.262	-2.919	4.127	1.208
209.512	-2.791	4	1.209
210.000	-2.791	4	1.209
220.000	-2.772	4	1.228
229.712	-2.83	4	1.170
230.000	-2.736	3.903	1.168
232.287	-1.983	3.137	1.154
233.104			1.149

Horizontal 1:250 Vertical 1:250

CONTINUATION SECTION - B

ISSUE	DESCRIPTION	DATE
1	ISSUED FOR DEVELOPMENT APPLICATION - AMENDED SITE FORMATION HIGHTS	23.01.2024
0	ISSUED FOR DEVELOPMENT APPLICATION	06.09.2022

DESIGNED: T.RYDEN DATE: JAN 2024
DRAWN: A.SCHMID SCALE: AS SHOWN
SURVEYING: MACRO SURVEYING SHEET SIZE: A1

ISSUED FOR DEVELOPMENT APPROVAL
NOT FOR CONSTRUCTION

MDE Manage Design Engineer

CLIENT: CLIFTON YAMBA LAND PTY LTD
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CLIFTON YAMBA

PROJECT: PROPOSED MHE DEVELOPMENT
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YAMBA, NSW 2464
LOT 2 DP733507 & LOT 32 DP128863

DA CIVIL DRAWING
DRAWING TITLE: EARTHWORKS SECTIONS - SHEET 2 OF 3
DWG No: D16 SHEET: 16 OF 43 REV: 1

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VERTICAL GEOMETRY

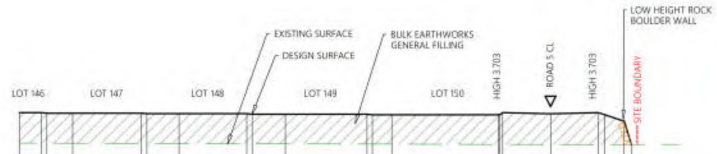
HORIZONTAL GEOMETRY

DATUM RL -14.0

CHAINAGES	CUT / FILL	DESIGN SURFACE	NATURAL SURFACE
0.000			
5.230	0.0	0.658	0.658
10.000	-1.179	1.843	0.664
12.632	-1.831	2.5	0.669
13.832	-1.858	2.53	0.672
17.432	-0.651	1.33	0.679
18.832	-0.648	1.33	0.682
20.000	-1.035	1.719	0.684
23.332	-2.14	2.83	0.690
26.328	-2.785	3.481	0.696
30.000	-2.685	3.389	0.704
30.828	-2.663	3.369	0.705
35.328	-2.767	3.481	0.714
35.578	-2.785	3.5	0.715
40.000	-2.776	3.5	0.724
50.000	-2.757	3.5	0.743
58.878	-2.739	3.5	0.761
59.378	-2.788	3.55	0.762
60.000	-2.787	3.55	0.763
70.000	-2.767	3.55	0.783
71.378	-2.764	3.55	0.786
71.878	-2.813	3.6	0.787
80.000	-2.797	3.6	0.803
82.678	-2.792	3.6	0.808
83.178	-2.841	3.65	0.809
90.000	-2.827	3.65	0.823
95.178	-2.817	3.65	0.833
95.428	-3.077	3.911	0.834
100.000	-2.954	3.797	0.843
102.128	-2.897	3.743	0.847
106.928	-3.007	3.863	0.856
107.178	-2.843	3.7	0.857
110.000	-2.838	3.7	0.862
119.178	-2.83	3.7	0.870
119.678	-2.879	3.75	0.871
120.000	-2.879	3.75	0.871
128.578	-2.873	3.75	0.878
129.078	-2.921	3.8	0.879
130.000	-2.921	3.8	0.879
138.478	-2.913	3.8	0.887
138.978	-2.963	3.85	0.887
140.000	-2.962	3.85	0.888
147.878	-2.965	3.85	0.885
148.378	-2.915	3.8	0.885
150.000	-2.916	3.8	0.884
157.778	-2.919	3.8	0.881
158.278	-2.869	3.75	0.881
160.000	-2.87	3.75	0.880
167.178	-2.892	3.75	0.858
167.678	-2.844	3.7	0.856
170.000	-2.851	3.7	0.849
175.000	-2.867	3.7	0.833

Horizontal 1:250 Vertical 1:250

BULK EARTHWORKS SECTION - C



DESIGN GRADELINE: 0% | 0% | 0% | 0% | -2.5% | 2.5% | 2.5%

VERTICAL GEOMETRY

HORIZONTAL GEOMETRY

DATUM RL -14.0

CHAINAGES	CUT / FILL	DESIGN SURFACE	NATURAL SURFACE
175.000	-2.867	3.7	0.833
177.078	-2.873	3.7	0.827
177.578	-2.825	3.65	0.825
180.000	-2.832	3.65	0.818
186.478	-2.851	3.65	0.799
186.978	-2.803	3.6	0.797
190.000	-2.811	3.6	0.789
196.378	-2.829	3.6	0.771
196.878	-2.78	3.55	0.770
200.000	-2.789	3.55	0.761
207.678	-2.81	3.55	0.740
208.178	-2.761	3.5	0.739
210.000	-2.766	3.5	0.734
220.000	-2.794	3.5	0.706
220.178	-2.794	3.5	0.706
220.428	-2.998	3.703	0.705
224.928	-2.898	3.59	0.692
229.428	-3.023	3.703	0.680
230.000	-2.83	3.512	0.683
231.867	-2.198	2.89	0.692
233.424			0.701

Horizontal 1:250 Vertical 1:250

CONTINUATION SECTION - C

ISSUE	DESCRIPTION	DATE
1	ISSUED FOR DEVELOPMENT APPLICATION - AMENDED SITE FORMATION HEIGHTS	23.01.2024
0	ISSUED FOR DEVELOPMENT APPLICATION	08.09.2022

DESIGNED: T.RYDEN | DATE: JAN 2024
DRAWN: A.SCHMID | SCALE: AS SHOWN
SURVEYING: MACRO SURVEYING | SHEET SIZE: A1

ISSUED FOR DEVELOPMENT APPROVAL
NOT FOR CONSTRUCTION

MDE Manage Design Engineer

CLIENT: CLIFTON YAMBA LAND PTY LTD

TITLE: 110 & 120 CARRS DRIVE, YAMBA
DEVELOPMENT APPLICATION CIVIL WORKS PLANS

CLIFTON YAMBA

PROJECT: PROPOSED MHE DEVELOPMENT
110 & 120 CARRS DRIVE
YAMBA, NSW 2464
LOT 2 DP733507 & LOT 32 DP128863

DA CIVIL DRAWING

DRAWING TITLE: EARTHWORKS SECTIONS - SHEET 3 OF 3

DWG No: D17 | SHEET: 17 OF 43 | REV: 1

Appendix 6 Works schedule

	Establishment period	Maintenance period															
	Year 1	Year 2				Year 3				Year 4				Year 5			
		Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Civil works																	
Install construction fencing																	
Install sediment fencing																	
Install information signage																	
Revegetation																	
Seed collection, cleaning, storage																	
Site preparation																	
Install jute matt and mulch																	
Tubestock, supply and install																	

	Establishment period	Maintenance period															
	Year 1	Year 2				Year 3				Year 4				Year 5			
		Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Replacement tubestock, supply and install																	
watering																	
Weed control																	
Primary																	
Secondary																	
Maintenance																	
Other works																	
Monitoring and reporting																	

Appendix 7 Existing vegetation species list

Scientific name	Common name	Growth form
Acacia melanoxylon	blackwood	Tree
Alphitonia excelsa	red ash	Tree
*Archontophoenix spp.**	Alexander palm	Palm & palmlike
*Asparagus aethiopicus**	ground asparagus	Other
*Baccharis halimifolia**	groundsel bush	Shrub
Banksia integrifolia	coast banksia	Tree
Baumea articulata	jointed twig-rush	Grass
Baumea juncea	-	Grass
Breynia oblongifolia	coffee bush	Shrub
Callistemon salignus	willow bottlebrush	Shrub
Carex appressa	tall sedge	Grass
Casuarina glauca	swamp oak	Tree
Centella asiatica	Indian pennywort	Forb
*Cinnamomum camphora**	camphor laurel	Tree
Convolvulus erubescens	pink bindweed	Other
Cupaniopsis anacardioides	tuckeroo	Tree
Cyclophyllum longipetalum	coast canthium	Tree
Cyperus haspan	-	Grass
Dianella longifolia	blue flax lily	Forb
Eclipta platyglossa	yellow twin-heads	Forb
Elaeocarpus obovatus	hard quandong	Tree
Entolasia marginata	bordered panic	Grass
Entolasia stricta	wiry panic	Grass
Eucalyptus tereticornis	forest red gum	Tree
Geitonoplesium cymosum	scrambling lily	Other
Glochidion ferdinandi var. ferdinandi	cheese tree	Tree
Glycine clandestina	twining glycine	Other

Scientific name	Common name	Growth form
Gonocarpus spp.	raspwort	Forb
Hibiscus diversifolius	swamp hibiscus	Shrub
Hydrocotyle acutiloba	-	Forb
Imperata cylindrica	-	Grass
*Ipomoea cairica**	morning glory - coastal	Other
Juncus kraussii subsp. australiensis	sea rush	Grass
Juncus usitatus	-	Grass
*Lantana camara**	lantana	Other
Livistona australis	cabbage palm	Other
Lobelia stenophylla	-	Forb
Lophostemon suaveolens	swamp mahogany	Tree
Maclura cochinchinensis	cockspur thorn	Other
Melaleuca alternifolia	-	Shrub
Melaleuca linariifolia	flax-leaved paperbark	Shrub
Melaleuca quinquenervia	broad-leaved paperbark	Tree
Melaleuca sieberi	-	Shrub
Microlaena stipoides	weeping grass	Grass
Morinda jasminoides	sweet morinda	Other
Myrsine variabilis	-	Shrub
Notelaea longifolia	large mock-olive	Tree
*Ochna serrulata**	ochna	Shrub
Parsonsia straminea	common silkpod	Other
Paspalidium distans	-	Grass
Paspalum dilatatum	paspalum	Grass
*Paspalum wettsteinii**	broad-leaf paspalum	Grass
*Passiflora suberosa**	corky passionfruit	Other
Philydrum lanuginosum	frogsmouth	Forb
Pittosporum revolutum	rough fruit pittosporum	Shrub
Pratia puprurescens	-	Forb

Scientific name	Common name	Growth form
Pteridium esculentum	bracken	Fern
*Senna pendula**	cassia	Shrub
*Setaria sphacelata**	setaria	Grass
Smilax australis	lawyer vine, wait-a-while, barbwire vine	Other
Sporobolus virginicus	-	Grass
Trophis scandens	burny vine	Other
Velleia spathulata	-	Forb
Wikstroemia indica	-	Shrub

*Introduced species

Appendix 8 Statement of Landscape Intent

Statement of Landscape Intent

110-120 Carrs Drive

Yamba, NSW

Project Reference: L22084

Gold Coast
1638 Tweed Street, Burleigh Heads QLD 4220
PO Box 3805, Burleigh Town QLD 4220

Gladstone
2/172 Goondoon Street, Gladstone, QLD 4680
PO Box 5332, Gladstone QLD 4680

admin@zonelandscape.com.au

Document Revisions

Rev.	Comments	Date	Initial
	Preliminary Issue	01/09/2022	EP&HL
	For Lodgement	09/09/2022	EP&HL
A	For Lodgement - (In response to client comments)	15/09/2022	EP&HL
B	For Lodgement	13/04/2023	EP&HL
C	For Lodgement	20/07/2023	EP&HL
D	Updated Civil Bases/RFI Response	07/02/2024	EP

Document Sources

Rev.	Base Information	Issued By	Issued
A	Biodiversity Development Assessment Report	Ecosure	22/06/2022
	Vegetation Management Plan	Ecosure	16/01/2024
-	Architectural Plans - Communal Facilities	Mark Shapiro	30/06/2022
1	Civil Package - Earthworks & Sections	MHE	18/01/2024
1	Civil Package - Typical Road Sections	MHE	02/02/2024

1.0 Site Locality.

Site Analysis

1.1 Site Locality

2.0

Landscape Design.

2.1 Landscape Design Character Imagery

Site Boundary
110 & 120 Carrs Drive Yamba.

Development & Staging Boundary
Development boundary line as outlined within Civil, Environmental and Architectural packages.

Landscape Design

2.2 Landscape Plan Master Plan

0m 50m 100m N

Development Boundary
110 & 120 Carrs Drive Yamba.

1 **Primary Estate Entry**
Primary development entry off Carrs Drive. Primary entry to feature estate entry statement for the development. Potential to incorporate feature central tree/palm species and hardstand treatment to delineate entry.

2 **Buffer Planting**
Buffer planting to be provided to all offset areas. Refer to Landscape Treatment Areas plan for further information.

3 **Bioretention Basins**
Stormwater bioretention basins to be planted with appropriate WSUD plantings. Refer to civil engineering plans prepared by MDE for all stormwater treatment device details.

4 **Batter & Riparian Zones**
Planting zones to batters and riparian buffers. Refer to Landscape Treatment Areas plan for further information. Potential to incorporate recreational tracks and viewing areas. Refer to Recreation Node Plan for further details.

5 **Internal Streetscape**
Streetscape plantings are to be achieved through frontage tree planting Tree plantings to be located to avoid all services, street lights and driveways. Grade 'A' turf is to be planted throughout the verges to the property frontage boundary. Root guard to be installed to all trees adjacent to services.

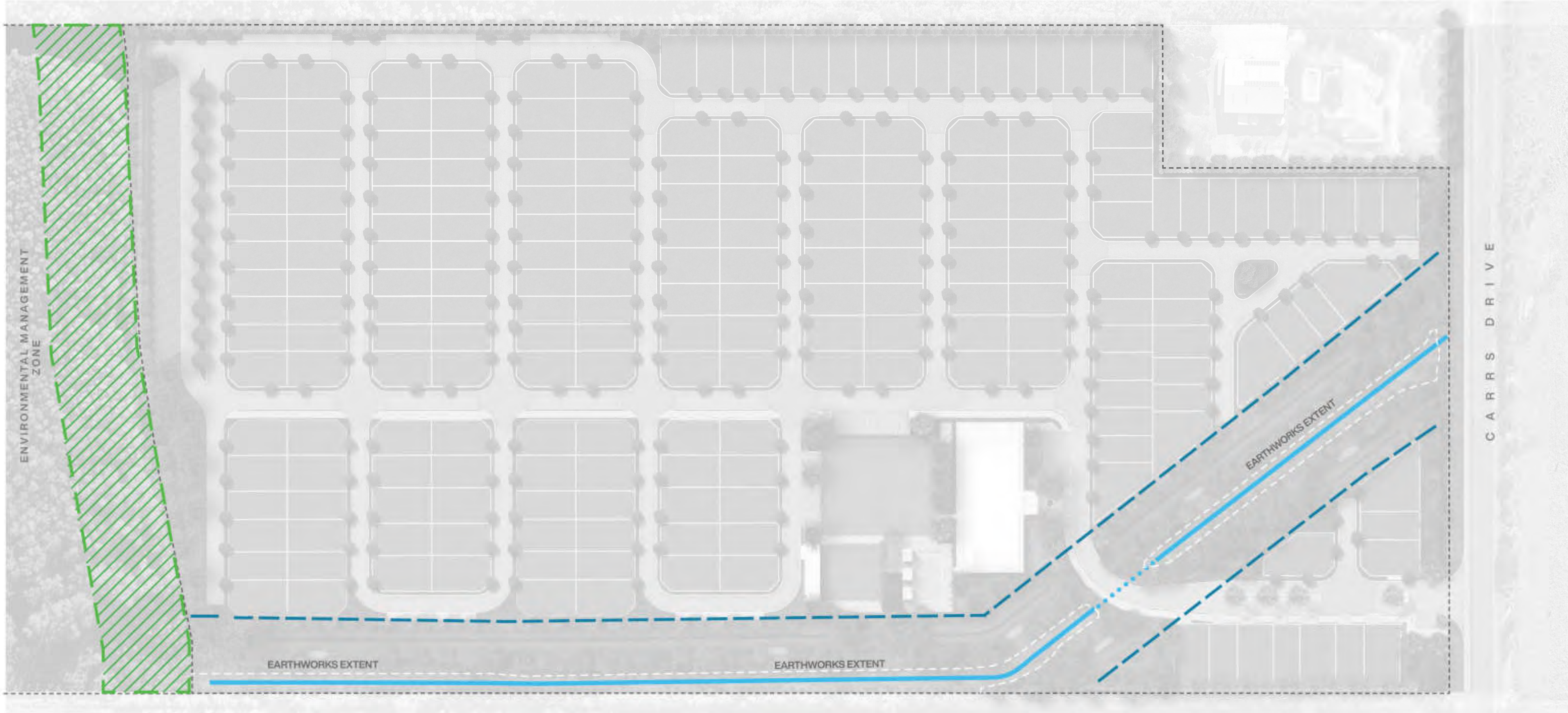
6 **Communal Facilities**
Communal facilities to include communal lounge, pool, bowls and croquet greens. Refer to architectural plans for further details.

7 **Existing Vegetation**
Refer to **Vegetation Management Plan** prepared by Ecosure Improving Ecosystems for further details on treatments proposed or these areas.

8 **Existing Stream**
Existing stream (bank and bed). No earthworks within this zone. Works within this zone will be limited to weeding and native infill planting only. Refer to VMP for further details.

Landscape Design

2.3 Landscape Design Development Layout



Development Boundary
110 & 120 Carrs Drive Yamba.

30M Vegetated Buffer
Refer to VMP for further details.

Existing Waterway/Watercourse & Vegetation
Refer to VMP for further details.

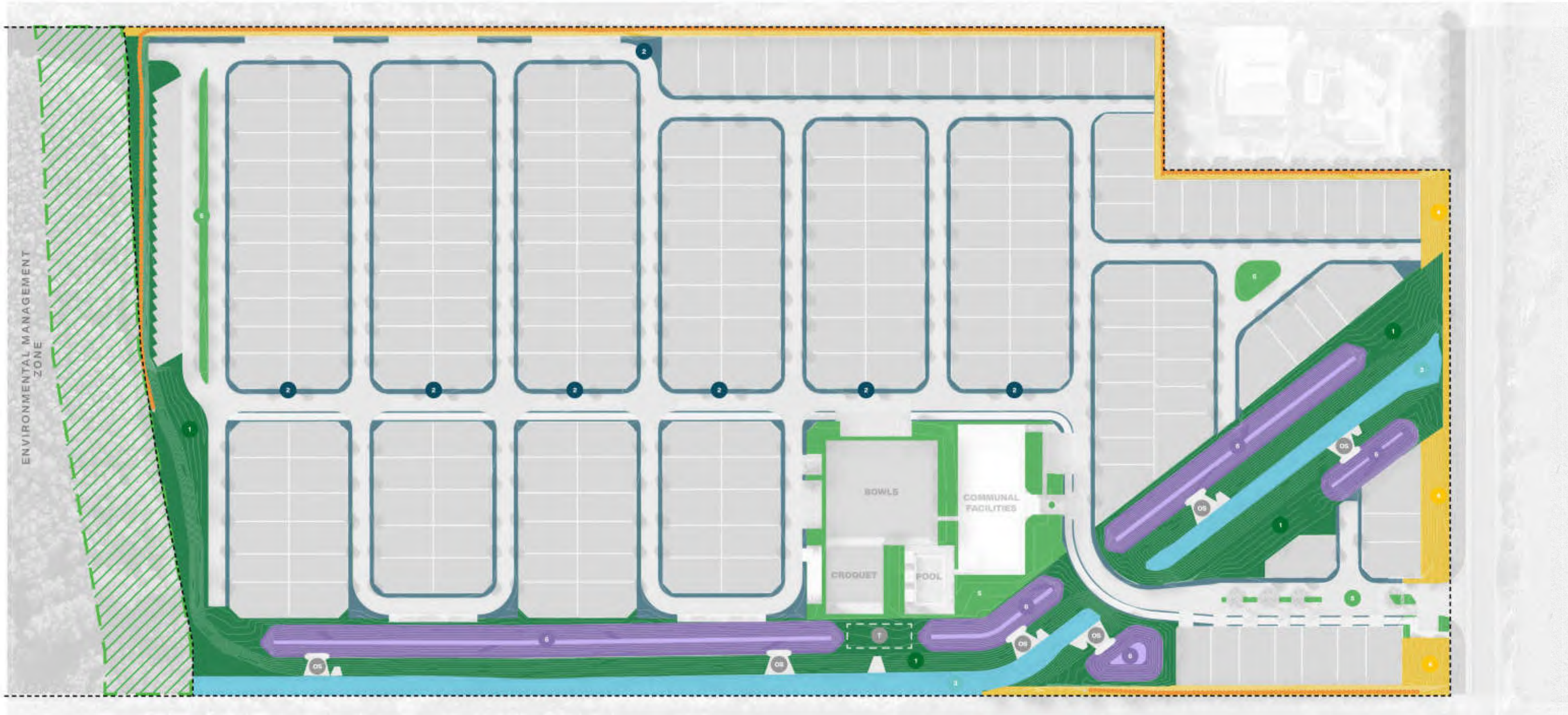
20M Riparian Setback Buffer
Refer to VMP for further details.

Refer to **Biodiversity Development Assessment Report** prepared by Ecosure Improving Ecosystems for further details on treatments proposed or these areas.

Refer to **Vegetation Management Plan** prepared by Ecosure Improving Ecosystems for further details on treatments and planting zones.

Landscape Design

2.4 Landscape Plan Vegetation Management Zones



Development Boundary
110 & 120 Carrs Drive Yamba.

30M Vegetated Buffer
Refer to VMP for further details.

Overflow Weir & Scour protection
Refer to civil plans for further details.

OSD Tank
Refer to civil plans for further details. No large tree species to be planted in this zone.

Riparian Zone & Batter Planting
Batter planting zones to all buffer zones. Ensure native and riparian species are used.

Internal Verge
Verge to be planted with shade trees where offsets allow, turf to base. Refer to sections for further details.

Existing Stream
Existing stream (bank and bed). No earthworks within this zone. Works within this zone will be limited to weeding and native infill planting only. Refer to VMP for further details.

Buffer Planting
Dense screening vegetation to be provided to all buffer planting areas. Refer to Sections for further details.

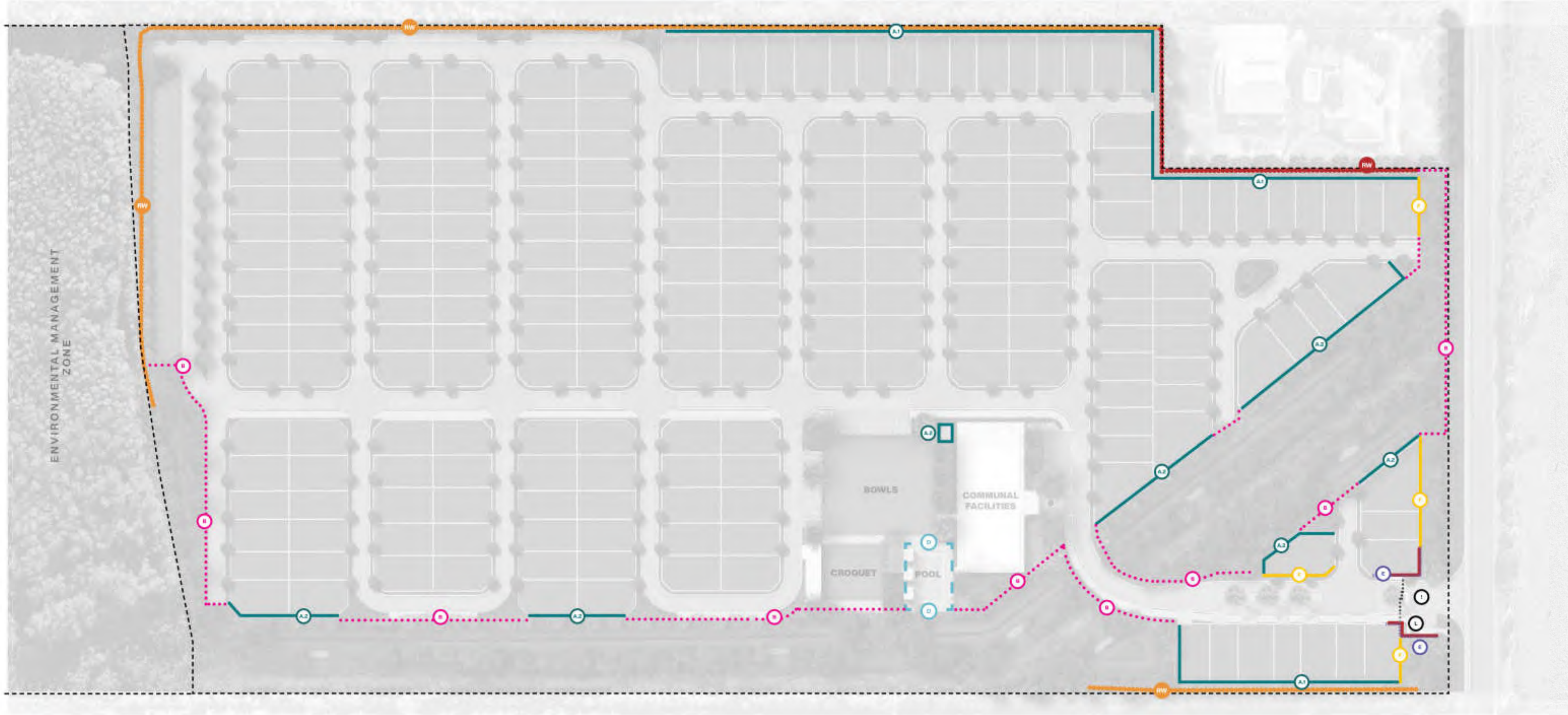
Communal Open Space & Feature Planting Zones
Communal open space planting to feature shade trees and layered ground covers. Potential to install edible species and fruit trees within this planting zone.

Bioretention Basins
Stormwater bioretention basins to be planted with appropriate WSUD plantings. Refer to **Planting Palettes** for species listings. Refer to civil engineering plans prepared by MDE for all stormwater treatment device details.

Retaining Wall
Block & Rock retaining wall. Refer to civil engineering plans prepared by MDE for all retaining wall details and heights.

Landscape Design

2.5 Landscape Plan Treatment Areas



Retaining Wall (RW, orange)
Rock retaining wall. Refer to civil engineering plans prepared by MDE for details. Vehicular safety barrier/bollards to be provided where required.

Retaining Wall (RW, red)
Block retaining wall. Refer to civil engineering plans prepared by MDE for details.

Fence Type A
Interface Fencing
Typical height: 1200-1800mm
A.1 Solid Privacy Fence | A.2 Transparent Privacy Fencing

Edge Treatment
Bollards
Bollards to turf/planting interfaces

Fence Type D
Pool Fencing
Typical height: 1200mm
Proposed pool fence

Type E
Feature Entry walls & Retaining walls
Feature entry walls and retaining structures with stone cladding or similar. To be confirmed within detailed design.

Type F
Frontage Fencing
Feature solid white PVC frontage fencing to Carrs Road.

Major Entry Statement
Entry statement and vehicular/ pedestrian entry gates. Entry statement proposed to be wholly located within private property. Refer to 'Materials and Finishes' palette for further details. Design to be confirmed within detailed design.

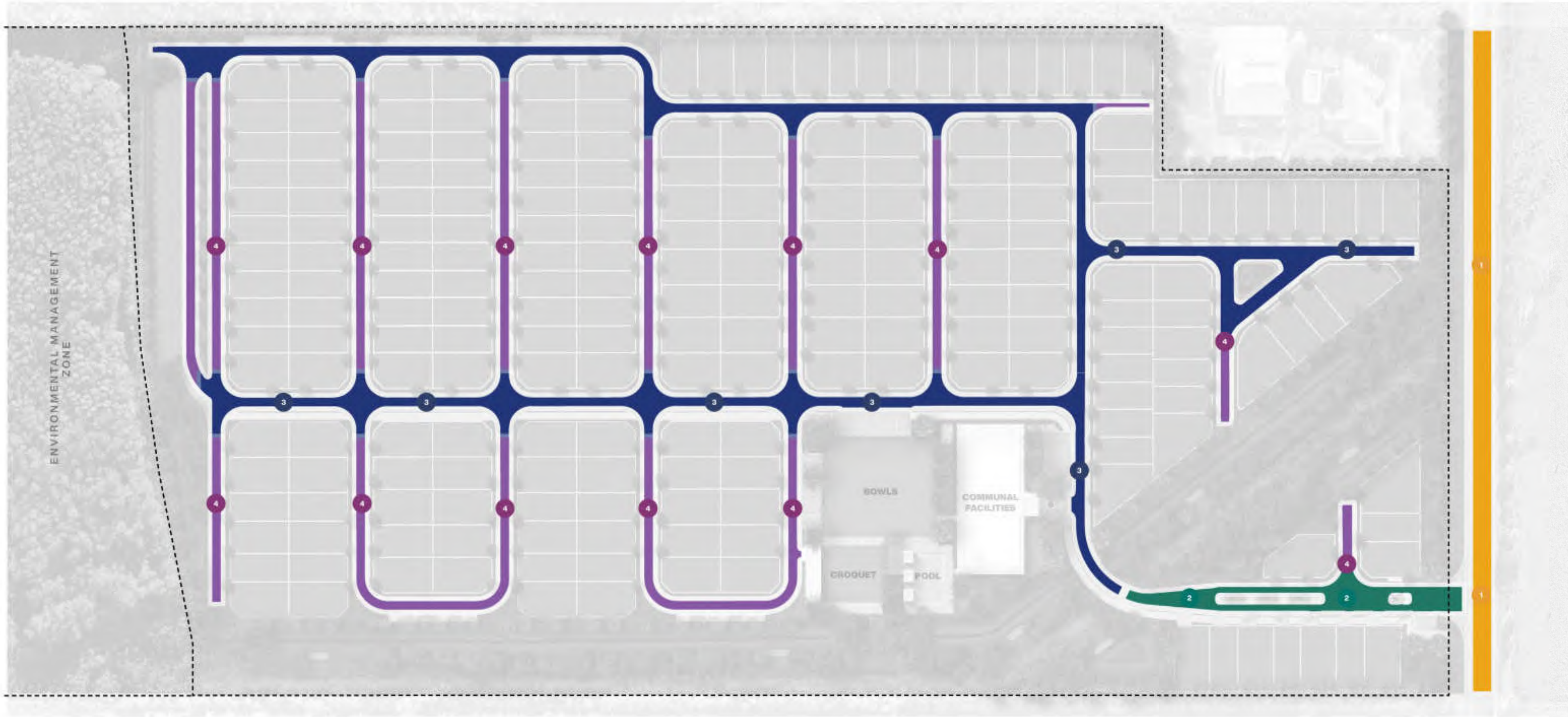
Letter Box Wall
Entry letter box wall along pedestrian pathway.

Note: Retaining wall locations included for reference only. Refer to civil engineering plans for all details. This plan set does not seek approval for any retaining structures. All fence alignments to be confirmed during operational works phase.

0m 50m 100m N

Landscape Design

2.6 Landscape Plan Fence & Edges



Development Boundary
110 & 120 Carrs Drive Yamba.

Tree Type 1 External Streets

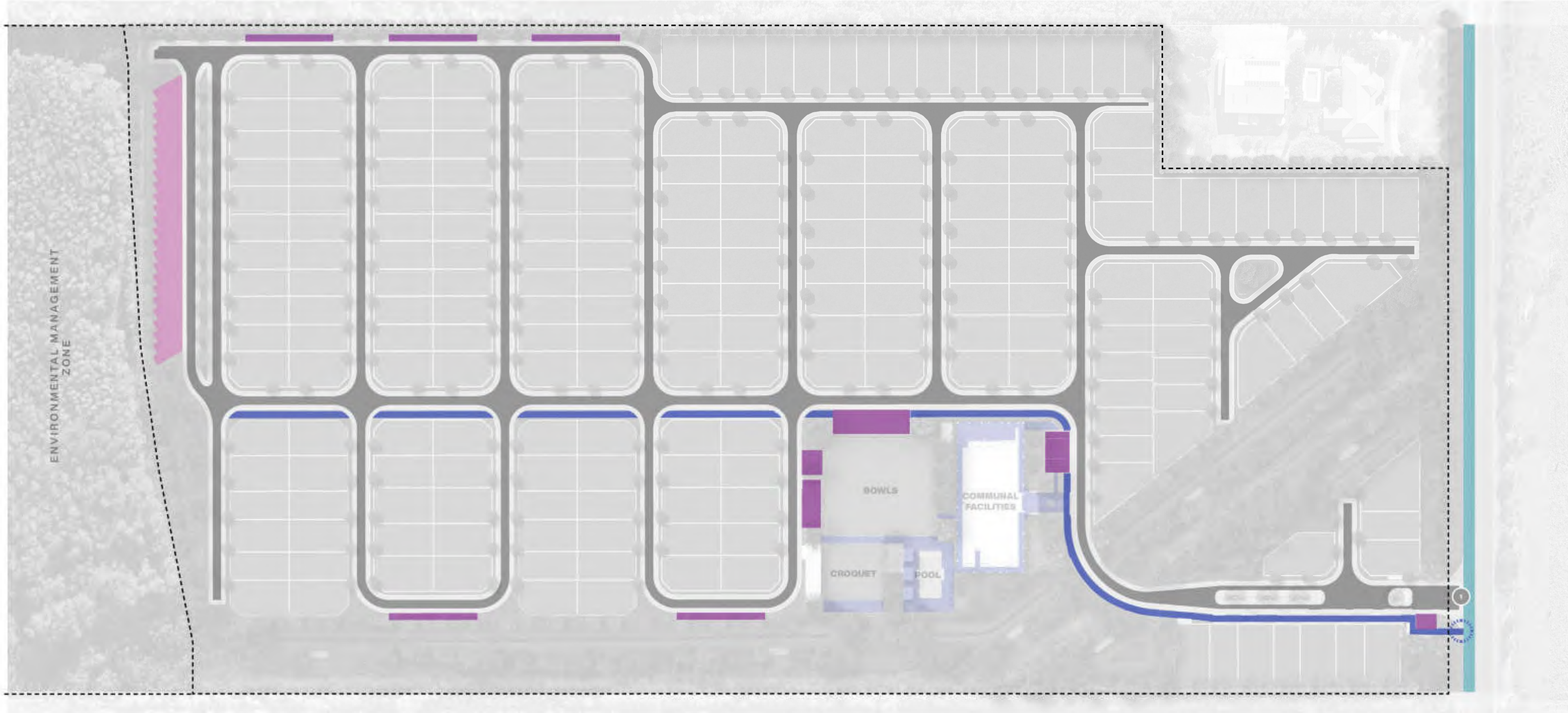
Tree Type 2 Development Entry Points

Tree Type 3 Primary Road

Tree Type 4 Minor Road

Landscape Design

2.7 Landscape Plan Tree Species



Development Boundary
110 & 120 Carrs Drive Yamba.

Primary Estate Entry
Primary development entry off Carrs Drive. Primary entry to feature estate entry statement for the development.

Pedestrian Circulation
Pedestrian pathway provides connectivity throughout the development. Connections are provided to Carrs Drive Shared Path.

Carrs Drive Shared Path
Future Carrs Drive Shared Path @ 2.5m.

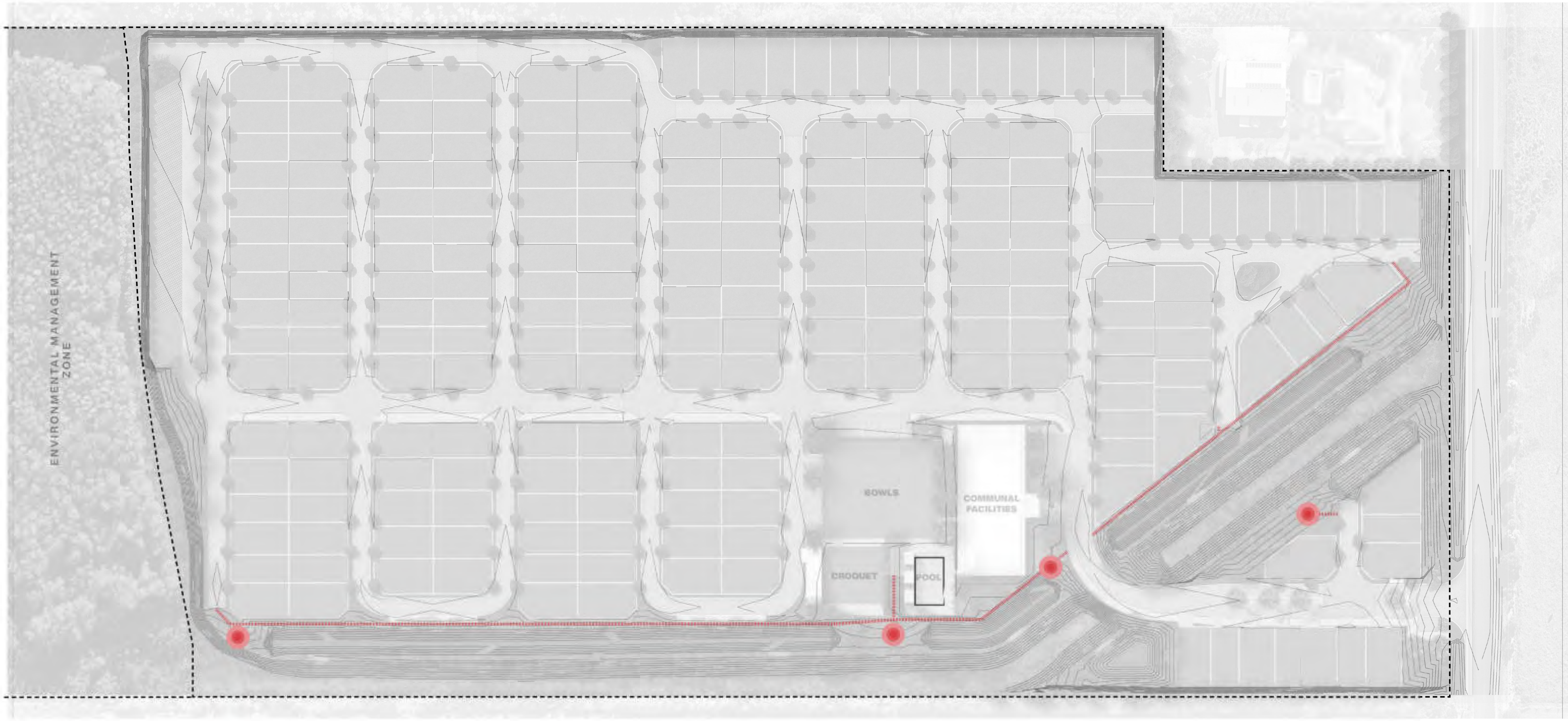
Vehicular Visitor Parking
Refer to civil plans for further details.

RV Parking
Refer to civil plans for further details. Potential to incorporate permeable paving to this zone.

Landscape Design

2.8 Landscape Plan Pedestrian Access & Mobility Plan

0m 50m 100m N



Development Boundary
110 & 120 Carrs Drive Yamba.

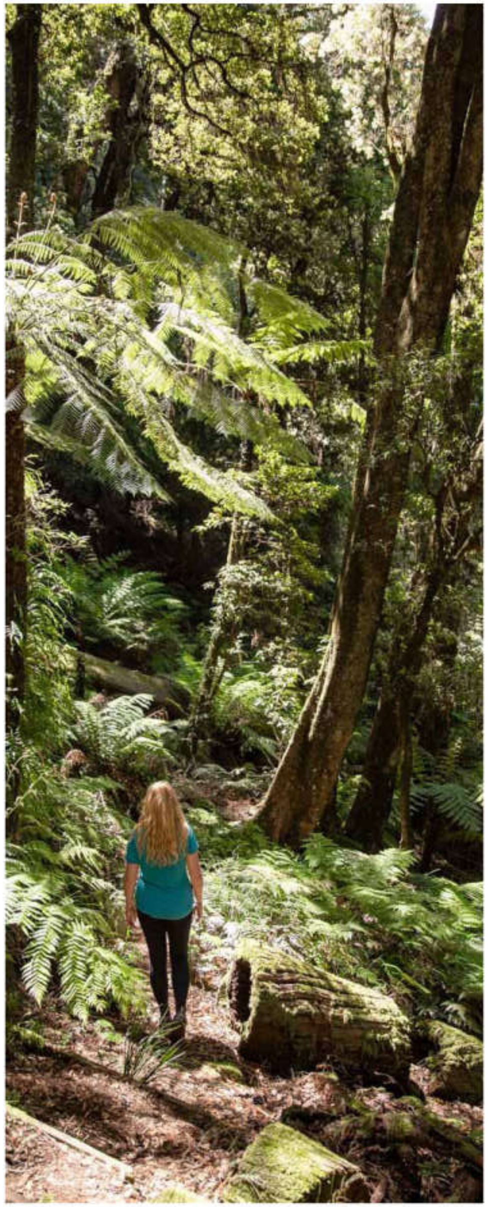
Access Track
Access track. Proposed to connect with nodes from road reserve. Potential to provide walking trail between these locations. Grading to be confirmed with civil.

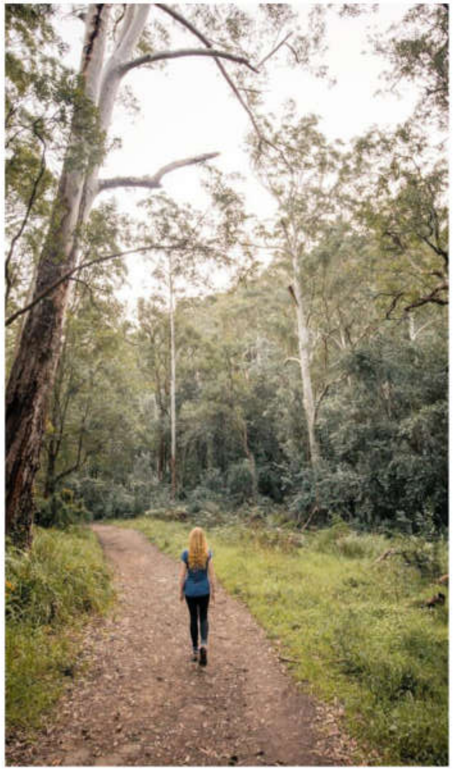
Nodes
Suggested node locations. Potential for viewing areas, signage and seating elements to be located within these areas.

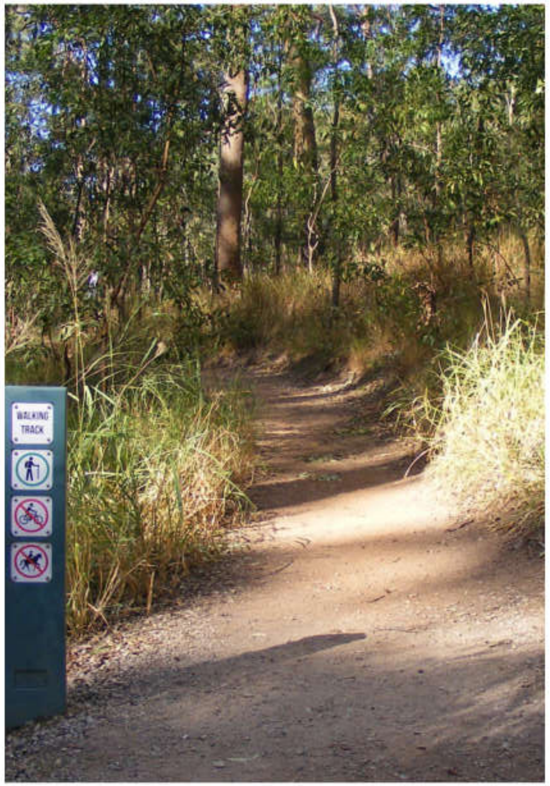
Landscape Design

2.9 Landscape Plan Recreation Network

0m 50m 100m N



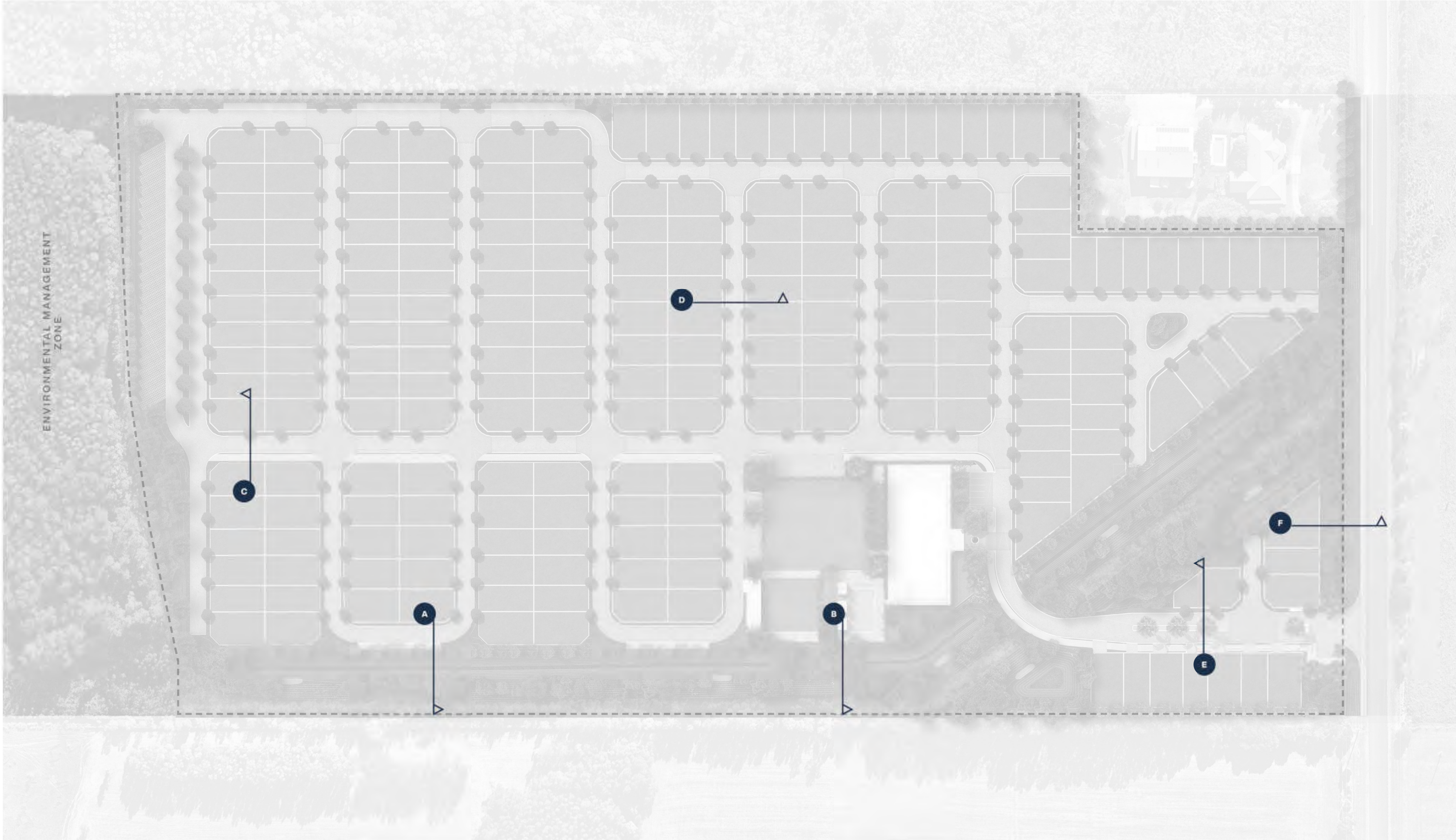


2.10 Landscape Plan Recreation Character Imagery

3.0

Site Sections.



Landscape Design

3.1 Landscape Design: Section Plan

1. **Bioretention Basins**
   Stormwater bioretention basins to be planted with appropriate WSUD plantings. Refer to civil engineering plans prepared by MDE for all stormwater treatment device details.
2. **Stream Offset & Riparian Zone**
   Existing Swamp Oak swamp forest of the coastal lowlands of the NSW North Coast Bioregion (PCT 1235). Existing stream and associated landscape zone located through development. Vegetation associated with a tidal drainage line will be retained and restored within a 10m either side of the high bank.
3. **Proposed Carpark**
   Potential carpark located along 'Road 10'.
4. **Edge Treatment Bollards**
   Timber bollards to turf/planting interfaces
5. **Existing Stream**
   Existing stream. No earthworks within this zone. Refer to VMP for further details
6. **Potential Access Track**
   Potential to incorporate access track to connect with nodes from road reserve. Grading to be confirmed with civil.

REFER TO CIVIL SECTION C FOR FURTHER INFORMATION

Site Sections

3.2 Site Sections Sections A

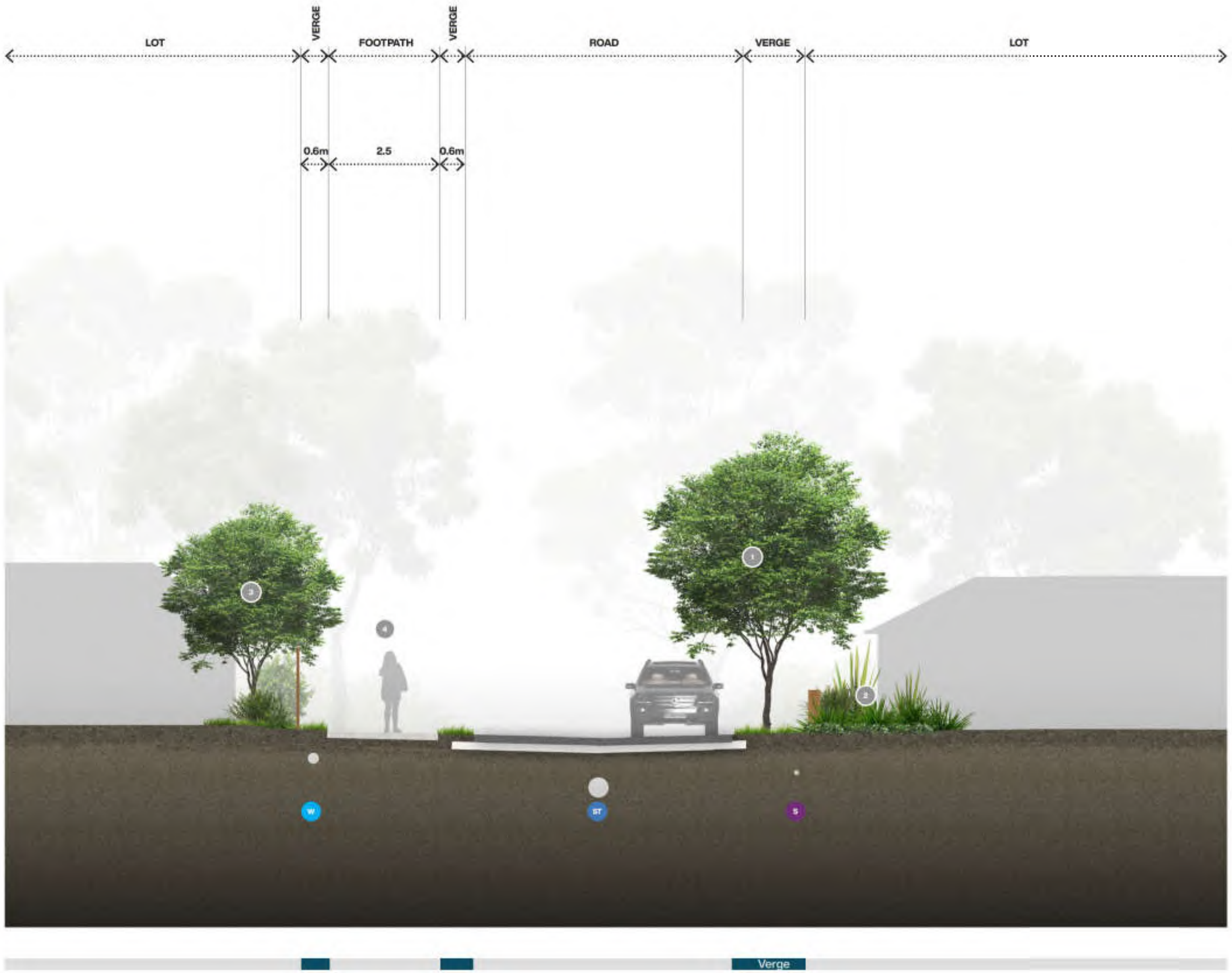
1. **Proposed Communal Open Space**
   Proposed pool deck to overlook existing areas of landscape.
2. **Stream Offset & Riparian Zone**
   Existing Paperbark swamp forest of the coastal lowlands of the NSW North Coast Bioregion and Sydney Basin Bioregion (PCT 1064 Zone 2).
   Existing stream and associated landscape zone located through development. Vegetation associated with a tidal drainage line will be retained and restored within a 10m either side of the high bank.
3. **Existing Stream**
   Existing stream. No earthworks within this zone. Refer to VMP for further details
4. **Potential Access Track**
   Potential to incorporate access track to connect with nodes from road reserve. Grading to be confirmed with civil.

D. **Fence Type D**
   Pool fencing proposed to be 1200m high.

REFER TO CIVIL SECTION B FOR FURTHER INFORMATION

Site Sections

3.3 Site Sections Sections B



Street Tree Plantings
Streetscape plantings are to be achieved through frontage tree planting tree plantings to be located to avoid all services ex. street lights, and driveways. Grade 'A' turf is to be planted throughout the verges to the property frontage boundary. Root guard to be installed to all trees adjacent to services.

Private Lot Landscaping
Private lot landscaping and entry pathway/letterbox. Planting to tie into established estate character and provide further softening to the streetscape. To be completed under private scope.

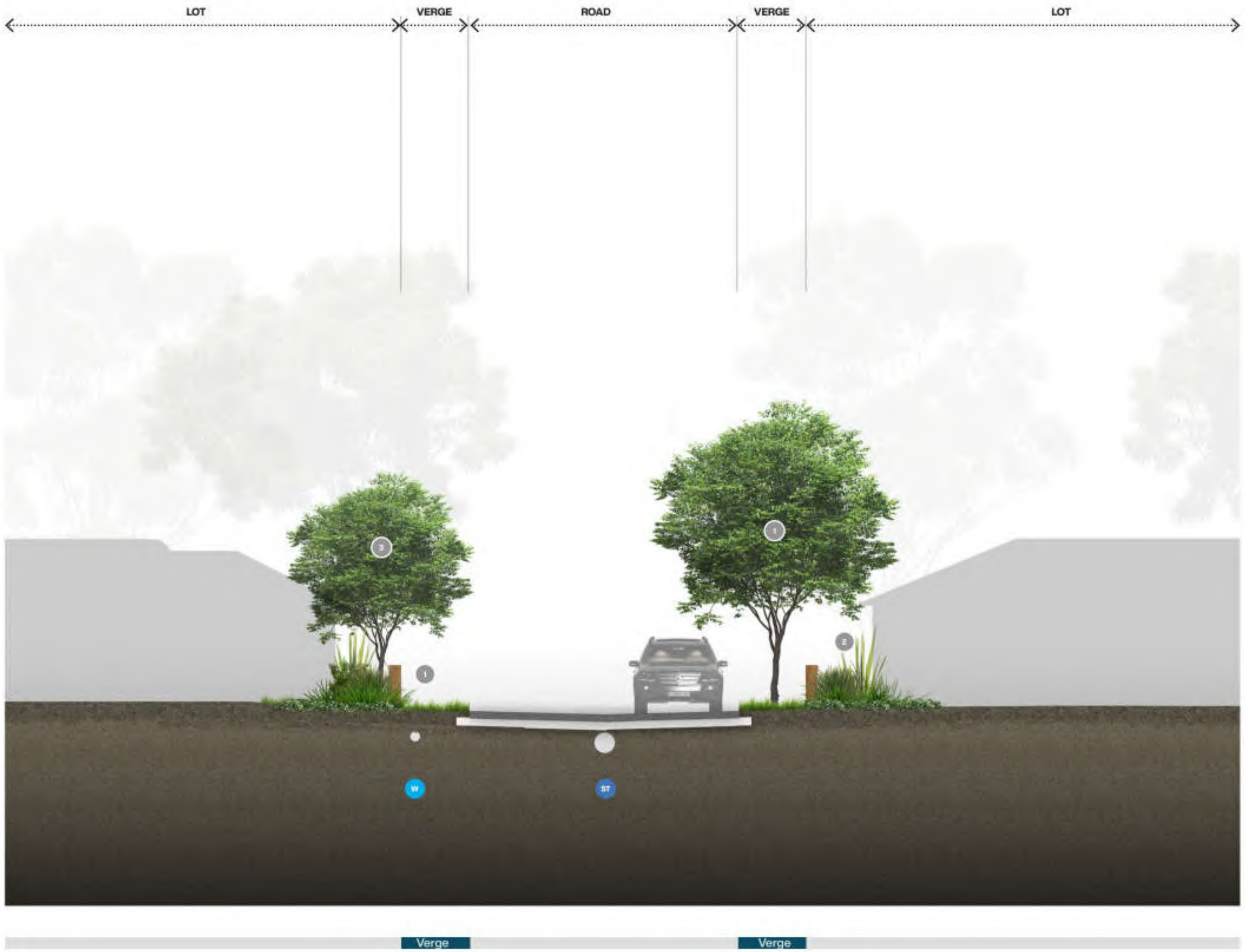
Private Tree
Potential to provide additional tree plantings within private zone where services restrict street trees within verge.

Pedestrian Pathway
Pedestrian pathway provides connectivity throughout the development. Proposed average width of 2.5m. Refer to civil documentation for further details.

REFER TO CIVIL SECTION ROAD 2 CH20 FOR FURTHER INFORMATION

Site Sections

3.4 Site Sections Section C - Main Road



1 **Street Tree Plantings**
Streetscape plantings are to be achieved through frontage tree planting tree plantings to be located to avoid all services ex. street lights, and driveways. Grade 'A' turf is to be planted throughout the verges to the property frontage boundary. Root guard to be installed to all trees adjacent to services.

2 **Private Lot Landscaping**
Private lot landscaping and entry pathway/letterbox. Planting to tie into established estate character and provide further softening to the streetscape. To be completed under private scope.

3 **Private Tree**
Potential to provide additional tree plantings within private zone where services restrict street trees within verge.

REFER TO CIVIL SECTION ROAD4 CH50 FOR FURTHER INFORMATION

Site Sections

3.5 Site Sections Section D - Minor Road

1 **Street Tree Plantings**
Streetscape plantings are to be achieved through frontage tree planting tree plantings to be located to avoid all services ex. street lights, and driveways. Grade 'A' turf is to be planted throughout the verges to the property frontage boundary.

2 **Pedestrian Pathway**
Pedestrian pathway provides connectivity throughout the development. Proposed average width of 2.5m. Refer to civil documentation for further details.

3 **Median Strip**
Exposed agg concrete median strip with feature planting zones. Refer to civil plans for further information. Potential to incorporate larger feature species where space/services allow. Root barrier/structural soil cells to be provided where required.

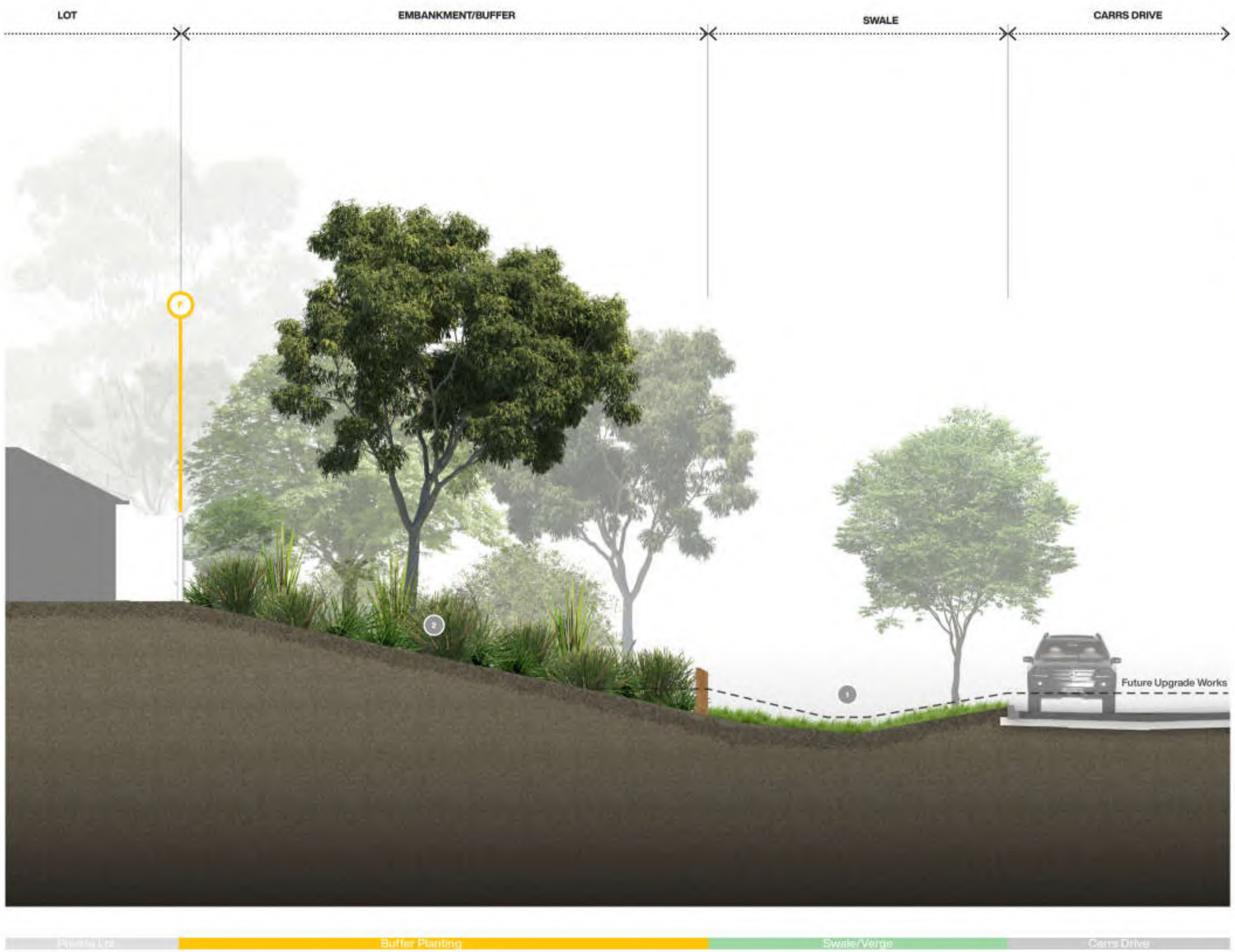
4 **Private Lot Landscaping**
Private lot landscaping and entry pathway/letterbox. Planting to tie into established estate character and provide further softening to the streetscape. To be completed under private scope.

F **Type F**
Frontage Fencing
Feature solid white PVC frontage fencing to Entry Road (lot 8 & 11)

REFER TO CIVIL SECTION ROAD 1 CH70 FOR FURTHER INFORMATION

Site Sections

3.4 Street Sections Section E - Entry Road



1 **Carrs Road Verge & Swale**
Treatment of swale to be confirmed. Potential to incorporate street trees along Carrs Drive where space and offsets allow. Pedestrian pathway location to be confirmed.

2 **Buffer Planting**
Buffer planting to be provided to all offset areas. Refer to Landscape Treatment Areas plan for further information.

F **Type F**
Frontage Fencing
Feature solid white PVC frontage fencing to Carrs Road.

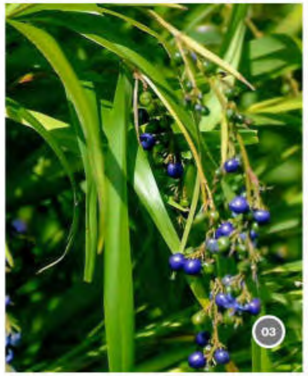
REFER TO CIVIL SECTION D FOR FURTHER INFORMATION

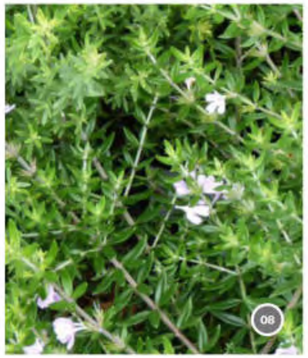
Site Sections

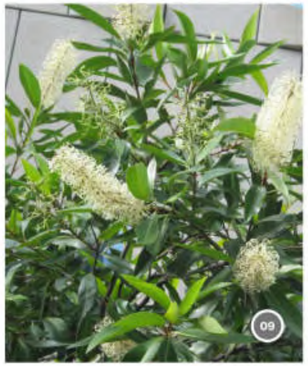
3.6 Site Sections Section F - Carrs Drive Interface

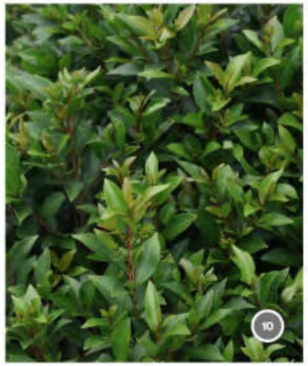
4.0

Planting Palettes.









Groundcover

1	**Hardenbergia violacea**	Happy Wonderer
	Viola banksii	Native violet
2	**Grevillea 'Poorinda Royal Mantle'**	Grevillea Royal Mantle
3	**Dianella caerulea**	Blue Flax Lilly
	Myoporum parvifolium	Yareena
4	**Liriope Evergreen Giant**	Evergreen Giant
5	**Lomandra longifolia 'Tanika'**	Mat Rush
6	**Carex appressa**	Tall sedge
7	**Westringia fruticosa 'mundi'**	Mundi
	Carpobrotus glaucescens	Pigface

Shrubs & Accents

8	**Westringia fruiticosa**	Coastal Rosemary
9	**Callistemon salignus**	Willow bottlebrush
10	**Syzygium Hedges**	Lilly Pilly Various
11	**Alpinia sp**	Native Ginger
12	**Acacia concurrens**	Black wattle

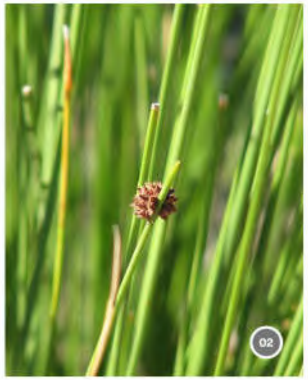
Cascading and Trellis

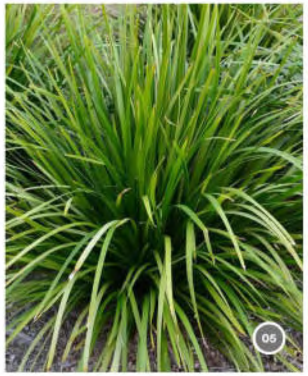
Dichondra Silver Falls	Silver Falls
Trachelospermum jasminoides	Star Jasmine

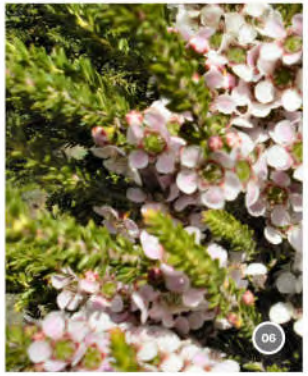
PLANTING NOTE: *ALL PLANTING SPECIES, PLACEMENTS AND QUANTITIES TO BE CONFIRMED DURING OPERATIONAL WORKS PHASE*

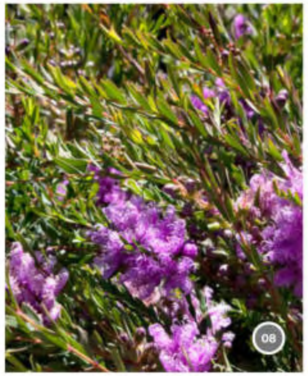
Design Details

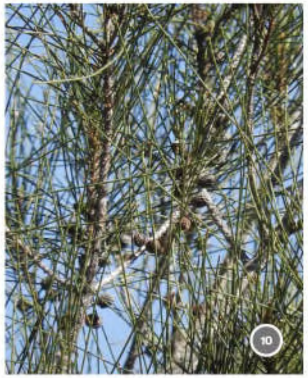
4.1 Planting Palette Character & Communal Facilities

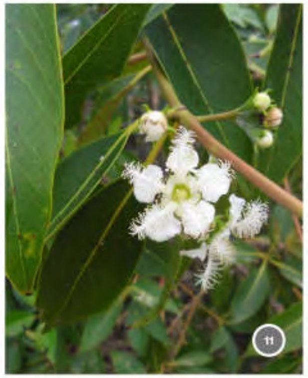












Groundcover

1.	**Carex appressa**	Tall Sedge
2.	**Ficinia nodosa**	Knobby Club Rush
3.	**Lepidosperma laterale**	Variable sword-sedge
4.	**Lomandra hystrix**	A Mat-rush
5.	**Lomandra longifolia**	Spiny-headed Mat-rush
	Myoporum insulare	Common boobialla

Shrubs & Accents

6.	**Leptospermum liversidgei**	Olive tea-tree
7.	**Melaleuca seiberi**	River bottlebrush
8.	**Melaleuca thymifolia**	Thyme honey myrtle
9.	**Banksia robur**	Swamp banksia

Trees & Palms

10.	**Casuarina glauca**	Swamp Oak
11.	**Lophostemon suaveolens**	Swamp Mahogany
	Melaleuca bracteata	Black tea-tree
12.	**Melaleuca quinquenervia**	Broad-leaved Paperbark

Channel/Stream Bed

	Machaerina rubiginosa	Swamp Oak
	Fimbristylis ferruginea	Swamp Mahogany
	Schoenoplectus validus	Black tea-tree
	Phragmites australis	Broad-leaved Paperbark

Refer to **Vegetation Management Plan** prepared by Ecosure Improving Ecosystems for further details and planting palettes.

Species have been selected in accordance with Water Sensitive Urban Design plant selections by Water by Deisgn Guidelines.

All tree stock to be supplied and installed in accordance with NATSPEC guidelines.

Planting Palettes

4.2 Planting Palette Biobasin/Riparian Corridor / Environmental Zone Infill Planting

Planting Palettes

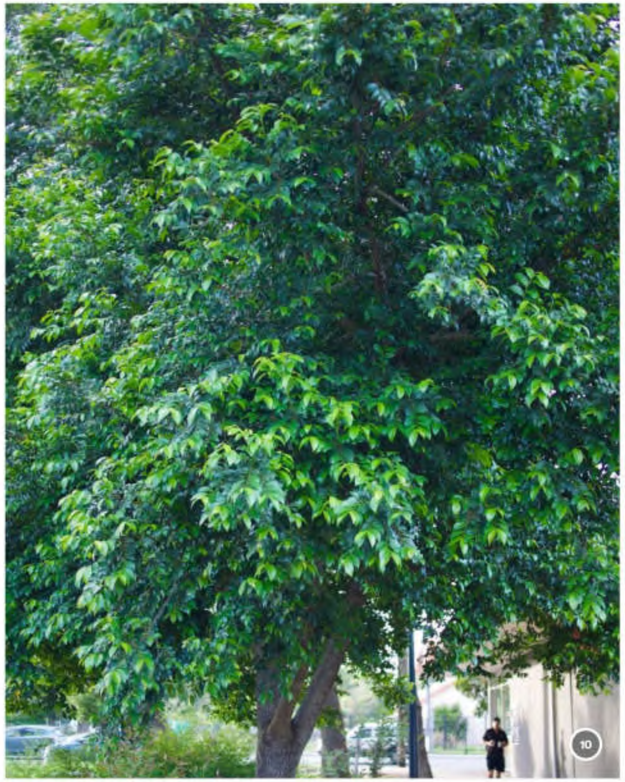
4.4 Planting Palette Streetscape

Planting Palettes

4.4 Planting Palette Streetscape

Planting Palettes

4.5 Planting Palette Streetscape



Planting Palettes

4.6 Planting Palette Streetscape

Streetscape Species

1.	**Acmena smithii**	Lilly Pilly	3
2.	**Livistonia australis**	Cabbage Palm	2 5
3.	**Backhousia citriodora**	Lemon Myrtle	3 4
4.	**Corymbia gummifera**	Bloodwood	5
5.	**Cupaniopsis anacardiodes**	Tuckeroo	1 3 4
6.	**Elaeocarpus reticulatus**	Blueberry Ash	1 4
7.	**Flindersia australis**	Crow's Ash	5
8.	**Flindersia schottiana**	Bumpy Ash	3 5
9.	**Flindersia xanthoxylum**	Yellowwood	5
10.	**Glochidion ferdinandi**	Cheese Tree	4
11.	**Lophostemon confertus**	Brush Box	3
12.	**Syzygium australe**	Brush Cherry	3 4
13.	**Tristaniopsis laurina**	Water Gum	1 3 4
14.	**Waterhousea floribunda**	Weeping Lilly Pilly	1 2 3 5

Refer to **Section 2.7 Landscape Design - Streetscape Planting** for planting locations.

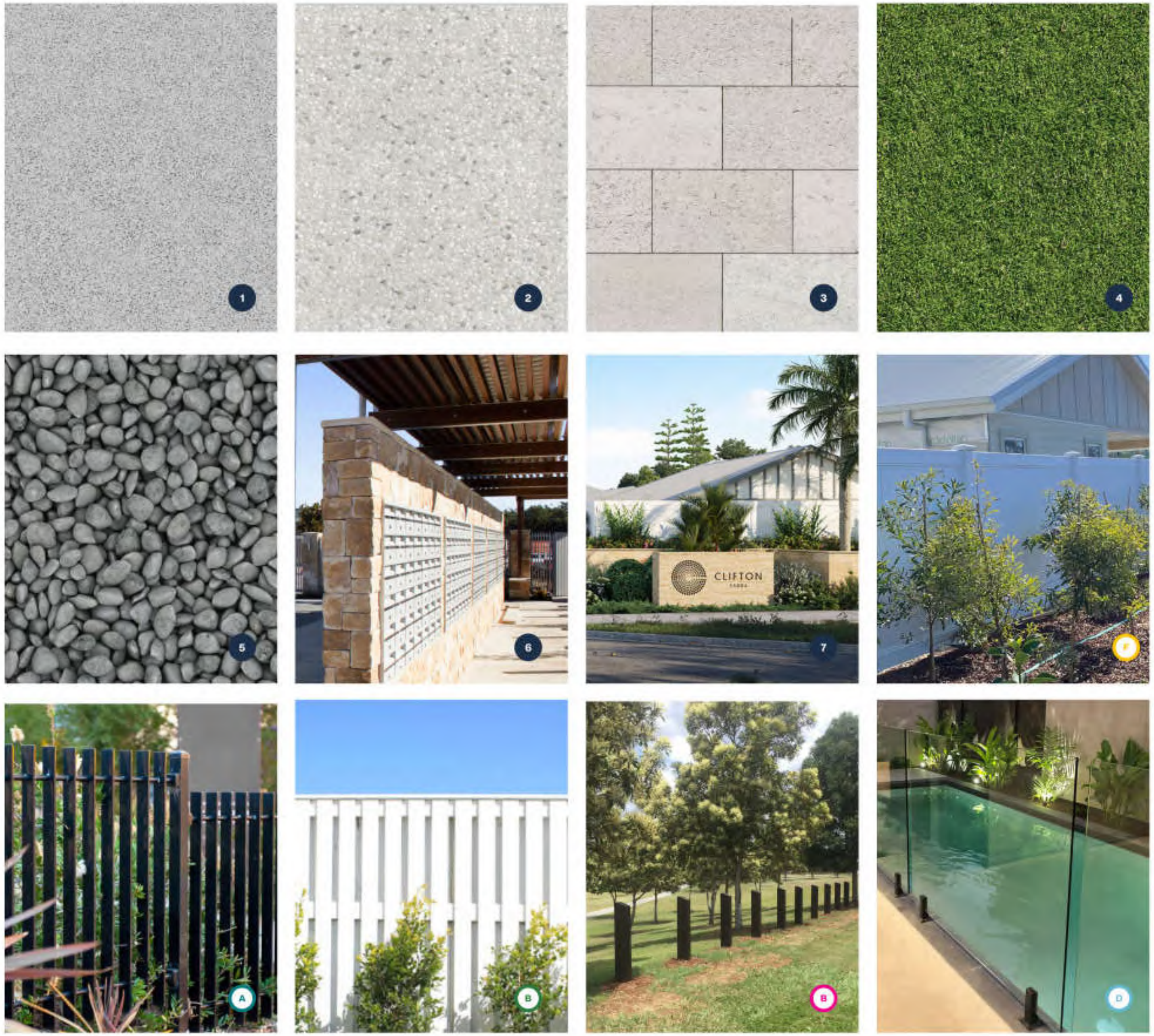
Tree species have been selected in accordance with the **'Yamba Street Tree Master Plan'** documentation produced by Clarence Valley Council. Selected tree species have been extracted from Zone 3 Floodplain species selections within the *Secondary Street - Residential, Minor Street (Residential)* & *Park Edge Floodplain (Residential)* planting selections. Tree plantings to be located to avoid all services eg. street lights, driveways, stormwater pits and bio pods.

All tree stock to be supplied and installed in accordance with NATSPEC guidelines.

Planting Palettes

4.7 Planting Palette Streetscape

5.0
Design Details.



Surfaces & Materials

1	**Hardscape Type 1**	Concrete
2	**Hardscape Type 2**	Concrete/Exposed Aggregate
3	**Hardscape Type 3**	Feature Paving
4	**Turf**	Artificial or real
5	**Gavel Type 1**	Charcoal Pebble
6	**Letter Boxes**	Communal/Design TBC
7	**Entry Statement**	Entry Statement with stone cladding
F	**Fence Type F**	Feature solid white PVC frontage fencing to Carrs Road
A	**Fence Type A**	50% transparent fence. Specifications TBC
B	**Fence Type B**	Lot privacy fence. Specifications TBC
B	**Edge Type B**	Bollards to road/open space interface
D	**Fence Type D**	Pool Fencing

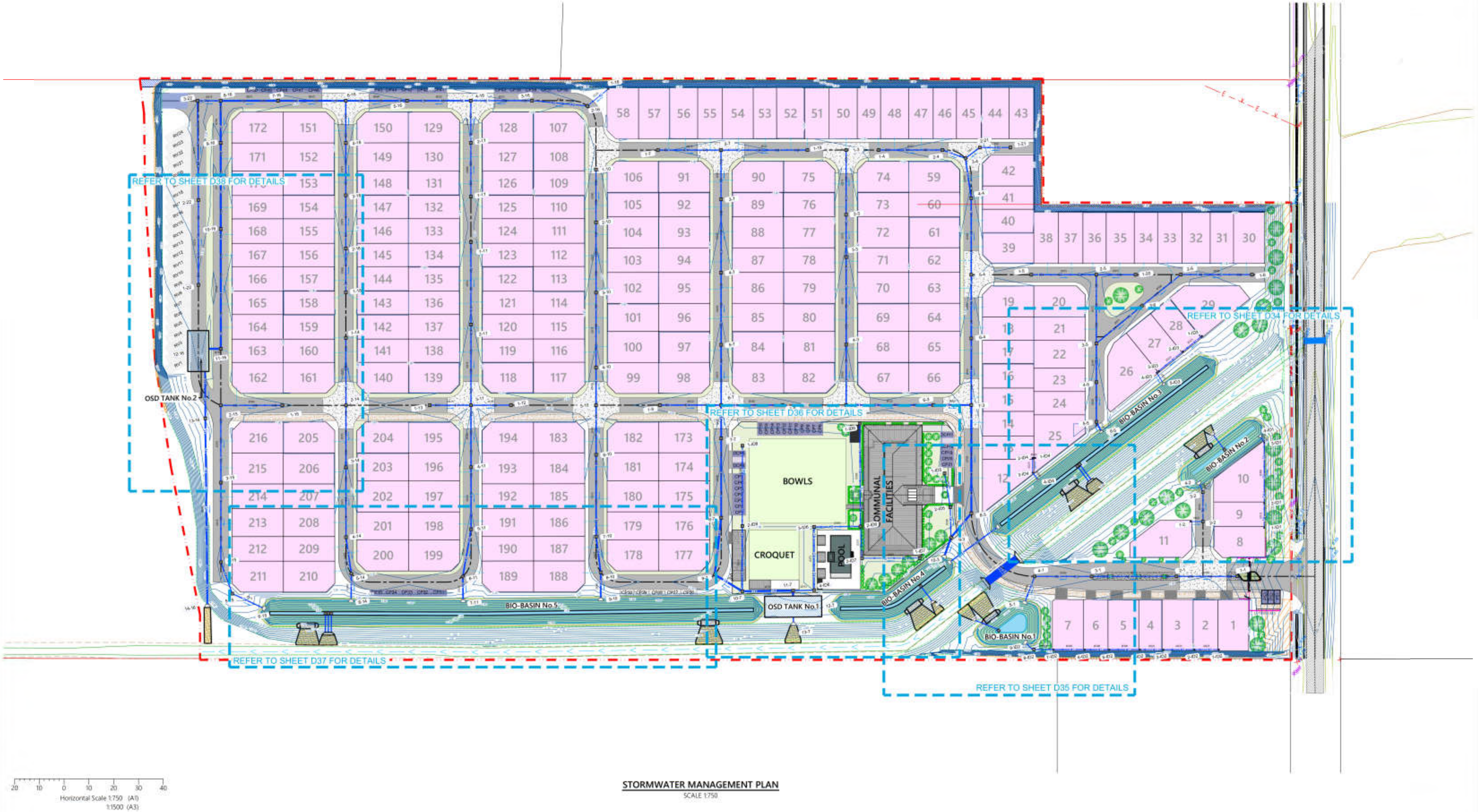
Typical finishes palette illustrated. Refer to Architectural documentation for all Architectural and built form finishes and general materials schedule.

Design Details

5.1 Materials & Finishes

zone
Landscape Architecture

Appendix 9 Stormwater Management Plan



STORMWATER MANAGEMENT PLAN

SCALE 1:750

PLANS TO BE PRINTED IN COLOUR

PRELIMINARY PLANS FOR DA PURPOSES ONLY NOT FOR CONSTRUCTION

ARCHITECTURAL INFORMATION FOR CLUB HOUSE SUPPLIED BY MARK SHAPIRO ARCHITECTS DRAWING NUMBER DA1002WIP REV 2

LEGEND

- DEVELOPMENT BOUNDARY
- INTERNAL LOT BOUNDARY
- BIO - BASIN TOP
- CHANNEL TOP OF BANK
- CHANNEL CENTRE LINE
- PROPOSED STORMWATER DRAINAGE
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- STORMWATER DRAINAGE PIT
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0	ISSUED FOR DEVELOPMENT APPLICATION	08.09.2022

DESIGNED:	T.RYDEN	DATE:	JAN 2024
DRAWN:	A.SCHMID	SCALE:	AS SHOWN
SURVEYING:	MACRO SURVEYING	SHEET SIZE:	A1

ISSUED FOR DEVELOPMENT APPROVAL
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MDE
Manage Design Engineer

www.md-engineer.com.au

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CLIFTON YAMBA

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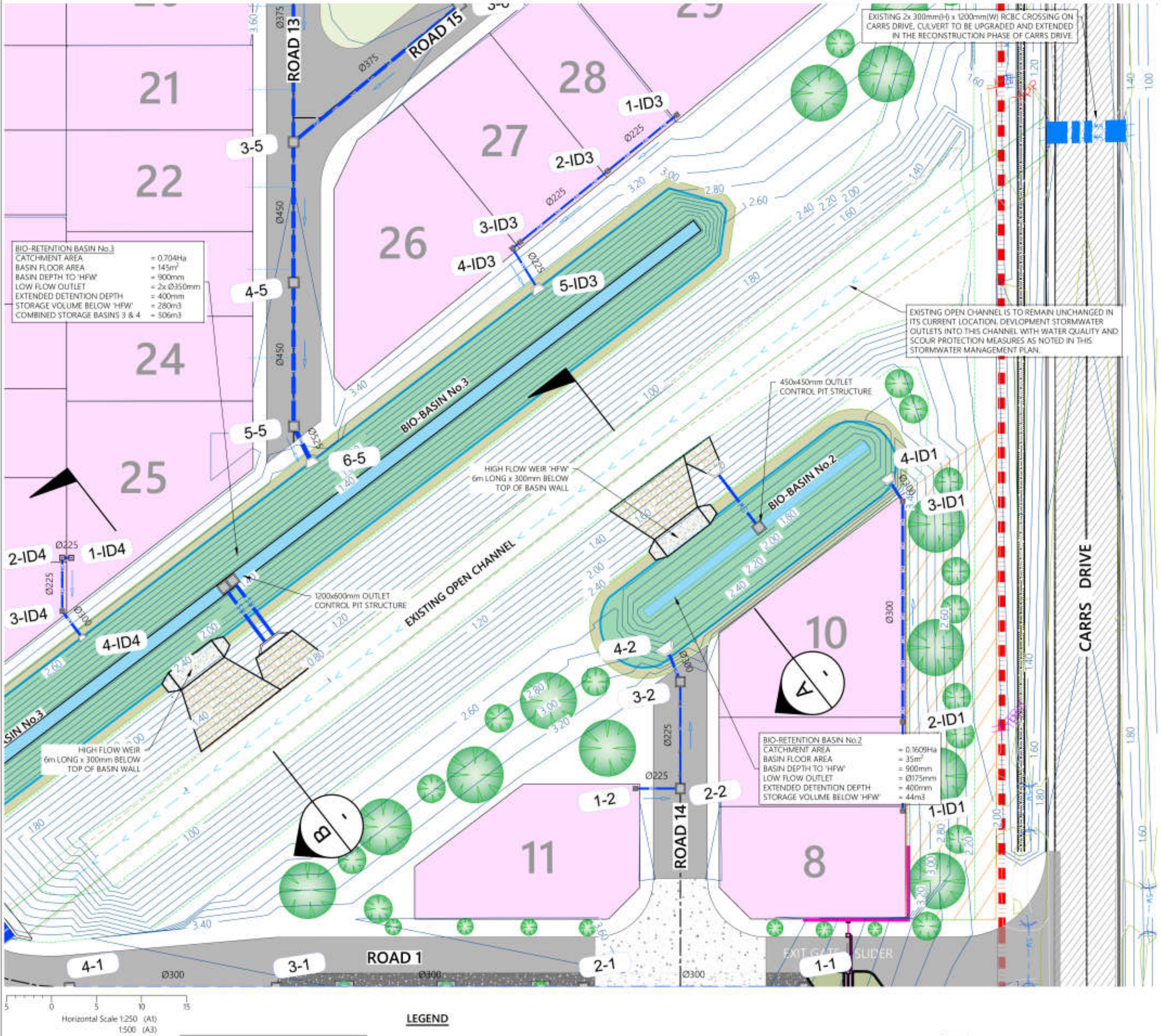
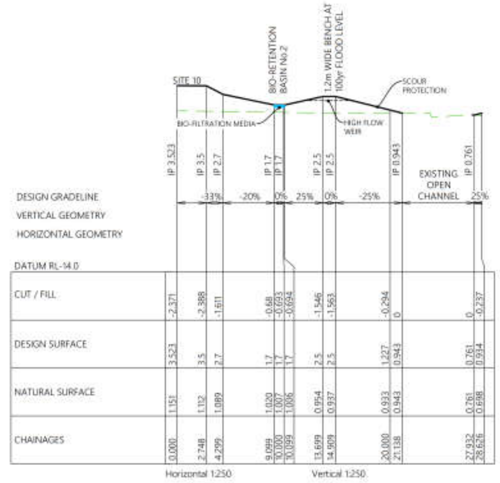
DA CIVIL DRAWING

DRAWING TITLE: STORMWATER MANAGEMENT PLAN

DWG No: D33 | SHEET: 33 OF 43 | REV: 1





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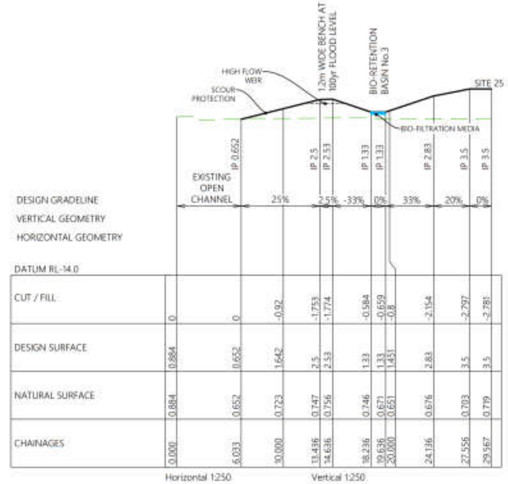

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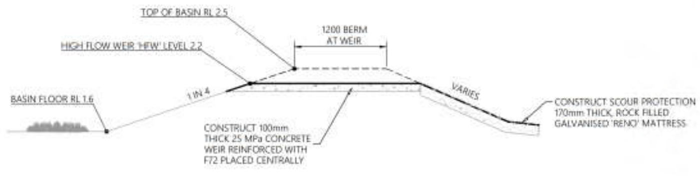

TYPICAL - HIGH FLOW WEIR DETAIL
N.T.S

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0	ISSUED FOR DEVELOPMENT APPLICATION	06.09.2022

DESIGNED: T.RYDEN | DATE: JAN 2024
DRAWN: A.SCHMID | SCALE: AS SHOWN
SURVEYING: MACRO SURVEYING | SHEET SIZE: A1

ISSUED FOR DEVELOPMENT APPROVAL
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MDE
Manage Design Engineer

CLIENT
CLIFTON YAMBA LAND PTY LTD

TITLE
110 & 120 CARRS DRIVE, YAMBA
DEVELOPMENT APPLICATION CIVIL WORKS PLANS

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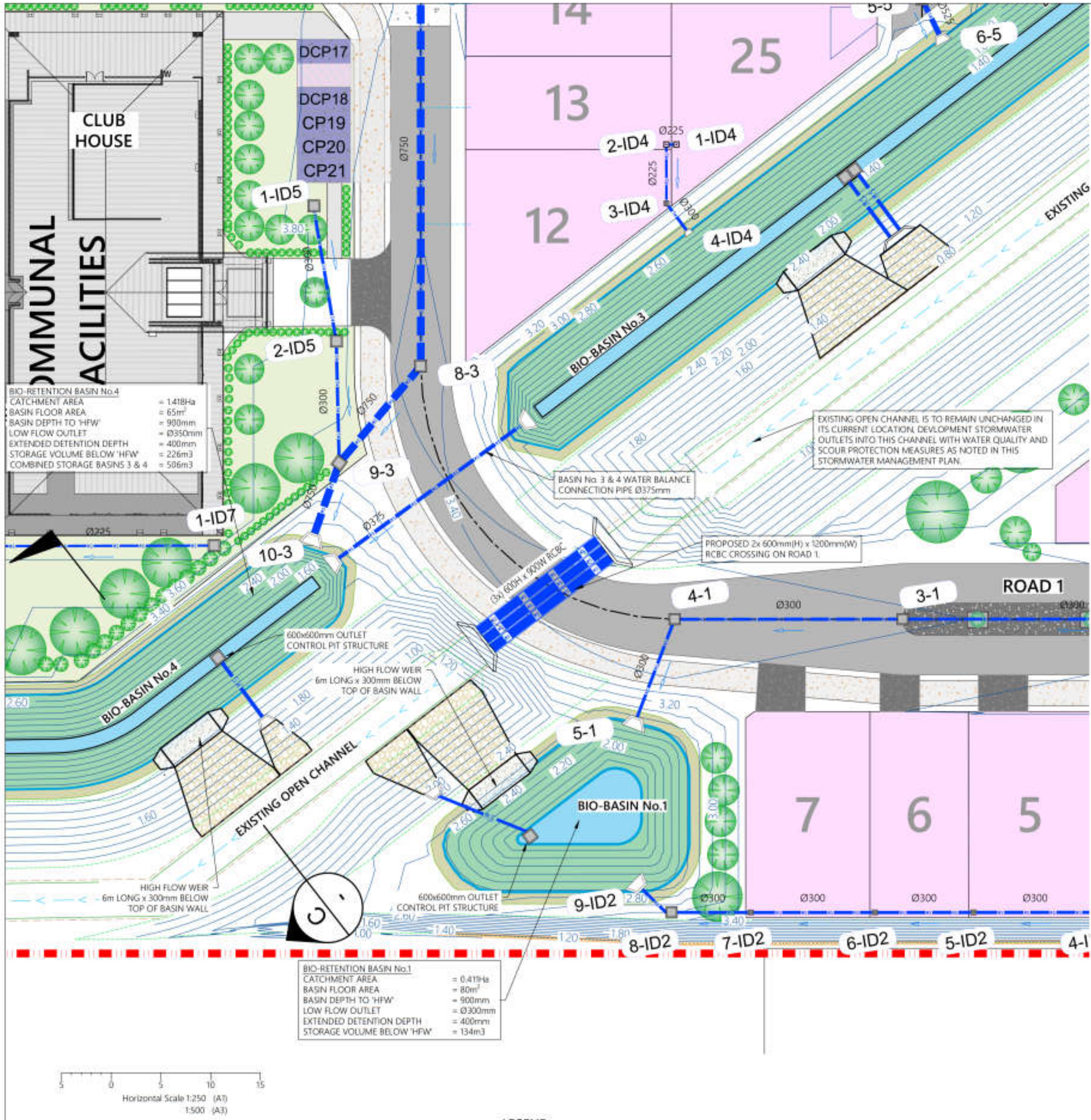
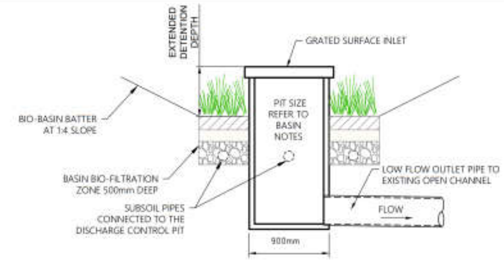
DA CIVIL DRAWING

DRAWING TITLE: STORMWATER MANAGEMENT PLAN - SHEET 1

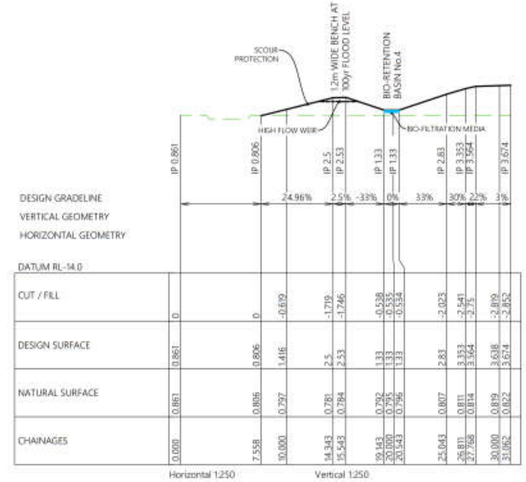
DWG No: D34 | SHEET: 34 OF 43 | REV: 1





TYPICAL - BIO-RETENTION DISCHARGE CONTROL PIT

N.T.S



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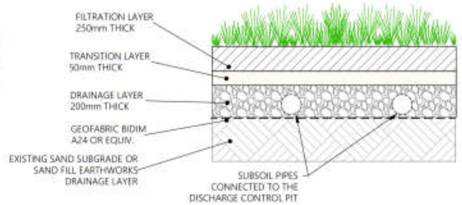

TYPICAL BIO-FILTRATION ZONE PROFILE (400mm THICK)

N.T.S

FILTER MEDIA - GENERAL DESCRIPTION

THE MATERIAL CAN BE OF SILICEOUS OR CALCAREOUS ORIGIN.
THE MATERIAL MUST BE TESTED FOR DESIRED HYDRAULIC CONDUCTIVITY USING THE AUSTRALIAN STANDARD (AS4419-2003).

REFER TYPICAL SPECIFICATION BELOW.

SPECIFICATION FOR BIORETENTION FILTER MEDIA:

BIORETENTION FILTER MEDIA SHALL COMPRISE OF TWO LAYERS

1. THE FILTRATION LAYER IS TO BE 250mm THICK AND CONFORM TO THE FOLLOWING SOIL SPECIFICATIONS.

pH	5.5 - 7.5	(pH 1:5 IN WATER)
ELECTRICAL CONDUCTIVITY (dS/cm)	< 1.2	
TOTAL SALTS (ppm)	< 600	
CLAY	2 - 4%	(<0.002mm)
SILT	4 - 8%	(0.002 - 0.05mm)
VERY FINE SAND	5 - 10%	(0.05 - 0.15mm)
FINE SAND	10 - 25%	(0.15 - 0.25mm)
MEDIUM TO COARSE SAND	60 - 70%	(0.25 - 1.0mm)
COARSE SAND	7 - 10%	(1.0 - 2.0mm)
FINE GRAVEL	< 3%	(2.0 - 3.4mm)
HYDRAULIC CONDUCTIVITY (mm/hr)	200 (+/- 20%)	

THE FILTRATION LAYER WILL BE AMELIORATED TO PROVIDE ADEQUATE INITIAL GROWTH. THIS LAYER IS TO CONSIST OF PREMIXED ZEOLITE 20% BY VOLUME PRIOR TO DELIVERY AND PLACEMENT. PRIOR TO PLANTING THE FOLLOWING SHALL BE PLACED INTO THE TOP 75MM.

AGRICULTURAL LIME - RATE TO BE DETERMINED DEPENDING ON SELECTED FILTER MATERIAL	10-30 kg/100sq.m INDICATIVE RANGE
SUPERPHOSPHATE AT	2 kg/100sq.m
MAGNESIUM SULPHATE AT	3 kg/100sq.m
POTASSIUM SULPHATE AT	2 kg/sq.m
TRACE ELEMENTS MIX	1 kg/100sq.m
FERTILISER NPK16.4.14 AT	4 kg/100sq.m

2. TRANSITION LAYER IS TO BE 50mm THICK WELL GRADED COARSE SAND
3. THE DRAINAGE LAYER IS TO BE 200mm THICK WITH 5-7mm WASHED AGGREGATE

* THERE SHOULD BE NO GEOFABRIC INTERFACE BETWEEN THE TWO LAYERS, ONLY AT THE INTERFACE WITH THE SAND SUBGRADE

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ARCHITECTURAL INFORMATION FOR CLUB HOUSE SUPPLIED BY MARK SHAPIRO ARCHITECTS DRAWING NUMBER DA1002WIP REV 2

LEGEND

- DEVELOPMENT BOUNDARY
- INTERNAL LOT BOUNDARY
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DESIGNED: T.RYDEN | DATE: JAN 2024
DRAWN: A.SCHMID | SCALE: AS SHOWN
SURVEYING: MACRO SURVEYING | SHEET SIZE: A1

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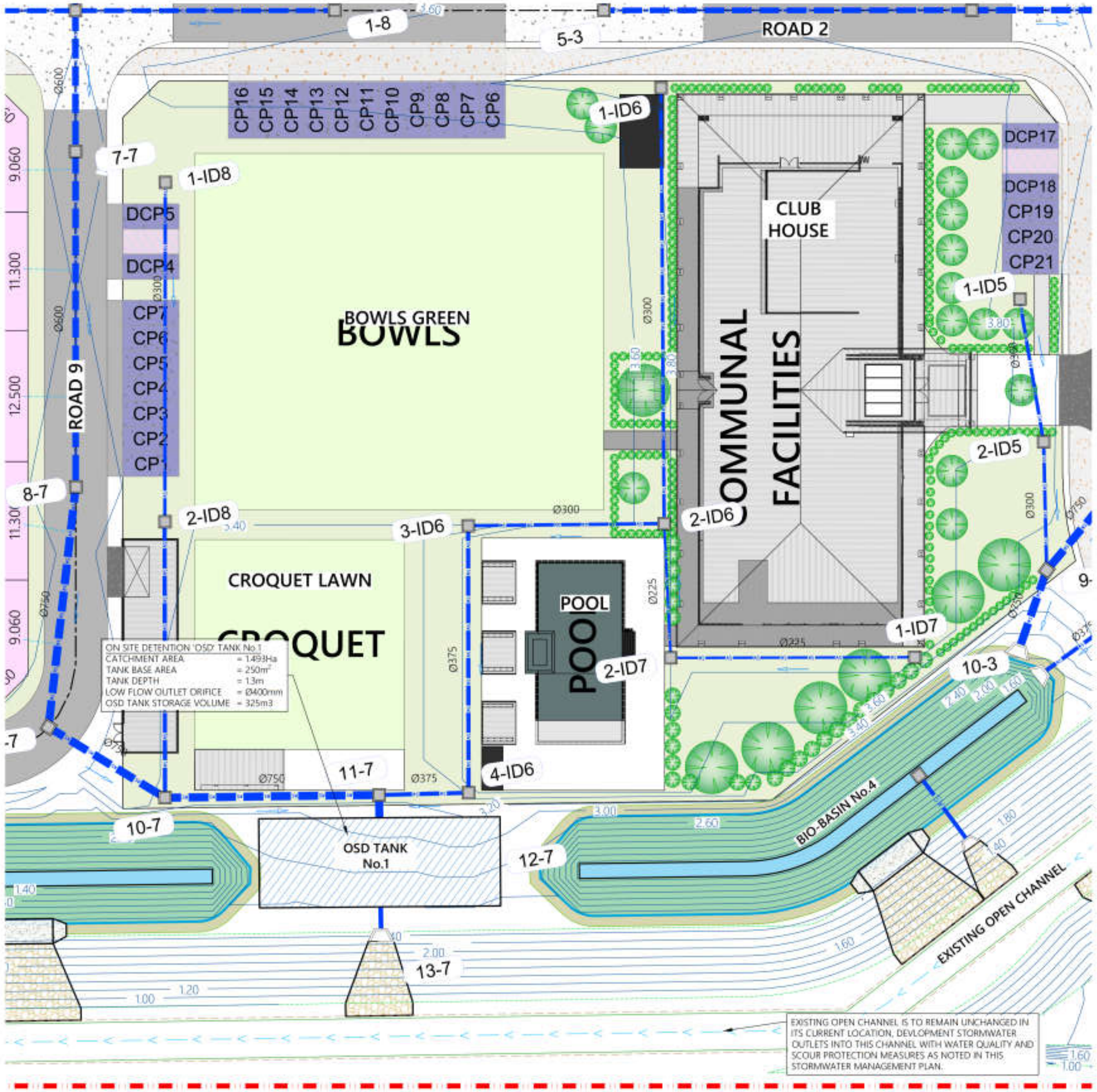
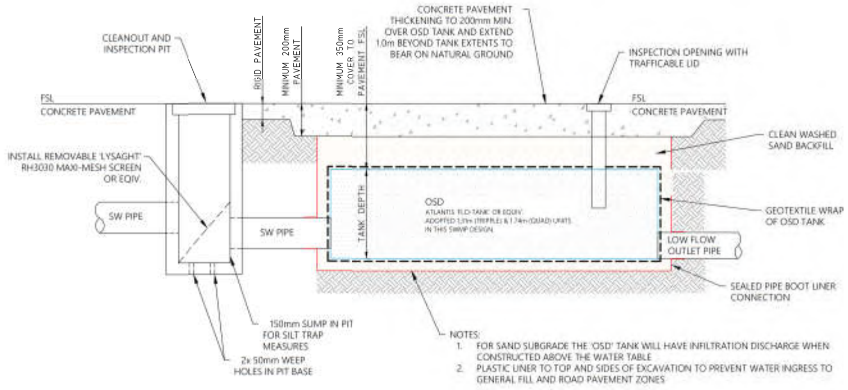
DA CIVIL DRAWING

DRAWING TITLE: STORMWATER MANAGEMENT PLAN - SHEET 2

DWG No: D35 | SHEET: 35 OF 43 | REV: 1





TYPICAL DETAIL - SECTION VIEW
OSD ATLANTIS 'FLO-TANK'
N.T.S

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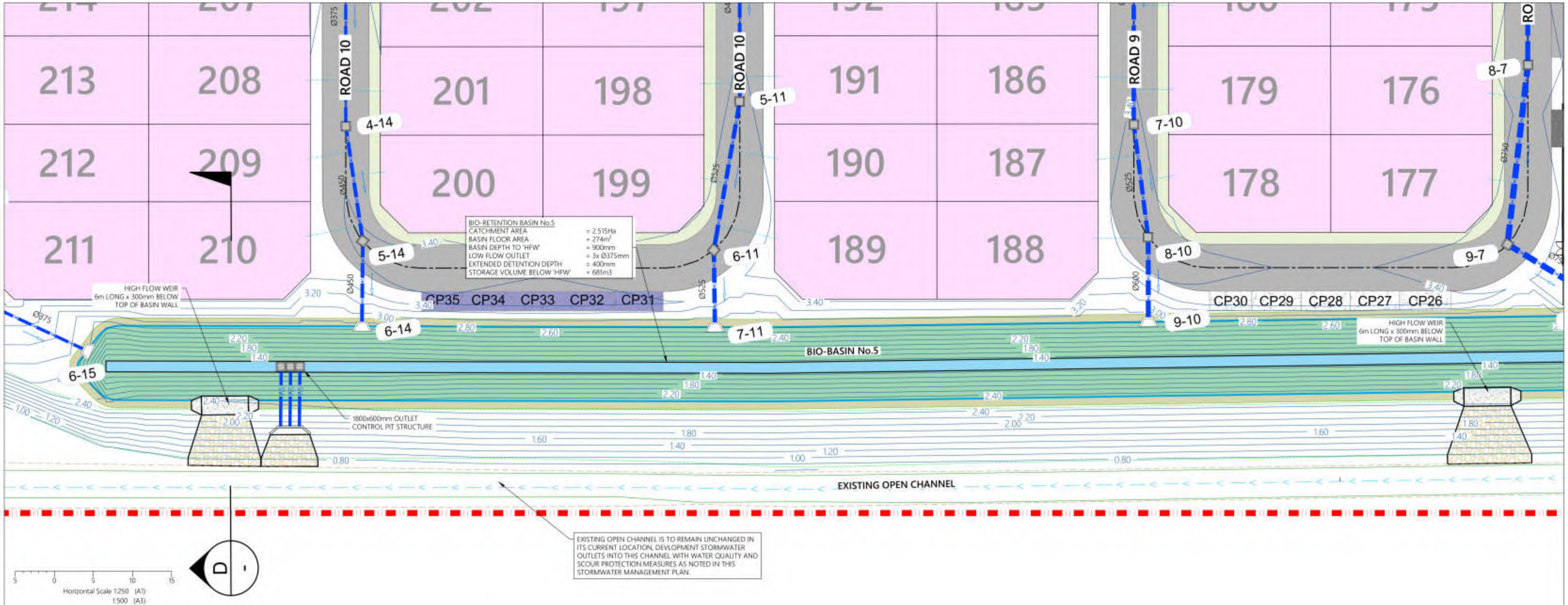
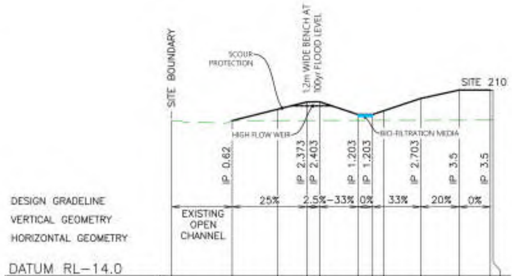
DA CIVIL DRAWING

DRAWING TITLE: STORMWATER MANAGEMENT PLAN - SHEET 3

DWG No: D36

 REV: 1





CUT / FILL		0	-1.067	-1.739	-1.767	-0.559	-0.557	-0.914	-2.048	-2.837	-2.831	
DESIGN SURFACE		0.62	1.695	2.373	2.403	1.203	1.203	1.563	2.703	3.5	3.5	
NATURAL SURFACE		0.620	0.629	0.634	0.637	0.644	0.647	0.649	0.655	0.663	0.669	0.669
CHAINAGES	0.000	5.699	10.000	12.711	13.921	17.521	18.921	20.000	23.421	27.057	30.000	30.257

Horizontal 1:250 Vertical 1:250

SECTION-D (BIO-BASIN No.5)

LEGEND

- DEVELOPMENT BOUNDARY
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DRAWN: A.SCHMID — SCALE: AS SHOWN
SURVEYING: MACRO SURVEYING — SHEET SIZE: A1

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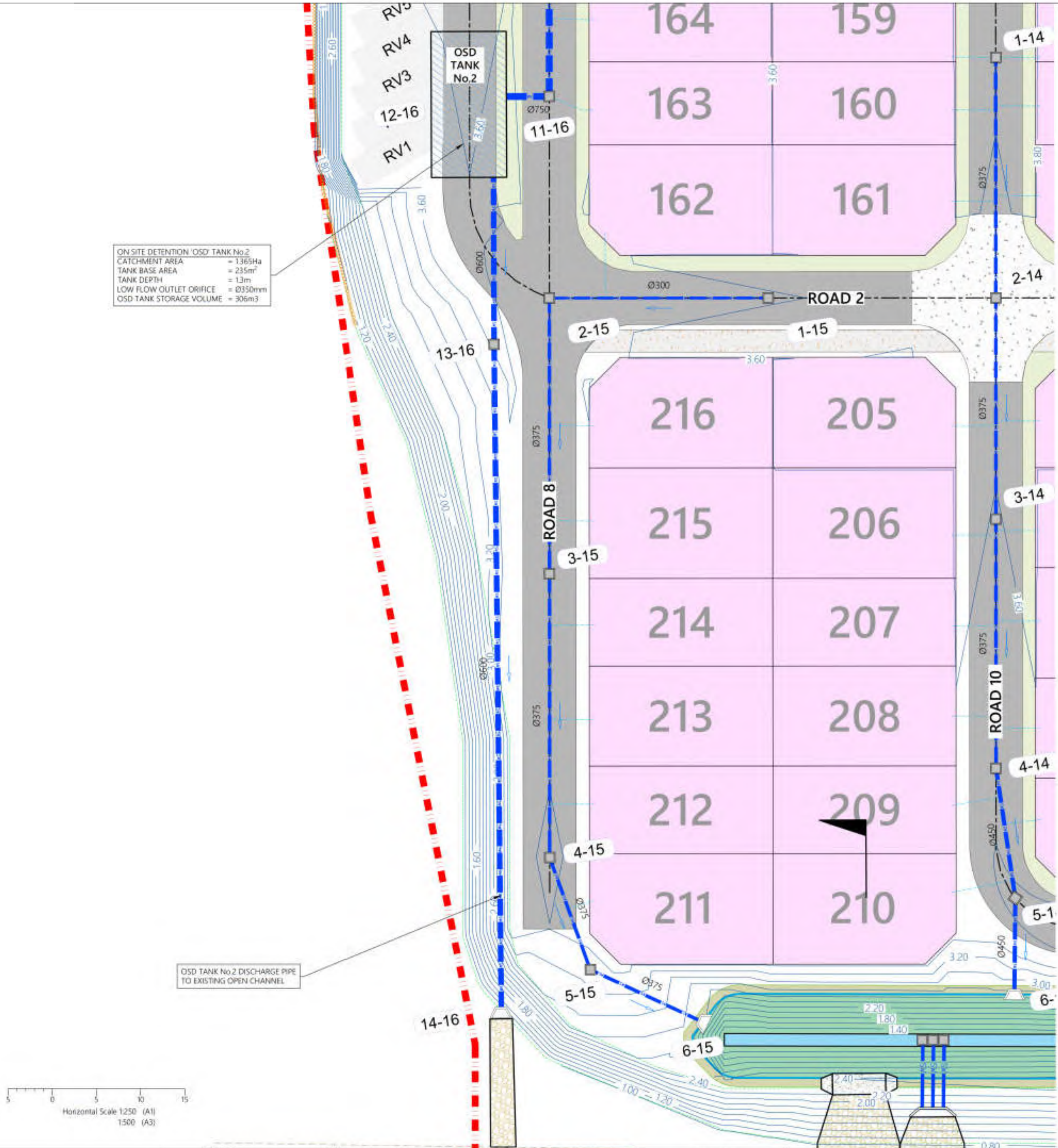
DA CIVIL DRAWING

DRAWING TITLE: STORMWATER MANAGEMENT PLAN - SHEET 4

DWG No: D37 — SHEET 37 OF 43 — REV: 1



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- GRASSED AREA

PLANS TO BE PRINTED IN COLOUR

PRELIMINARY PLANS FOR DA PURPOSES ONLY NOT FOR CONSTRUCTION

ISSUE	DESCRIPTION	DATE
1	ISSUED FOR DEVELOPMENT APPLICATION - AMENDED SITE FORMATION HEIGHTS	23.01.2024
0	ISSUED FOR DEVELOPMENT APPLICATION	08.09.2022

DESIGNED:	T.RYDEN	DATE:	JAN 2024
DRAWN:	A.SCHMID	SCALE:	AS SHOWN
SURVEYING:	MACRO SURVEYING	SHEET SIZE:	A1

ISSUED FOR DEVELOPMENT APPROVAL
NOT FOR CONSTRUCTION

MDE
Manage Design Engineer

www.md-engineer.com.au

CLIENT
CLIFTON YAMBA LAND PTY LTD

TITLE
110 & 120 CARRS DRIVE, YAMBA
DEVELOPMENT APPLICATION CIVIL WORKS PLANS

CLIFTON YAMBA

PROJECT
PROPOSED MHE DEVELOPMENT
110 & 120 CARRS DRIVE
YAMBA, NSW 2464
LOT 2 DP733507 & LOT 32 DP128863

DA CIVIL DRAWING

DRAWING TITLE:
STORMWATER MANAGEMENT PLAN - SHEET 5

DWG No: D38 | SHEET: 38 OF 43 | REV: 1

Revision History

Revision No.	Revision date	Details	Prepared by	Reviewed by	Approved by
01	05/10/2023	Draft Vegetation Management Plan for 120 Carrs Drive, Yamba	Jennifer Timbs, Ecologist Ziggy Andersons, Senior Ecologist	Rachel McBride, Senior Ecologist	Leigh Knight, Principal Environmental Planner
02	7/12/2023	Final Vegetation Management Plan for 120 Carrs Drive, Yamba	Jennifer Timbs, Ecologist Ziggy Andersons, Senior Ecologist	Leigh Knight, Principal Environmental Planner	
03	30/01/2024	Vegetation Management Plan for 120 Carrs Drive, Yamba_R1	Ziggy Andersons, Senior Ecologist	Leigh Knight, Principal Environmental Planner	

Distribution List

Copy #	Date	Type	Issued to	Name
1	12/02/2024	Electronic	Clifton Yamba Land Pty Limited ATF Yamba Land Trust	Chesney Boshoff
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