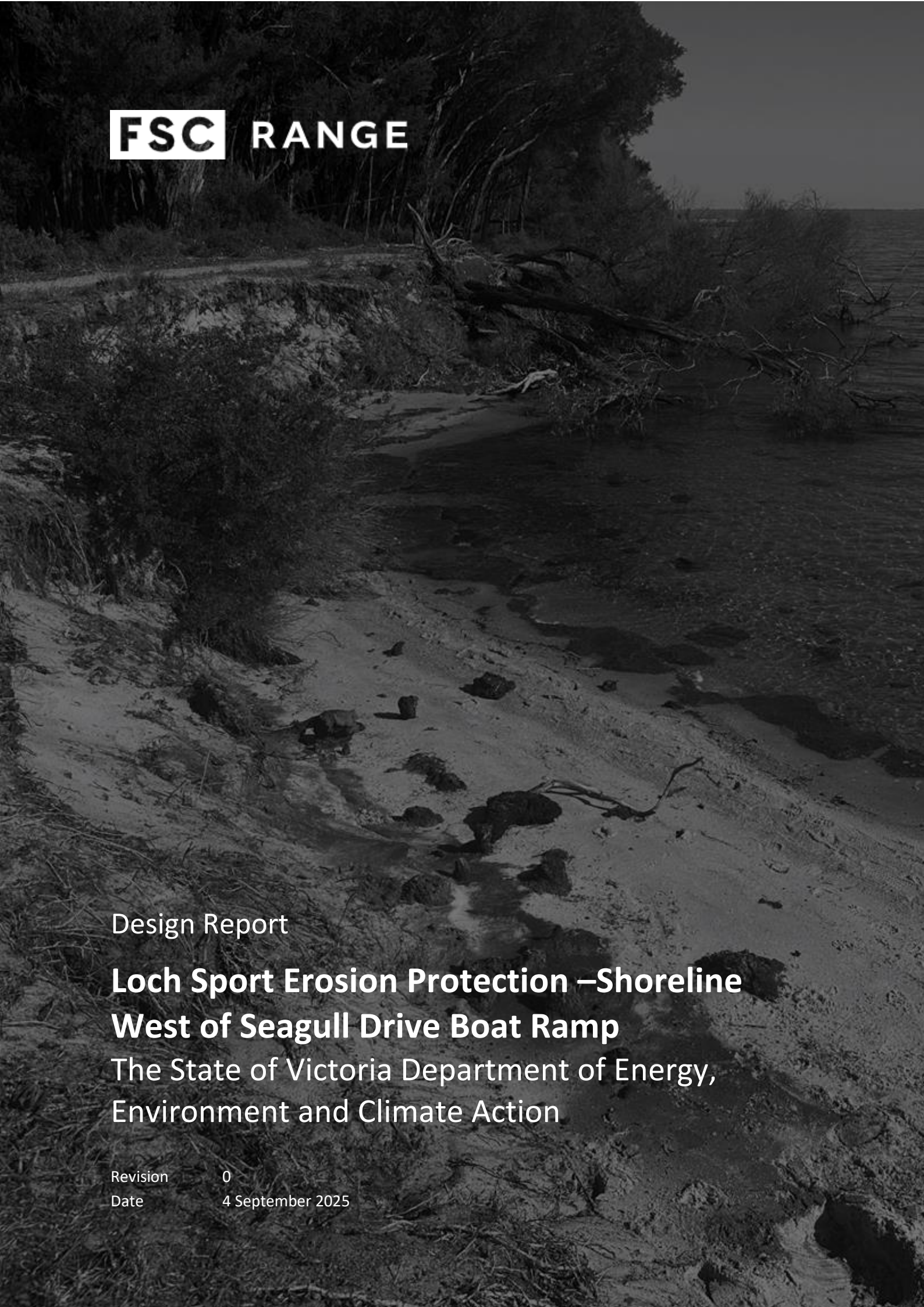

FSC RANGE

Design Report

# Loch Sport Erosion Protection –Shoreline West of Seagull Drive Boat Ramp

The State of Victoria Department of Energy, Environment and Climate Action

Revision 0
Date 4 September 2025

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| Document Information | |
|---|---|
| Client | The State of Victoria Department of Energy, Environment and Climate Action |
| Project | Loch Sport Erosion Protection –Shoreline West of Seagull Drive Boat Ramp |
| Project Number | 250094 |
| Report Title | Design Report |
| File Reference | 250094-CST-REP-2 |

| This Revision | | | |
|---|---|---|---|
| Current Revision | 0 | | |
| Date | 4 September 2025 | | |
| Status | IFT | | |
| TS<br>Author(s) | | Reviewed | Approved |

| Document History | | | | | |
|---|---|---|---|---|---|
| Rev. | Date | Status | Author(s) | Reviewed | Approved |
| A | 6/08/2025 | Interim Issue | TS | AWP | AWP |
| B | 29/08/2025 | Final Draft | TS | AWP | AWP |
| 0 | 4/09/2025 | IFT | TS | AWP | AWP |
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| | | | | | |

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# 1 INTRODUCTION

## 1.1 Project Overview

The aim of this project is to provide detailed design for erosion management control, for the protection of the shoreline west of Seagull Drive Boat Ramp along Lake Victoria in Loch Sport (Figure 1-1). Detailed design is required for rock groynes along the shoreline based on the Erosion Management Options Assessment (FSC Range, 2025), which builds on the recommendations outlined in the *Loch Sport Foreshore Coastal Processes and Options Assessment* and the *Seagull Drive Boat Ramp Carpark Erosion Management Options Assessment* (BMT, 2022, 2023c).

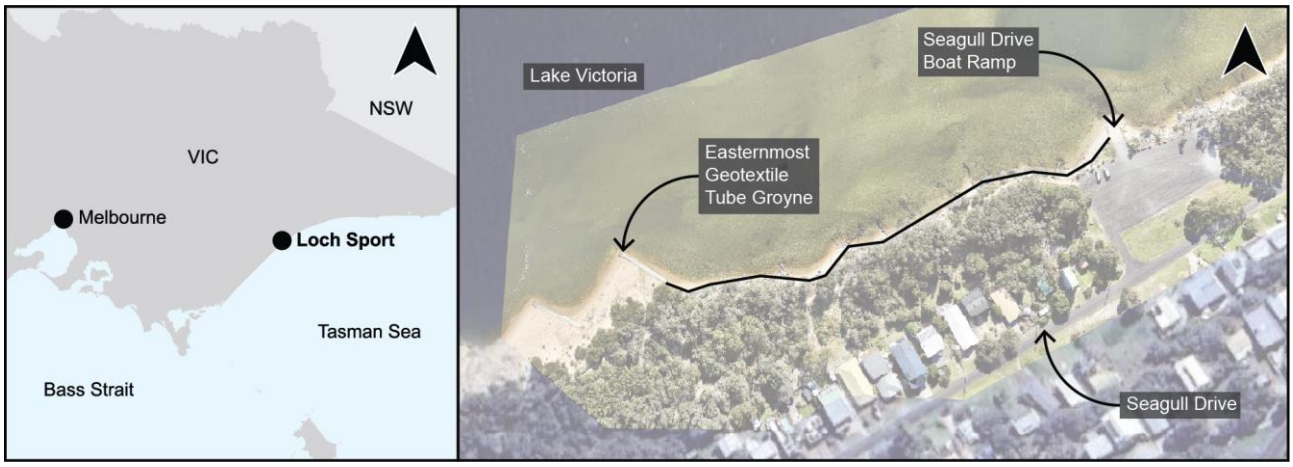


***Figure 1-1: Map of site locality***

(left) The location of Loch Sport in relation to Melbourne. (right) An aerial view of the project area, the eroding shoreline extent outlined in black with surrounding features labelled.

## 1.2 Scope of Services

FSC Range was engaged by the State of Victoria Department of Energy, Environment, and Climate Action (DEECA) to develop erosion management protection options for the shoreline west of Seagull Drive Boat Ramp. The initial stage of the project involved data review, site investigations, an options assessment, and identification of a preferred coastal protection approach. The current phase of work involves progressing the selected option through detailed design. Specifically, the scope includes preparation of engineering design documents to 90% completion, comprising a design report (this document), detailed drawings, technical specifications, a bill of quantities (BOQ), and a cost estimate based on the detailed design.

## 1.3 Existing Documentation

The existing documentation provided to inform this design have been listed below (Table 1-1).

***Table 1-1: Summary of existing documentation***

Provided by DEECA to FSC Range for review to inform the development and design of erosion management protection options.

| Description | Reference | Relevance |
|---|---|---|
| Gippsland Lakes and 90 Mile Beach Local Coastal Hazard Assessment Project – Report 1: Summary Report | (Water Technology Pty Ltd, 2014a) | Regional |
| Gippsland Lakes and 90 Mile Beach Local Coastal Hazard Assessment Project – Report 2: Inundation Hazard | (Water Technology Pty Ltd, 2014b) | Regional |
| Gippsland Lakes/90 Mile Beach Local Coastal Hazard Assessment Project – Report 4: Lakes Shoreline Erosion Hazard | (Water Technology Pty Ltd, 2014c) | Regional |
| Loch Sport Foreshore Erosion Investigation | (Oldfield Consulting Australasia Pty Ltd, 2021) | Local |
| Loch Sport Foreshore Coastal Processes & Options Assessment | (BMT Commercial Australia Pty Ltd, 2022) | Local |
| Loch Sport Foreshore Reserve Coastal Erosion / Adaptation Planning Community Engagement Findings Oct, 2022 | (DELWP, 2022) | Local |
| Aerial imagery between Bream Road and Pelican Point (undated, circa 2024) | (The State of Victoria Department of Energy, Environment and Climate Action, 2024a) | Local |
| Seagull Drive Boat Ramp Carpark Erosion Management - Options Assessment (East) | (BMT Commercial Australia Pty Ltd, 2023c) | Site Nearby |
| Aerial imagery and digital surface model along Seagull Drive (dated 03/05/2025) | (The State of Victoria Department of Energy, Environment and Climate Action, 2025) | Site |
| Markup of Proposed Layout of Additional Boat Ramps at Loch Sport | (Wellington Shire Council, 2024b) | Site |

# 2 BASIS OF DESIGN

## 2.1 Overview

The purpose of this section is to define the design basis for the detailed design of the rock groynes. The design is aimed to provide erosion protection for the shoreline west of Seagull Drive boat ramp in Loch Sport. The following precedence was adopted to define the design basis:

- Relevant legislation,
- Australian Standards,
- Previous site investigations,
- Stakeholders needs,
- Other guidelines as required.

Table 2-1 lists the primary standards and guidelines used for the design of the rock groynes.

***Table 2-1 Standards, Guidelines and Policies***

| Designation | Title |
|---|---|
| AS 4997 | Guidelines for the Design of Maritime Structures |
| CIRIA 2007 | The Rock Manual: The use of rock in hydraulic engineering |
| Engineer Manual 1110-2-1100 | Coastal Engineering Manual (2nd ed.) |
| Marine and Coastal Policy | Victorian State Government Marine and Coastal Policy |

## 2.2 Staged Implementation

The design adopts a staged implementation approach. The Stages are as follows:

- Stage 1: Construction of short rock groynes.
- Stage 2: Extension of rock groynes to full recommended length.
- Stage 3: Beach nourishment to provide a 5 m wide beach.
- Stage 4: Beach nourishment to provide a 10 m wide beach.
- Stage 5: Placement of additional rock layer(s) to increase groyne crest level to accommodate future sea level rise.

The sequencing and scope of each stage will be determined during the Tender process.

## 2.3 Coastal Processes

BMT (2023) has assessed the coastal processes associated with this site; parameters adopted in this design have been summarised in Table 2-2.

The provided documentation does not report wave periods in the area. Wave periods were therefore evaluated using several methods outlined in the USACE Shore Protection Manual for fetch-limited scenarios, including Jonswap Parametric Method and Sverdrup-Munk-Brettschneider Method (USACE, 1984). These methods showed wave periods ranging from 3.7 seconds to 5.9 seconds. This range of values was evaluated during design.

Tidal level data is limited at the site. The assumed tidal range is between approximately ±0.2 m (Metung) and ±0.03 m (Lake Wellington) (BMT, 2023 and WT, 2014). Measured water levels at Loch Sport for a representative 3-month period in 2011 are shown in Figure 2-1. Based on this data, the astronomic component appears to range from approx. -0.05 m AHD to +0.05 m AHD, however there is an approximately bimonthly oscillating residual component, due to wind setup and freshwater flows, which ranges from approx. 0.1 m AHD to 0.7 m AHD.

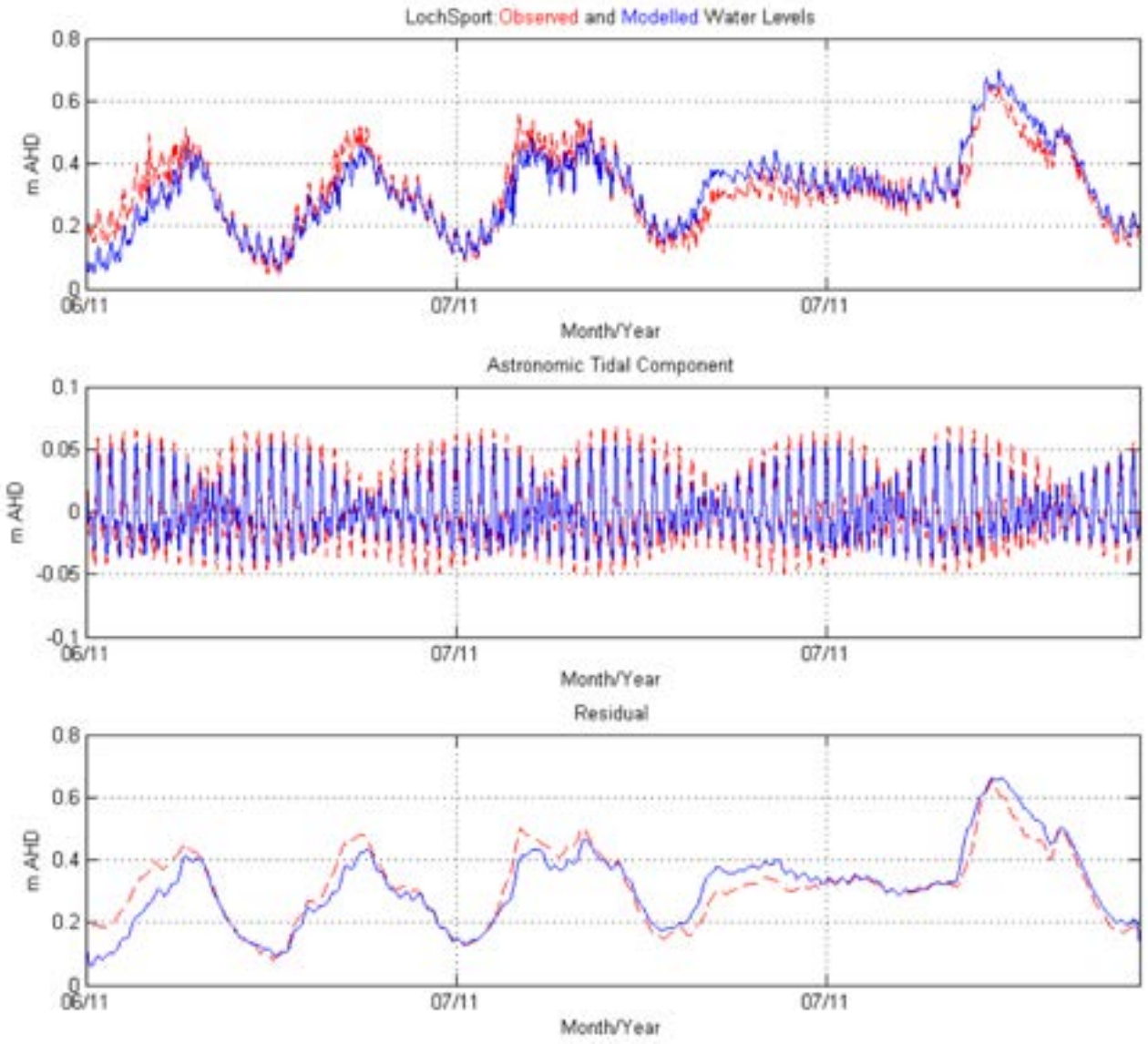


***Figure 2-1: Comparisons of Total, Tidal and Residual Water Level Data for the 2011 Ambient Conditions Simulation at Loch Sport***
Reproduced from Water Technology (2014)

The design tidal water levels were therefore assumed as follows, based on the measured water level data presented in Water Technology (2014):

*MHW = astronomic component + average high residual component*
*MHW = 0.05 m AHD + 0.5 m AHD*
***MHW = +0.55 m AHD***

*MLW = astronomic component + average low residual component*
*MLW = -0.05 m AHD + 0.15 m AHD*
***MLW = +0.10 m AHD***

***Table 2-2: Design basis for coastal processes***
Extracted from BMT (2023) unless noted otherwise.

| Process | Parameter | Value |
|---|---|---|
| Tidal Plane | Mean Higher High Water (MHHW)[1] | +0.55 m AHD |
| | Mean Lower Low Water (MLLW)[1] | +0.10 m AHD |
| Storm Water Level | 10-year ARI Event Peak Water Level [2] | 1.59 m AHD |
| | 100-year ARI Event Peak Water Level [2] | 1.71 m AHD |
| Sea Level Rise (SLR) | 2070 SLR [2] | 0.4 m |
| | 2100 SLR [2] | 0.8 m |
| Waves | Significant Wave Height ($H_s$) | 0.5 m |
| | Peak Wave Period ($T_p$) [3] | 3.7 s to 6.9 s |
| fetch | Fetch (m) | 11 km |
| Currents | Peak Tidal Current (m/s) | N/A [4] |

1. Tidal range derived from measured water levels shown in Water Technology (2014) and are based on methodology described above.
2. Reported in BMT (2023) and WT (2014). Assumed relative to baseline year 2014.
3. Wave period was not reported in the available literature and were therefore calculated based on methodology described above.
4. The study area is classified as 'Protected' to 'Very Protected' from currents (Water Technology 2014).

## 2.4 Site Investigations

The site investigations relevant for groyne design are specified in Table 2-3.

***Table 2-3: Design basis for site investigations***

| Investigation | Description |
|---|---|
| Feature and level survey | Gippsland Ports (2024) conducted a detailed feature, level, and bathymetric survey associated with the existing groynes on 18th of June 2025 (Appendix A). |
| Bathymetric survey | |
| Geotechnical investigation | No geotechnical investigations were completed for this project. Geotechnical investigations completed for a nearby site on the eastern side of the Seagull Drive boat ramp (Geotesta, 2024), shown in Appendix B, are assumed to be representative of the project area. These conditions were therefore used to inform both the design of the proposed works and the assessment of constructability, though actual conditions may vary locally and should be confirmed by the Contractor prior to construction. |
| Soil contamination investigation | Sediment sampling and analysis were completed by Geotesta (2024), shown in Appendix B, and BMT (2023). No additional investigations were deemed necessary. |
| Heritage assessment | The structures were not found to be impacted by listings on the Heritage Register, Heritage Inventory, or Local Heritage Overlays. Therefore, no additional heritage assessment site investigations were deemed necessary. |
| Vegetation assessment | Given that no sensitive habitats or species were identified within the proposed footprint, no further site investigations were deemed necessary. Environmental controls are to be implemented during construction per the Technical Specifications. |
| Marine ecological assessment | |
| Existing underground services | A Dial Before You Dig check shall be completed prior to construction to understand service locations that may be affected by the proposed work including NBN, telecommunications, water, and electricity lines. |

## 2.5 Groyne Design

The dimensions governing the groyne design are specified in Table 2-4, and detailed in the following sections.

***Table 2-4 Groyne overall dimensions***

| Criterion | Adopted Design Value | Basis |
|---|---|---|
| Top of Groyne (Landside) | 1.25 m AHD | • To sit higher than MHW levels, including allowance for wave setup/runup.<br>• Additional rock layers can be added as needed in the future to accommodate future SLR, these future updates are reflected in the design drawings. |
| Top of Groyne (Lakeside) | 0.50 m AHD | To match existing MLW levels plus reasonable allowance for wave setup/runup. |
| Length of Groyne | 15 to 16 m | **Stage 1:** Minimum length recommended to achieve functional outcome in the immediate term. |
| | 25 to 28 m | **Stage 2:** Length recommended to achieve optimal, long term shoreline stabilisation. |
| Groyne Spacing | 40 m | Maximum spacing recommended, achieving a length to spacing ratio from approx. 1:2.5 (Stage 1) down to approx. 1:1.6 per design guidance in the CEM and to match existing, functional groynes in the area. |
| Rock Armour – Median Size $D_{n50}$ | 0.30 m | Based on methodologies outlined in the CEM (USACE, 2012) for assessing stability of structures under wave action. |
| Rock Armour – Median Mass $M_{50}$ | 70 kg | Based on methodologies outlined in the CEM (USACE, 2012) for assessing stability of structures under wave action. |
| Slope | 1V:2H | Slope recommended for stability and to minimise overtopping effects. |
| Crest Width | 0.90 m | 3 rocks wide minimum, smallest width for stability and to minimise footprint. |
| Toe Width | 0.60 m | Width and thickness (0.5m) to provide sufficient volume to accommodate future scour conditions (i.e. acting as a 'falling toe') while minimizing disturbance of potential acid sulphate soils. |

### 2.5.1 Groyne Alignment

Groyne alignment, length and spacing were determined using a combination of empirical and analytical methods, as well as numerical modelling tools.

A one-line shoreline model, ShorelineS (Elghandour, 2018), was employed to assess the functionality of groyne length and spacing. This model simplifies the shoreline into a single representative line, allowing simulation of sediment transport and shoreline evolution over time under varying wave and structural conditions. It accounts for wave-generated longshore transport gradients, coastal structures, and nourishment to provide insights into sediment accumulation and erosion patterns.

However, the model did not perform reliably for the shorter groyne (Stage 1) configuration, primarily due to grid resolution limitations. Specifically, grid sizes below 10 m were required to resolve the groyne spacing and length, but this introduced numerical instability and unrealistic shoreline behaviour. As a result, the model was instead used to confirm the recommended full-length groyne field alignment and spacing, which represent the long-term, optimal shoreline stabilisation layout.

The Stage 1, shorter groynes were therefore assessed using empirical methods:

- The log-spiral (parabolic bay) method (Hsu and Evans, 1989) was used to estimate the equilibrium shoreline orientation in the lee of each groyne, assuming they act as control points influencing sediment deposition through wave refraction and diffraction.
- Dean's method (Dean, 2002) was used to estimate the potential shoreline accretion and downdrift erosion based on groyne spacing, length, and the local wave climate, providing a simplified, transport-based estimate of groyne performance and bypass potential.

The equilibrium shoreline prediction for each stage is shown in Figure 2-2. This figure highlights that for Stage 1 shorter groynes, some localized shoreline setback may be realised near the groynes on the lee side. This erosion is not anticipated to be significant, however nourishment is recommended to minimise this potential localised erosion and maintain sediment bypassing to adjacent groynes. Regular monitoring (minimum annual and after significant storm events) is also recommended to ensure functionality of the groynes and that significant localised erosion does not progress. The groyne compartments are expected to fill within one to two years, based on the annual sediment supply estimated by BMT (2022), however initial nourishment to the funding extent available is recommended to enhance and ensure shoreline resilience.

Additional considerations for the groyne dimensions include downstream impacts. At the downstream end of the project shoreline, the proposed upgrade to the Seagull Drive Boat Ramp includes a jetty and a sheet pile wall along its eastern edge. This sheet pile wall is anticipated to act as a groyne providing protection to the adjacent shoreline in front of the car park. However, as the timing of the boat ramp upgrade remains uncertain, the detailed groyne field design needed to consider both the long-term influence of the future structure on sediment dynamics and potential interim conditions if the groyne field is constructed before the sheet pile wall. Prior to its construction, the unprotected shoreline is expected to experience erosion of up to 5 m in a single storm and potentially 10 m in a season with successive significant storm events (BMT, 2022). This erosion estimate is based on historical shoreline response, and annual maximum waves of approximately 0.5 m, which are wind-driven and depth-limited in this sheltered environment. This wave climate can be expected to occur annually, based on the local wind climate.

These erosion extents represent a conservative estimate, assuming a fully erodible coast. In reality, the presence of vegetation and asphalt infrastructure will limit surface erosion, but undermining of the carpark edge may occur, particularly during prolonged or successive storm events. The initial groyne field may also

exacerbate erosion in this section by impeding natural sediment bypass, unless it is fully nourished during construction to re-establish equilibrium transport.

We recommend that the proposed jetty sheet pile wall (or similar structure at the boat ramp) be constructed within one year of the groyne field implementation to stabilise this vulnerable section. As the current shoreline is as close as 2 m from the existing carpark, regular monitoring is strongly recommended during the interim period. If erosion progresses, temporary coastal protection works should be considered. These may include:

- Strategic beach nourishment, designed to avoid excessive siltation of the boat ramp.
- A low rock or geotextile sandbag revetment along the carpark shoreline where the shoreline is within 5 m of the bitumen edge. (Refer to Figure 2-3 for proposed extents.)
- Small groyne between proposed jetty seawall and easternmost groyne.

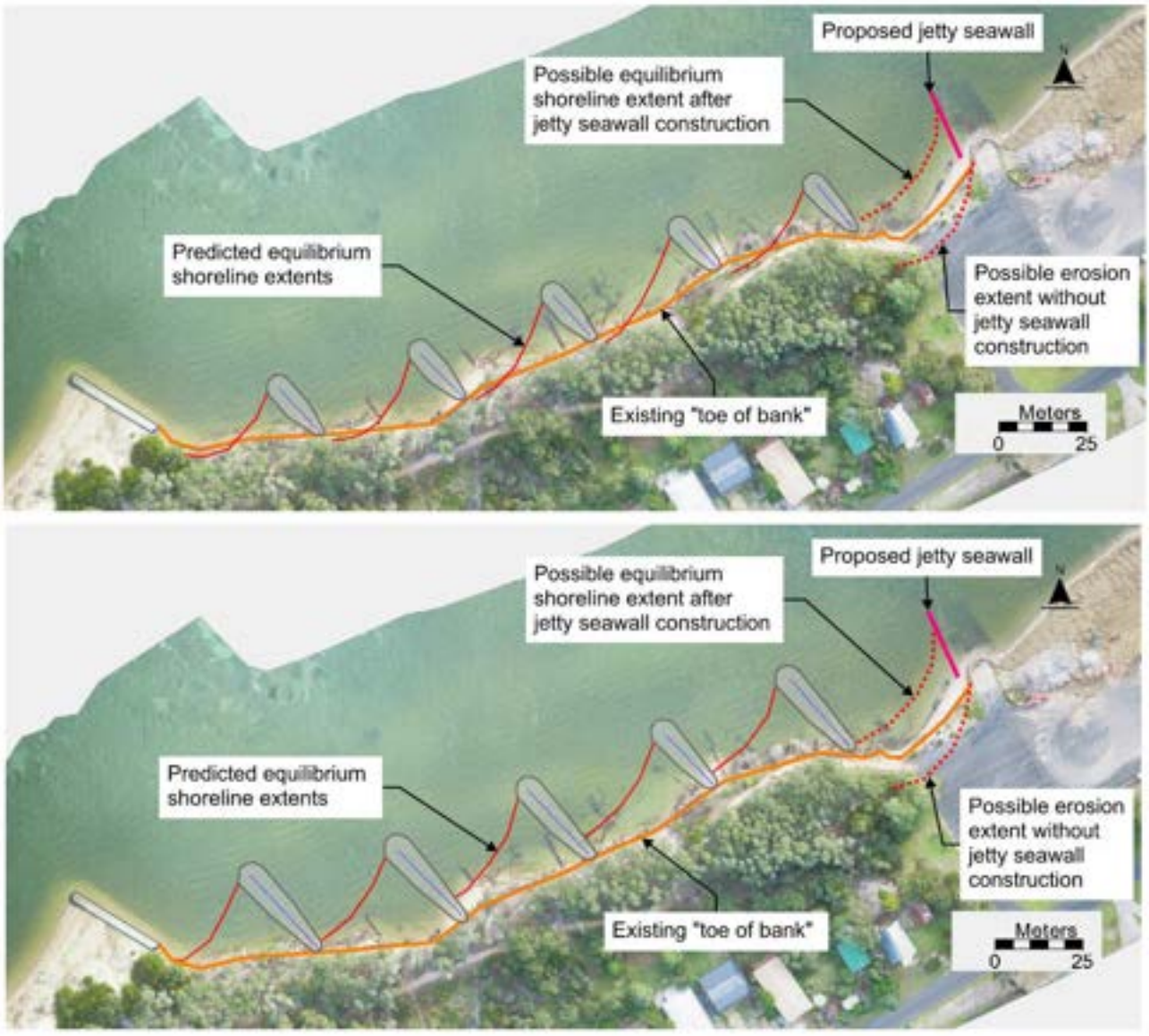


***Figure 2-2: Predicted Equilibrium Shoreline Extents for Stage 1 (Top) and Stage 2 (bottom)***

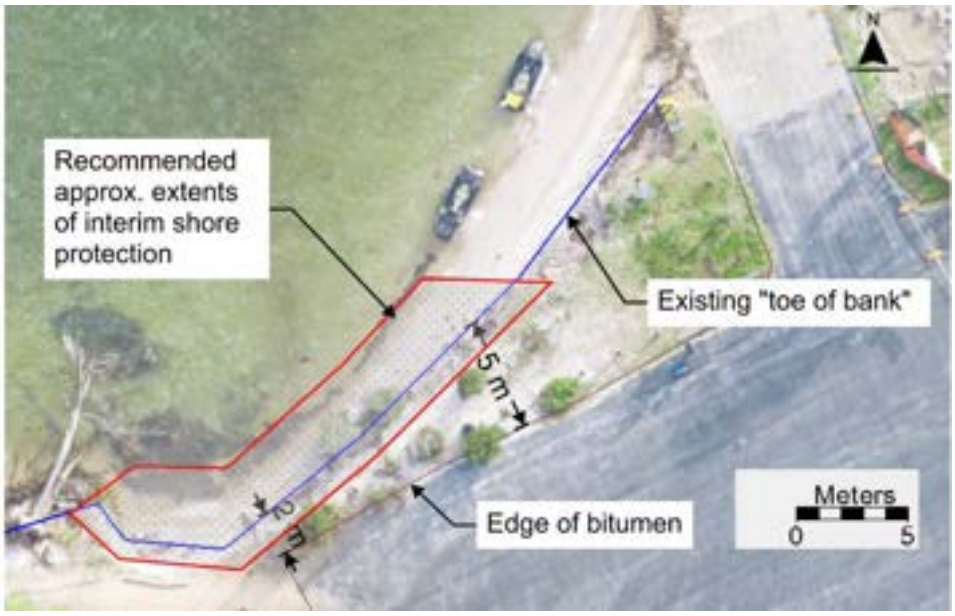


***Figure 2-3: Proposed interim shore protection extents***
Aerial imagery, and mapped "Edge of Bitumen" and "Toe of bank" from the site survey (Gippsland Ports, 2025)

### 2.5.2 Rock Sizing

Armour rock stability was evaluated using methodology outlined in the CEM and Rock Manual. Various methods were evaluated to assess stability under wave attack for both for non-overtopped and overtopped conditions. An underlayer or filter layer under the primary armour was not deemed necessary due to low structure height as well as low wave action, therefore the entire structure was designed to consist of a single class of armour rock. This approach is cost effective for low-crested structures where the underlayer or core volume is small relative to the armour layer. Additionally, using smaller core material often requires bunding from tidal water, making it more economical to construct the entire structure with armour rock. This simplifies construction by allowing truck back tipping to deliver rock to the end of the groyne without the need for sorting different material types. The delivered armour rock is then sorted and individually placed by machine.

An underlying geotextile is required to prevent the subgrade material from being washed out through the voids in the rock armour due to wave action.

### 2.5.3 Crest Design

The crest design was based on stability and geometry. The crest width has been taken as 0.90 m, a minimum of 3 rocks wide which, according to the CEM, is the minimum width for constructability and stability of the structure. The minimum width has been adopted to minimise the footprint of the structure.

### 2.5.4 Toe Design

The toe structure aims to provide a robust foundation for the groyne slope, effectively safeguarding any foreseeable scour events. The toe design was based on estimated scour depth, determined using methodologies outlined in the CEM (USACE, 2012). The toe width of 0.6 m and thickness of 0.6 m provides sufficient volume to ensure a stable slope under scoured conditions and prevent undermining of the structure. This 'falling toe' design minimizes disturbance of potential acid sulphate soils.

## 2.6 Beach Nourishment

Beach nourishment is an essential aspect of groyne field design, it not only stabilizes the shoreline but also works synergistically with the groynes to trap sand and build up the beach. This process involves strategically adding sand or sediment to the beach, ensuring the maintenance of a stable and protective beach profile.

Beach nourishment should be simultaneously implemented with groyne construction to combat erosion and enhance shoreline resilience. Construction of the groynes may be staged, and as each groyne is constructed it is best practice to place sand on the updrift (western side) to 'fill' the groyne compartment in order to minimise impact on down-drift coastline.

### 2.6.1 Sand Source

A portion of the sand may be sourced via beach scraping from the adjacent groyne compartments upstream and/or downstream, if a surplus is identified at the time of construction, to reduce costs and construction impacts.

Previous investigations by BMT (2023) concluded that the lakebed sand in the immediate vicinity is not suitable for beach nourishment, as the sediment samples grain size were smaller than the beach sediment and/or contains acid sulphate soils.

Nearby dredging operations could provide nourishment material; however, these operations are typically ad hoc, and to our knowledge no campaigns are currently planned.

Accordingly, it is anticipated that imported sand may be required to meet the project's design and construction needs.

### 2.6.2 Nourishment Design

The beach profile was designed based on site characteristics and coastal conditions. Characteristics of the recommended nourished beach profiles are as follows:

- Design beach berm level = 1.0 m AHD
- Design beach berm width = Stage 3: 5 m, Stage 4: 10 m
- Design beach toe level = -0.75 m AHD (approximate, toe to meet existing grade)
- Design beach slope = 1H:8V

It is acknowledged that available funding may limit the extent of nourishment that can be delivered. Nourishment was therefore separated into separable portions of work, shown as Stages in the Design Drawings (Appendix C). If the available budget does not allow for completion of the full Stage 3 works (i.e. nourishing all groyne compartments to a minimum 5 m beach berm width), the nourishment should be carried out to the maximum practical extent that budget allows, with priority given to the areas most vulnerable to erosion. Based on the current coastal reserve widths and the predicted shoreline extents shown in Figure 2-2, it is currently recommended that priority be given to the easternmost compartments, prioritizing Cell 6 (fronting the parking lot) and extending westwards as budget allows. In the case that the where western compartments are not nourished, monitoring will be required to assess their performance. Monitoring is particularly important if sand is sourced from the adjacent western groyne field, as those groyne compartments will tend to refill first, while the newly constructed compartments may take longer to reach their design capacity.

# 3 COST ESTIMATE

The cost estimate to complete the rock groynes and beach nourishment for each stage is summarised in Table 3-1, outlining the Base Cost, as well as P50 (including a 20% contingency) and P90 (including a 45% contingency) estimates. The estimate is based on a Class 5 Estimate using January 2025 values and updated for the detailed design quantities. The Bill of Quantities is presented in Appendix D.

The cost estimates were prepared for each Stage independently. This approach assumes that mobilisation and demobilisation, traffic control, access preparation, and other associated setup costs would be incurred for each Stage separately. As a result, the individual Stage estimates reflect a conservative basis.
It should be noted that significant cost savings could be achieved if multiple Stages were delivered concurrently, as shared mobilisation and site access preparation would reduce overall construction costs.

***Table 3-1: Cost estimate summary***

| Stage of Implementation | Base Estimate | P50 | P90 |
|---|---|---|---|
| **Stage 1 (Short rock groynes)** | $362,280 | $434,740 | $525,310 |
| **Stage 2 (Rock groyne extensions to full recommended lengths)** | $323,430 | $388,110 | $468,970 |
| **Stage 3 (Beach nourishment of 5m beach berm width)** | $219,100 | $262,920 | $317,689 |
| **Stage 4 (Beach nourishment of additional 5m beach berm width)** | $175,580 | $210,700 | $254,590 |

# 4 DESIGN SUMMARY

FSC Range have prepared a detailed design package for a field of rock groynes and beach nourishment in accordance with the design basis presented herein. See the design drawings in Appendix C for plans and details. The Bill of Quantities is shown in Appendix D.

## 4.1 Rock Groynes

The rock groynes consist of a single rock Class with $D_{n50}$ = 0.30 m, $M_{50}$ = 70 kg. A geotextile is to be laid underneath the structure and encapsulate the armour toe. The groynes are to have side slopes of 1V:2H, a crest width of 0.90 m (3 armour stones wide), and a toe width and thickness of 0.6 m (2 stones).

The design includes the following staged implementation:

**Stage 1:** Construct five groynes, 15 to 16 m in length spaced approx. 40 m apart. Nourishment of the groyne compartments should be applied as funding allows, see Section 2.6 for details.

**Stage 2:** Extend each of the previously constructed five groynes by 10 m, to a total of 25 to 26 m in length. Nourishment of the groyne compartments should be applied as funding allows, see Section 2.6 for details.

**Stage 5** (future adaptation): Addition of rock layers to increase groyne crest height to accommodate future sea level rise.

## 4.2 Beach Nourishment

Beach nourishment is an essential part of groyne construction. The nourishment design includes the following staged implementation:

**Stage 3:** Nourished beach profile with a design beach berm level of 1.0 meters AHD, a design beach berm width of 5 meters and a design beach slope of 1H:8V.

**Stage 4:** Nourished beach profile with a design beach berm level of 1.0 meters AHD, an extended design beach berm width of 5 meters (total beach berm width of 10 m if constructed concurrently with Stage 3) and a design beach slope of 1H:8V.

If budget constraints do not allow the full extents of nourishment, it is recommended that the easternmost compartments are prioritized—starting with Cell 6 (fronting the parking lot)—and extending westward as funding permits. If western compartments are not nourished, their performance should be monitored, particularly if sand is sourced from the adjacent western groyne field, as these areas will refill first while newly constructed compartments may take longer to reach design capacity.

## 4.3 Additional Considerations

At the downstream end of the works, the proposed Seagull Drive Boat Ramp upgrade (including a jetty and sheet pile wall) is expected to function as a groyne protecting the carpark shoreline. As the timing of this upgrade is uncertain, the groyne field design should account for both interim conditions (before wall construction) and long-term conditions (after wall construction). Nourishment of this compartment is recommended to mitigate these risks; the proposed design implements a strategic nourishment of this cell to mitigate the erosion hazard while also preventing siltation of the boat ramp.

It is recommended that the sheet pile wall (or equivalent structure) be constructed within one year of groyne field implementation to stabilise this vulnerable section of shoreline. In the interim, monitoring is essential, and if erosion progresses, supplementary works may be required, such as targeted nourishment, a low revetment along the carpark edge, or a small groyne between the proposed jetty seawall and the easternmost groyne.

# 5 SAFETY

## 5.1 Our Approach and Philosophy

Safety is a design function that is progressively applied at all stages throughout the project life cycle including design, construction, commissioning, operation, maintenance, replacement, and disposal. Our objective is to reduce the risk to a level that is "As Low as Reasonably Practical" (ALARP) and is otherwise, by comparison, determined by:

- Design specifications
- Industry best practice
- Statutory requirements
- Codes of practice
- Applicable standards.

Responsibility lies with all persons who have control or influence over the design. It should also be understood that the scope of our design for safety is limited by the scope of the design work undertaken to date. The Safety in Design Register is presented in Appendix E.

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# APPENDIX A SITE SURVEY


| Amendment List | | | Equipment | Reliability | |
|---|---|---|---|---|---|
| Date | Rev. | Description | CeeEcho 200kHz<br>9 degree beam<br>survey system with<br>Trimble RTK-GNSS for<br>bathymetry and<br>Trimble R12i GNSS<br>rover for topo. | Depth Accuracy - ZOC A1<br>Position Accuracy - ZOC A1<br>Full bottom search not completed | |
| | | | | **Previous Plan Numbers** | |
| | | | | N/A | |

**Scale** 1:500 @ A1

0 25 50 metres

**Notations**
Datum for elevations is Australian Height Datum A.H.D.
Co-ordinate system is MGA2020, Zone 55 (Grey).
Horizontal and Vertical positioning derived using RTK-GNSS.
Contours are at 0.5m intervals.
All values are in metres. Aerial image captured 19/06/2025

| | |
|---|---|
| **Surveyed by** | M.Spykers & S.Harman |
| **Date of Survey** | 19/06/2025 |
| **Compiled by** | S. Harman |
| **Checked by** | M.Spykers (BAppSc Surveying) |
| **Date Checked** | 23/06/2025 |



# Gippsland Lakes

## Lake Victoria
## Loch Sport Shoreline Survey (Seagull Drv)

**6892**

Sheet 1 of 1 | Sheet Size A1

# APPENDIX B GEOTECHNICAL REPORT: EAST OF SEAGULL DRIVE BOAT RAMP


# GEOTECHNICAL INVESTIGATION REPORT

**PROJECT:** SEAGULL DRIVE BOAT RAMP, LOCH SPORT

**CLIENT:** BMT COMMERCIAL AUSTRALIA Pty Ltd

**DATE:** 15 FEBRUARY 2024

**REPORT No.:** GE13574-23

GEOTESTA

GEOTESTA PTY LTD ABN 91 851 620 815
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# TABLE OF CONTENTS

# 1. INTRODUCTION

Geotesta was engaged by BMT Commercial Australia Pty Ltd (Client) to undertake geotechnical investigation for the proposed development boat ramp at Seagull Drive, Loch Sport. It is understood that client plans to improve the existing boat ramps.

The geotechnical investigation work was conducted on 22 January 2024 and consisted of drilling one (1) deep borehole to a maximum depth of 10.0m below the existing surface level, three (3) Dynamic Cone Penetrometer (DCP) to a maximum depth of 2m from the existing water level.

This report presents the results of the geotechnical investigation including site geology, subsurface soil conditions, in-situ testing results, laboratory testing results, salinity and aggressivity assessment, and recommendations on design CBR and parameters for designing foundations.

## 2. FIELD INVESTIGATION

The geotechnical investigation involved drilling of one (1) borehole (BH1) to a maximum depth of 10.0m below the existing surface level and three (3) Dynamic Cone Penetrometer (DCP) (DCP1 to DCP3). A site plan showing the approximate borehole locations is presented in Figure 1. The field investigation was carried on 22 of January 2024.

Standard Penetration Testing (SPT) was undertaken in the deep boreholes at 1.5m depth intervals to determine soil consistency and density. Dynamic Cone Penetrometer (DCP) testing was carried out next to the borehole to determine soil consistency and density at the test locations.

The deep borehole drilling and SPT were performed using a track mounted Comacchio drilling rig. DCP testing was carried out by Geotesta's Geotechnical Engineer. Representative soil samples were collected to provide information on the engineering properties of the geological units encountered in the boreholes.

The fieldwork was performed in the presence of a Geotesta geotechnical engineer who positioned boreholes and DCP locations based on the client requirement and considering safety of the field engineers. Collected samples prepared borehole logs in accordance with AS 1726 – 2017 "Geotechnical site investigations". Field observations and in-situ test results are presented in borehole logs attached in **Appendix A** of this report.


**Figure 1: Site Plan and Borehole Locations**

# 3. FINDINGS

## 3.1 Site Conditions

The Seagull boat ramp is situated north to the 31 Seagull Drive, Loch Sport, VIC 3851. The existing boat ramp includes a car park area. The topography is generally flat. The land area closer to the BH1 location predominantly comprises small to medium sized trees. The approximate water level at DCP locations DCP1 to DCP3 was around 0.7m.

## 3.2 Site Geology

The 1:250,000 geological map published by the Geological Survey of Victoria indicates that the site is underlain by Coastal Dune Deposits (Qd1) which predominantly consists of sand, silt, clay, well sorted, poorly consolidated, coastal dune and beach deposits with some swamp deposits.

A geological map of the site is shown in **Figure 2**.

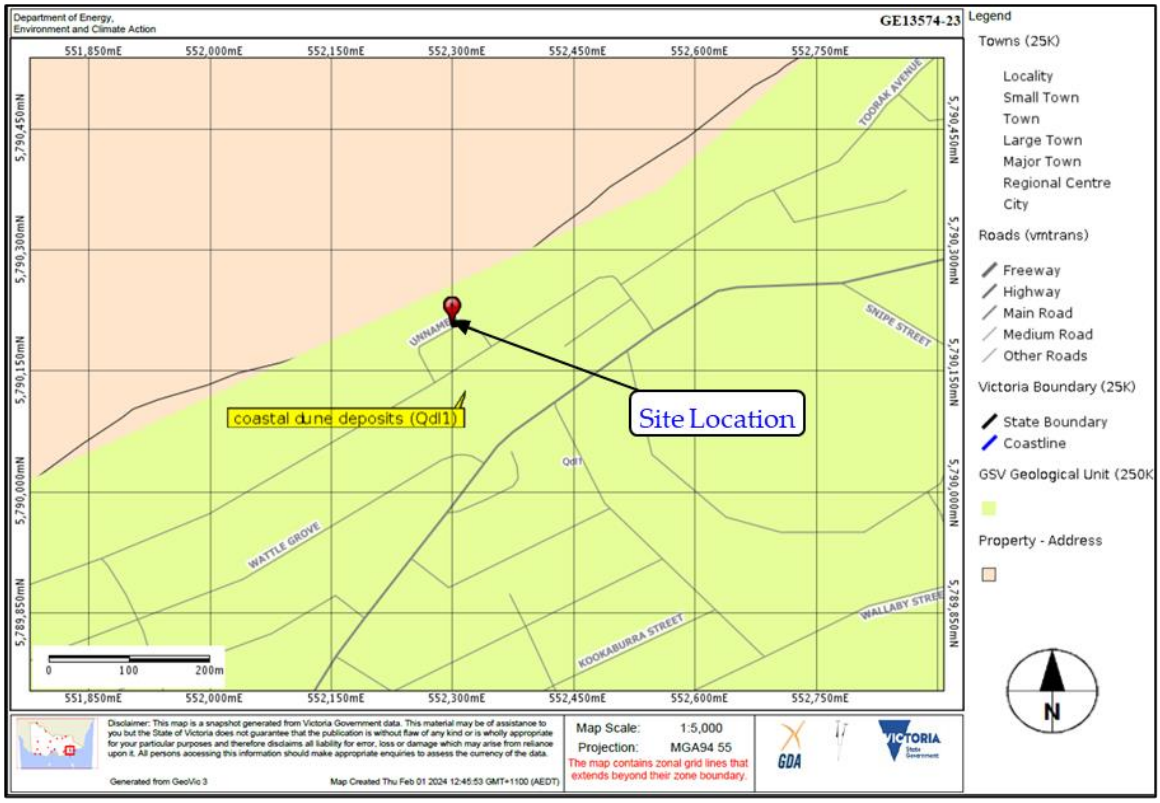



**Figure 2: Geological map (Source: Geological Survey of Victoria)**

### 3.3 Generalised Soil Profile

The encountered soil profiles are presented in the borehole logs in **Appendix A** and summarised in **Table 1** below.

**Table 1: Summary of subsurface profiles encountered in the boreholes**

| Bore No. | Depth (m) (BGL) | Soil Type | Consistency / Density |
|---|---|---|---|
| BH1 | 0 – 0.3 | Fill (Silty Sand) | Moderately Compacted |
| | 0.3 – 0.6 | SAND | Loose |
| | 0.6 – 1.2 | SAND | Medium Dense |
| | 1.2 – 3.0 | SAND | Loose |
| | 3.0 – 10.5 | SAND | Medium Dense |

***Note:*** *Borehole terminated @ 10.5m Below Ground Level (BGL); Groundwater encountered at 1.7m BGL*

### 3.4 Groundwater

Groundwater was encountered in the Borehole BH1 location at 1.7m below the ground level. Reference to Visualising Victoria's Groundwater (VVG) website indicates the depth to groundwater table is less than 5m below the ground level. **Figure 3** below shows an extract from VVG website showing the local depth to water table at the site and immediate surroundings. It must be noted that seasonal effects and heavy rainfall periods may cause changes in groundwater levels.

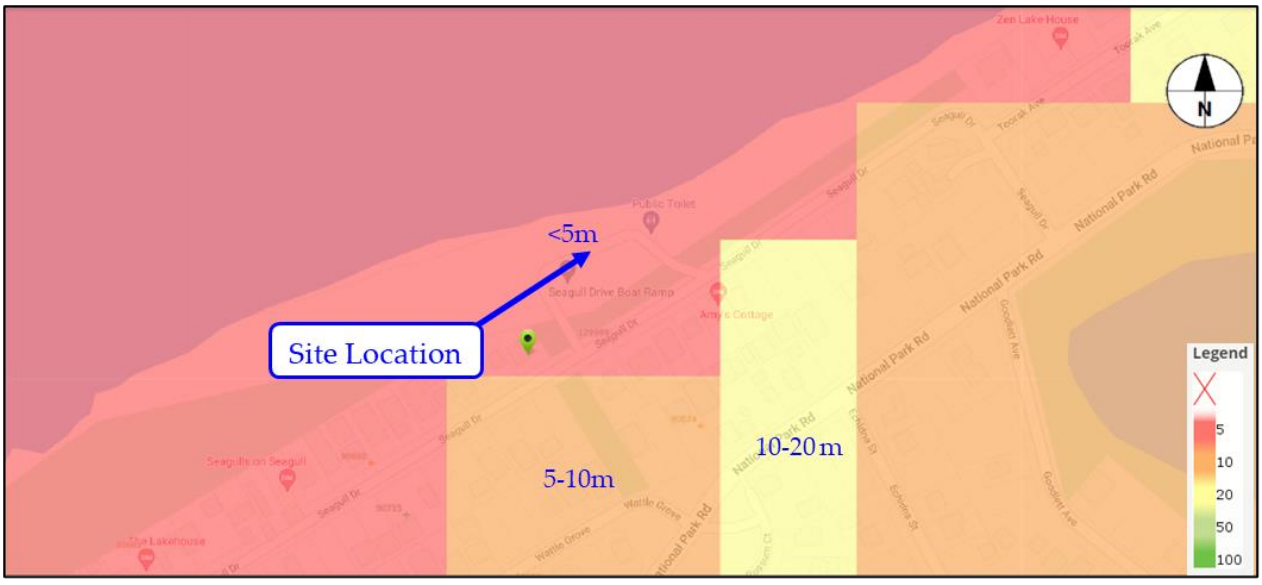



**Figure 3: Groundwater table depth at the site (Source: Visualising Victoria's Groundwater)**

### 3.5 Laboratory Testing

Laboratory testing on soil samples collected during the geotechnical investigation was carried out in Geotesta's NATA accredited laboratory. The laboratory test results are summarised in **Table 2**. Laboratory test certificates are attached in **Appendix B**.

**Table 2: Summary of laboratory test results**

| Borehole No. | Depth (m) | Material Type | Wn % | LL % | PI % | LS % | % Sand |
|---|---|---|---|---|---|---|---|
| **BH1** | 1.5 | Sand | 16.2 | - | - | - | - |
| **BH1** | 1.5-2.0 | Sand | 10.7 | - | - | - | 92 |
| **BH1** | 3.0 | Sand | 29.1 | - | - | - | - |
| **BH1** | 4.5 | Sand | 19.8 | - | - | - | - |
| **BH1** | 5.0-5.5 | Sand | 5.8 | - | - | - | 81 |
| **BH1** | 6.0 | Sand | 26.2 | - | - | - | - |
| **BH1** | 7.5 | Sand | 25.4 | - | - | - | - |
| **BH1** | 9.0 | Sand | 18.7 | - | - | - | - |
| **BH1** | 10.0 | Sand | 22.8 | - | - | - | - |

*Note: Wn - Moisture Content; LL - Liquid Limit; PI - Plasticity Index; LS - Linear Shrinkage*

### 3.6 Salinity and Aggressivity Assessment

Two (2) soil samples were submitted to Eurofins MGT Laboratory, a NATA accredited laboratory, for the salinity and aggressivity assessment. The testing was carried out for aggressivity suit and to assess the exposure classification for the proposed development.

Sampling was targeted to achieve a representative coverage of site conditions in line with assessed sub-surface profiles, proposed development, and the investigation scope. The laboratory testing certificates are presented in **Appendix B**.

#### 3.6.1 Salinity Assessment

Laboratory test results for the salinity assessment are summarised in **Table 3**.

**Table 3: Soil Salinity Test Results**

| Sample ID | Conductivity (Ec) (1:5 Aqueous extract (µS/cm) | ECe[1] (ds/m) | Salinity Assessment[2] |
|---|---|---|---|
| **BH1 @ 2.0m** | 110 | 1.87 | Non-Saline |
| **BH1 @ 9.0m** | 680 | 11.56 | Highly-Saline |

*[1]Based on EC to ECe multiplication factors in Department of Land and Water Conservation (2002) Guidelines (Table 6.1), a multiplication factor of 17 was applied to sands.*
*[2]Based on Victorian Resources Online (VRO) where ECe < 2dS/m = non-saline; ECe= 2- 4dS/m = slightly saline; ECe = 4-8dS/m = moderately saline; ECe = 8-16dS/m = highly saline; ECe > 16dS/m = extremely saline.*

Based on the above test result, the sandy soil is considered to be non-saline to highly-saline.

### 3.6.2 Aggressivity Assessment

Sulphate and pH test results for aggressivity assessment are summarised in **Table 4** and **Table 5**.

**Table 4: Aggressivity Classification Test Results for Concrete Piles**

| Sample ID. | pH (1:5 Aqueous Extract) | Sulphate ($SO_4$) (mg/kg) | Aggressivity Assessment-Concrete |
|---|---|---|---|
| **BH1 @ 2.0m** | 4.9 | <30 | Mild |
| **BH1 @ 9.0m** | 7.0 | <30 | Mild |

**In accordance with Table 6.4.2 (C), AS2159 -2009*

**Table 5: Aggressivity Classification Test Results for Steel Piles**

| Sample ID. | pH (1:5 Aqueous Extract) | Chlorides (ppm) | Resistivity (ohm.cm) | Aggressivity Assessment-Steel |
|---|---|---|---|---|
| **BH1 @ 2.0m** | 4.9 | 94 | 9200 | Mild |
| **BH1 @ 9.0m** | 7.0 | <5 | 1500 | Moderate |

**In accordance with Table 6.5.2 (C), AS2159 -2009*

Based on the above test result, the site is considered to be mild for concrete piles and mild to moderate for steel piles.
Aggressivity assessment for concrete and steel pile when exposed to sea water are summarised in **Table 6** and **Table 7**.

**Table 6: Exposure Classification for Concrete Piles in Sea Water**

| Exposure Conditions | Exposure Classification |
|---|---|
| **Sea Water - Submerged** | Moderate |
| **Sea Water – Tidal/Splash Zone** | Severe |

**In accordance with Table 6.4.2 (A), AS2159 -2009*

**Table 7: Exposure Classification for Steel Piles in Sea Water**

| Exposure Conditions | Exposure Classification |
|---|---|
| **Sea Water - Submerged** | Severe |
| **Sea Water – Tidal/Splash Zone – Cold Water (South of 30S)** | Severe |
| **Sea Water – Tidal/Splash Zone – Tropical/Subtropical Water (North of 30S)** | Very Severe |

**In accordance with Table 6.5.2 (A), AS2159 -2009*

### 3.6.3 Exposure Classifications for Concrete and Steel in Saline and Sulfate Soils

The site soil is considered highly saline to non-saline for concrete and steel piles, mild aggressive for concrete piles, and moderate to mild aggressive for steel piles.

# 4. FOOTING RECOMMENDATIONS

## 4.1 Geotechnical Design Parameters

The interpreted geotechnical parameters of soil materials encountered on site are provided in **Table 8**.

**Table 8: Geotechnical Design Parameters**

| Soil Material | $\gamma$ (kN/m$^3$) | Su (kPa) | c′ (kPa) | $\phi'$ (deg) |
|---|---|---|---|---|
| Fill | 18 | - | 0 | 28 |
| Sand (very loose) | 17 | - | 0 | 28 |
| Sand (medium dense) | 18 | - | 0 | 33 |
| Sand (dense) | 19 | - | 0 | 35 |

*Note: $\gamma$= unit weight; Su=undrained shear strength; c′=effective cohesion; $\phi'$=effective angle of friction*

## 4.2 Bored/ Driven Piles

The carrying capacity of bored/ driven piles can be estimated by adopting the parameters listed in **Table 9**, assuming the minimum pile length is 3m.

**Table 9: Geotechnical Parameters for Bored/ Driven Piles**

| Borehole No. | Depth (m) | Soil Material | Allowable Unit Skin Friction (kPa) | Allowable End Bearing (kPa) |
|---|---|---|---|---|
| BH1 | 0.0-0.3 | Fill | - | Not recommended |
| | 0.3-0.6 | Sand (loose) | 5 | Not recommended |
| | 0.6-1.2 | Sand (medium dense) | 20 | Not recommended |
| | 1.2-3.0 | Sand (loose) | 5 | Not recommended |
| | 3.0-4.5 | Sand (medium dense) | 20 | 600 |
| | 4.5-6.0 | Sand (medium dense) | 20 | 700 |
| | 6.0-7.5 | Sand (medium dense) | 20 | 900 |
| | 7.5-9.0 | Sand (medium dense) | 20 | 1000 |

| Borehole No. | Depth (m) | Soil Material | Allowable Unit Skin Friction (kPa) | Allowable End Bearing (kPa) |
|---|---|---|---|---|
| | 9.0-10.0 | Sand (medium dense) | 30 | 1100 |
| | 10-10.5 | Sand (medium dense) | 30 | 1200 |

It should be noted that the soil profile may vary across the site. It is recommended that a geotechnical engineer be engaged during the bored pier excavation stage to confirm founding depth and founding material. Installation of bored piers below groundwater shall require casing to protect the bored pier shaft from collapsing. A specialist piling contractor familiar with similar ground condition shall be engaged to carry the piling works.

### 4.3 Allowable Bearing Capacity for DCP Test Locations

Based on generalisation of the subsurface profile, the allowable bearing capacities for the DCP locations DCP1 to DCP3 is presented in **Table 10** below. DCP test results are presented in **Appendix A**.

*Table 10: Allowable bearing capacity for DCP Test Locations*

| Borehole Location | Depth from top of water (m) | Soil | Allowable Bearing capacity (kPa) |
|---|---|---|---|
| DCP1 | 0.0-0.7 | Water | - |
| | 0.7-1.3 | Sand (medium dense) | 60 |
| | 1.3-1.6 | Sand (dense) | 150 |
| | 1.6-2.0 | Sand (very dense) | 300 |
| DCP2 | 0.0-0.7 | Water | - |
| | 0.7-1.1 | Sand (medium dense) | 60 |
| | 1.1-1.4 | Sand (dense) | 150 |
| | 1.4-2.0 | Sand (very dense) | 300 |
| DCP3 | 0.0-0.7 | Water | - |
| | 0.7-0.8 | Sand (Loose) | - |
| | 0.8-1.2 | Sand (dense) | 150 |
| | 1.2-1.5 | Sand (very dense) | 300 |
| | 1.5-2.0 | Sand (very dense) | 350 |

# 5. RECOMMENDATIONS FOR EARTHWORKS

## 5.1 Excavation Influence Zone

Any footings or underground services within the excavation influence zone should be protected from potential collapse and undermining. The excavation influence zone is measured from the base of the excavation at an angle of 45° to the horizontal as shown in **Figure 4** below.

The influence angle specified above assumes that unsupported temporary excavation works are being undertaken during dry weather conditions and excavations are not left open for extended periods. Timely excavation, construction, and backfilling are important as the excavated natural sand tends to weaken or collapse over time.

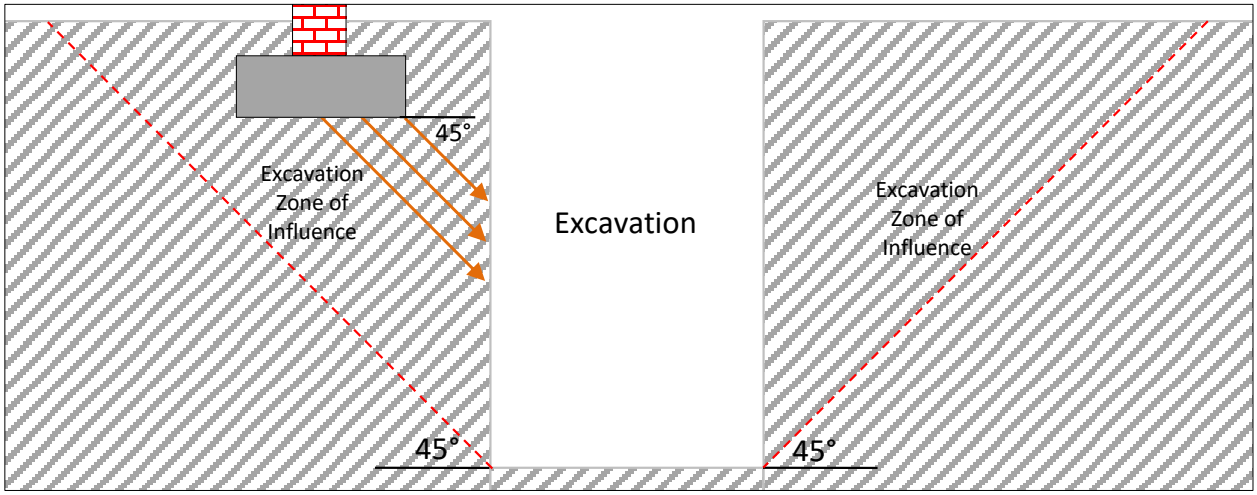



**Figure 4: Excavation zone of influence**

It is recommended that a geotechnical engineer be engaged to review and provide a more specific assessment of the proposed excavation method once detailed design and proposed construction methods for the site are available.

## 5.2 Excavation

Based on the soil profile and conditions encountered at the borehole locations, it is expected that footing excavation to 1.0m depth should be achievable without difficulty using small to medium-sized excavating equipment such as excavators or backhoes. Due to the presence of groundwater, the soil layer will likely collapse.

The excavation is likely to intersect the groundwater table around 1.7m below the ground level, and channel water/perched water due to the infiltration of surface run-off, particularly during rainy periods likely to present construction issues. The presence of

channel water and perched water is likely to influence excavation stability hence excavation support will likely need to be implemented. In addition, sump pumps and other suitable water removal methods will need to be implemented to remove water during construction.

### 5.3 Temporary Cut Batters

Any unsupported temporary cut batter into the sand layers should not be steeper than 1H:1V up to 1.5m high. Should groundwater/perched water be encountered during the excavation of material, it is recommended that a geotechnical engineer be engaged to provide advice on any proposed temporary cut batters.

The above recommendations assume that there are no existing structures or underground services adjacent to the excavation area. The allowable cut batter slopes may need to be revised based on the location of any adjacent structures and services following the commencement of earthworks at the site. It should be noted that following rainy periods, some degree of deterioration and minor slumping of unsupported cut batters is to be anticipated.

### 5.4 Design CBR Value

Based on the in-situ testing, and known geological properties, a CBR value of 5.0% is recommended for natural sandy subgrade. Lab testing should be conducted for more accurate results.

The prepared subgrade is to be assessed by a suitably qualified engineer before commencing pavement construction. Any localised soft spots are to be excavated and filled in accordance with recommendations provided below.

### 5.5 Subgrade Preparation

It should be noted that the Sand will be the subgrade for the proposed pavement. It is recommended that the following procedures be adopted for the preparation of subgrade beneath pavements:

**Silty Sand:**

- Compact the exposed material using a minimum 12-tonne smooth drum roller.
- Proof rolls the area using a minimum 12-tonne smooth drum roller to ensure no soft spots are present.
- Any soft spots encountered during the above compaction process should be excavated and backfilled with in-situ fill material without particle sizes greater than 75mm.

### 5.6 Earthworks

Where it is necessary to raise levels across the site using imported fill material, such fill material should be free of organic and/or unsuitable material and is to be placed in layers not exceeding 250mm loose thickness. Each layer will be suitably compacted prior to the placement of the next layer, to a minimum 98% standard maximum dry density. The water content of the fill should be reduced by aeration or increased by adding water as necessary to achieve this required compaction.

### 5.7 Compaction Requirements

Compaction of backfill material is required to ensure that excessive surface settlement does not occur. The required backfill density and minimum frequency of testing for compaction control as detailed in AS 3798 – 2007 are summarised below:

- 1 test per layer per material type per 2500m$^2$; or
- 1 test per 500m$^3$ distributed evenly throughout full depth and area; or
- 3 tests per site (whichever requires the most tests).

Testing should be undertaken in accordance with AS 1289 "Methods of testing for soil engineering purposes". Tested layers that do not satisfy the outlined criteria are to be stripped, replaced, re-compacted and re-tested to achieve the minimum compaction requirement specified above. Testing of compaction density should be undertaken by a NATA accredited geotechnical testing company. Representative samples of the controlled fill should be regularly tested.

All engineered fill will need to be compacted to achieve a minimum dry density ratio of 98% Standard Compaction with the test performed in accordance with Australian Standard AS 1289.5.1.1 or a Hilf density ratio of 98% in accordance with AS 1289. When compacted, the moisture content limit should be between -1% and +3% of the OMC.

Exception to the above moisture content criteria may be applicable to high plasticity clays. As such, high plasticity clays should be placed at 95% to 105% of the standard OMC. It is recommended to compact high plasticity clay material wet of OMC to minimise risk of future excessive swelling. It should be noted however that high plasticity clays wet of optimum moisture content tend to become very cohesive and therefore difficult to compact.

*DOCUMENT CONTROL*

| Date: | Version: | Report Prepared By: | Report Reviewed By: |
|---|---|---|---|
| 15 Feb. 2024 | GE13574-23 | Abishek Gade Martin<br>BTech (Civil) MSc MIEAust<br>Geotechnical Engineer | Aathee T Aatheesan<br>BScEng(Hons) PhD MIEAust<br>Senior Geotechnical Engineer |

# REFERENCES


- VicRoads (2018), Code of Practice for selection and design of pavements and surfacing; RC 500.22
- GeoVic online maps, Department of Primary Industries, State Government of Victoria
- Australian Standards (2007) – AS 3798-2007 – Guidelines on Earthworks for Commercial and Residential Developments
- "AS 1289 5.1.1 "Methods of testing soils for engineering purposes: Soil compaction and density tests - Determination of the dry density/moisture content relation of a soil using standard compactive effort", Standards Australia, 2017
- AS 1726 "Geotechnical site investigations", Standards Australia, 2017
- AS 2870 "Residential slabs and footings", Standards Australia, 2011
- AS 3798 "Guidelines on earthworks for commercial and residential developments", Standards Australia, 2007
- AS 2159 "Piling – Design and Installation"
- AS 1170.4 "Structural Design Actions – Part 4: Earthquake Actions in Australia"
- AS 3600 "Concrete Structures"
- AS 4678 "Earth Retaining Structures"
- GeoVic, Department of Economic Development, Jobs, Transport and Resources, Victoria, Australia, 2018
- VVG (Visualising Victoria's Groundwater)

# Information about this Report

The report contains the results of a geotechnical investigation conducted for a specific purpose and client. The results should not be used by other parties, or for other purposes, as they may contain neither adequate nor appropriate information. In particular, the investigation does not cover contamination issues unless specifically required to do so by the client.

**Test Hole Logging**

The information on the test hole logs (boreholes, test pits, exposures etc.) is based on a visual and tactile assessment, except at the discrete locations where test information is available (field and/or laboratory results). The test hole logs include both factual data and inferred information.

**Groundwater**

Unless otherwise indicated, the water levels presented on the test hole logs are the levels of free water or seepage in the test hole recorded at the given time of measuring. The actual groundwater level may differ from this recorded level depending on material permeability (i.e. depending on response time of the measuring instrument). Further, variations of this level could occur with time due to such effects as seasonal, environmental and tidal fluctuations or construction activities. Confirmation of groundwater levels, phreatic surfaces or piezometric pressures can only be made by appropriate instrumentation techniques and monitoring programmes.

**Interpretation of Results**

The discussion or recommendations contained within this report normally are based on a site evaluation from discrete test hole data. Generalized, idealized or inferred subsurface conditions (including any geotechnical cross-sections) have been assumed or prepared by interpolation and/or extrapolation of these data. As such these conditions are an interpretation and must be considered as a guide only.

**Change in Conditions**

Local variations or anomalies in the generalized ground conditions do occur in the natural environment, particularly between discrete test hole locations. Additionally, certain design or construction procedures may have been assumed in assessing the soil-structure interaction behaviour of the site. Furthermore, conditions may change at the site from those encountered at the time of the geotechnical investigation through construction activities and constantly changing natural forces.

Any change in design, in construction methods, or in ground conditions as noted during construction, from those assumed or reported should be referred to GEOTESTA for appropriate assessment and comment.

**Geotechnical Verification**

Verification of the geotechnical assumptions and/or model is an integral part of the design process - investigation, construction verification, and performance monitoring. Variability is a feature of the natural environment and, in many instances, verification of soil or rock quality, or foundation levels, is required. There may be a requirement to extend foundation depths, to modify a foundation system or to conduct monitoring as a result of this natural variability. Allowance for verification by geotechnical personnel accordingly should be recognized and programmed during construction.

**Reproduction of Reports**

Where it is desired to reproduce the information contained in our geotechnical report, or other technical information, for the inclusion in contract documents or engineering specification of the subject development, such reproductions should include at least all of the relevant test hole and test data, together with the appropriate standard description sheets and remarks made in the written report of a factual or descriptive nature. Reports are the subject of copyright and shall not be reproduced either totally or in part without the express permission of Geotesta.

# SITE PHOTOGRAPHS

Borehole BH1 location; looking at west

DCP1 testing location; looking at east

DCP2 testing location; looking at south

DCP3 testing location; looking at east

# Appendix A – Borehole Logs

# BOREHOLE LOG

**BH NO.:** BH1

**SHEET**: 1 OF 3

| | | | | | |
|---|---|---|---|---|---|
| CLIENT: | BMT Commercial Australia | DRILLING CO.: | Rockwell Drilling | EASTING: | Refer Site Plan |
| PROJECT: | Seagull Drive Boat Ramp | DRILL RIG: | Comacchio | NORTHING: | Refer Site Plan |
| JOB NO.: | GE13574-23 | DRILLER: | CD & DM | SURFACE: | N.A |
| LOCATION: | Loch Sport | INCLINATION: | Vertical | LOGGED: | AGM DATE: 22/01/24 |
| DATE DRILLED: | 22/01/2024 | HOLE DEPTH: | 10.50 m | CHECKED: | AT DATE: 15/02/24 |

| DRILLING METHOD | WATER | DEPTH (m) | DEPTH (m) | GRAPHIC LOG | GROUP SYMBOL | SOIL DESCRIPTION | MOISTURE CONDITION | CONSISTENCY DENSITY | DCP BLOWS PER 100mm | DPSH BLOWS PER 200mm | FIELD TESTING AND ADDITIONAL NOTES | SAMPLING | DEPTH (m) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 0.00 | | | | | | | | | CBR (%) 0 5 10 15 20 25 30 | | 0.00 |
| Continuous Flight Auger | ▼ | 0.50 | 0.30 | | FILL | FILL: Silty Sand, pale grey, presence of gravels and pebbles, fine to medium-grain, angular, rounded brown, up to 20mm | M | MC | 6 10 5 | | | | 0.50 |
| | | 1.00 | | | SP | SAND, poorly graded, dark grey, fine to medium grain, medium dense, moist, trace of silt and fine gravels | M | L | 3 3 3 | | | | 1.00 |
| | | | 1.20 | | | Grades: pale grey, creamy white, fine to coarse grain | | MD | 4 4 6 6 5 | | | | |
| | | 1.50 | 1.50 | | | Grades: trace of tree roots, dark brown | | L | 1 2 3 | | SPT @ 1.5m 2,3,4 N=7 | | 1.50 |
| | | | 1.70 | | | Grades: groundwater observed @ 1.7m | W | | | | | | |
| | | 2.00 | | | | | | | | | | D | 2.00 |
| | | 2.50 | 2.50 | | | Grades: dark brown mottled dark grey | | | | | | | 2.50 |
| | | 3.00 | 3.00 | | | | | | | | | | 3.00 |
| Wash Boring | | 3.50 | | | | Grades: dark grey | | MD | | | SPT @ 3.0m 3,4,6 N=10 | | 3.50 |
| | | 4.00 | 4.00 | | | Grades: green mottled grey, medium to coarse grain | | | | | | D | 4.00 |
| | | 4.50 | | | | | | | | | SPT @ 4.5m 6,7,7 N=14 | | 4.50 |
| | | 5.00 | | | | | | | | | | | 5.00 |

*STANDARD: AS 1289.6.3.2-1997 & AS 1726-2017*

**CONSISTENCY:**
- VS VERY SOFT
- S SOFT
- F FIRM
- ST STIFF
- VST VERY STIFF
- H HARD

**RELATIVE DENSITY:**
- VL VERY LOOSE
- L LOOSE
- MD MEDIUM DENSE
- D DENSE
- VD VERY DENSE

**COMPACTION:**
- WC WELL COMPACTED
- MC MODERATELY COMPACTED
- PC POORLY COMPACTED

**MOISTURE:**
- D DRY
- M MOIST
- W WET

**SAMPLING/ IN-SITU TESTING:**
- INTACT CORE SAMPLE
- T INTACT TUBE SAMPLE
- D DISTURBED SAMPLE
- B DISTURBED BULK SAMPLE
- H.B. HAMMER BOUNCING
- PP POCKET PENETROMETER
- STANDARD PENETRATION TEST (SPT)
- HSV FIELD VANE SHEAR TEST (UNCORRECTED)
- DCP DYNAMIC CONE PENETRATION TEST
- CPT CONTINUOUS CONE PENETRATION TEST

**WATER:**
- WATER LEVEL
- WATER LEVEL RISEN TO
- WATER INFLOW
- WATER LOSS

# BOREHOLE LOG

**BH NO.:** BH1

**SHEET: 2 OF 3**

| | | | | | |
|---|---|---|---|---|---|
| CLIENT: | BMT Commercial Australia | DRILLING CO.: | Rockwell Drilling | EASTING: | Refer Site Plan |
| PROJECT: | Seagull Drive Boat Ramp | DRILL RIG: | Comacchio | NORTHING: | Refer Site Plan |
| JOB NO.: | GE13574-23 | DRILLER: | CD & DM | SURFACE: | N.A |
| LOCATION: | Loch Sport | INCLINATION: | Vertical | LOGGED: | AGM DATE: 22/01/24 |
| DATE DRILLED: | 22/01/2024 | HOLE DEPTH: | 10.50 m | CHECKED: | AT DATE: 15/02/24 |

| DRILLING METHOD | WATER | DEPTH (m) | DEPTH (m) | GRAPHIC LOG | GROUP SYMBOL | SOIL DESCRIPTION | MOISTURE CONDITION | CONSISTENCY DENSITY | DCP BLOWS PER 100mm | DPSH BLOWS PER 200mm | FIELD TESTING AND ADDITIONAL NOTES | SAMPLING | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 5.00 | | | | | | | | | CBR (%) 0 5 10 15 20 25 30 | | 0.00 |
| Wash Boring | | 5.50 | 5.50 | | SP | SAND, poorly graded, green mottled grey, fine to med. grain, medium dense | W | MD | | | | | 5.50 |
| | | 6.00 | | | | Grades: brown, fine to medium grain | | | | | | D | 6.00 |
| | | 6.50 | | | | | | | | | SPT @ 6.0m 11,8,12 N=20 | | 6.50 |
| | | 7.00 | 7.00 | | | | | | | | | | 7.00 |
| | | 7.50 | 7.50 | | | Grades: medium to coarse grain | | | | | | | 7.50 |
| | | 8.00 | | | | Grades: brown | | | | | SPT @ 7.5m 8,7,5 N=12 | | 8.00 |
| | | 8.50 | | | | | | | | | | | 8.50 |
| | | 9.00 | 9.00 | | | | | | | | | | 9.00 |
| | | 9.50 | | | | Grades: trace of fine gravels | | | | | SPT @ 9.0m 13,9,6 N=15 | | 9.50 |
| | | 10.00 | | | | | | | | | | | 10.00 |

*STANDARD: AS 1289.6.3.2-1997 & AS 1726-2017*

**CONSISTENCY:**
- VS VERY SOFT
- S SOFT
- F FIRM
- ST STIFF
- VST VERY STIFF
- H HARD

**RELATIVE DENSITY:**
- VL VERY LOOSE
- L LOOSE
- MD MEDIUM DENSE
- D DENSE
- VD VERY DENSE

**COMPACTION:**
- WC WELL COMPACTED
- MC MODERATELY COMPACTED
- PC POORLY COMPACTED

**MOISTURE:**
- D DRY
- M MOIST
- W WET

**SAMPLING/ IN-SITU TESTING:**
- INTACT CORE SAMPLE
- T INTACT TUBE SAMPLE
- D DISTURBED SAMPLE
- B DISTURBED BULK SAMPLE
- H.B. HAMMER BOUNCING
- PP POCKET PENETROMETER
- STANDARD PENETRATION TEST (SPT)
- HSV FIELD VANE SHEAR TEST (UNCORRECTED)
- DCP DYNAMIC CONE PENETRATION TEST
- CPT CONTINOUOS CONE PENETRATION TEST

**WATER:**
- WATER LEVEL
- WATER LEVEL RISEN TO
- WATER INFLOW
- WATER LOSS

# BOREHOLE LOG

**BH NO.:** BH1

**SHEET: 3 OF 3**

| | | | | | |
|---|---|---|---|---|---|
| CLIENT: | BMT Commercial Australia | DRILLING CO.: | Rockwell Drilling | EASTING: | Refer Site Plan |
| PROJECT: | Seagull Drive Boat Ramp | DRILL RIG: | Comacchio | NORTHING: | Refer Site Plan |
| JOB NO.: | GE13574-23 | DRILLER: | CD & DM | SURFACE: | N.A |
| LOCATION: | Loch Sport | INCLINATION: | Vertical | LOGGED: | AGM DATE: 22/01/24 |
| DATE DRILLED: | 22/01/2024 | HOLE DEPTH: | 10.50 m | CHECKED: | AT DATE: 15/02/24 |

| DRILLING METHOD | WATER | DEPTH (m) | DEPTH (m) | GRAPHIC LOG | GROUP SYMBOL | SOIL DESCRIPTION | MOISTURE CONDITION | CONSISTENCY DENSITY | DCP BLOWS PER 100mm | DPSH BLOWS PER 200mm | FIELD TESTING AND ADDITIONAL NOTES | SAMPLING | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 10.00 | | | | | | | | | CBR (%) 0 5 10 15 20 25 30 | | 0.00 |
| Wash Boring | | 10.50 | 10.50 | | SP | SAND, poorly graded, brown, fine to medium grain, medium dense | W | MD | | | SPT @ 10.0m 7,6,9 N=15 | | 10.50 |
| | | | | | | End of Borehole @ 10.5m<br>Groundwater Encountered @ 1.7m | | | | | | | |
| | | 11.00 | | | | | | | | | | | 11.00 |
| | | 11.50 | | | | | | | | | | | 11.50 |
| | | 12.00 | | | | | | | | | | | 12.00 |
| | | 12.50 | | | | | | | | | | | 12.50 |
| | | 13.00 | | | | | | | | | | | 13.00 |
| | | 13.50 | | | | | | | | | | | 13.50 |
| | | 14.00 | | | | | | | | | | | 14.00 |
| | | 14.50 | | | | | | | | | | | 14.50 |
| | | 15.00 | | | | | | | | | | | 15.00 |

*STANDARD: AS 1289.6.3.2-1997 & AS 1726-2017*

**CONSISTENCY:**
- VS VERY SOFT
- S SOFT
- F FIRM
- ST STIFF
- VST VERY STIFF
- H HARD

**RELATIVE DENSITY:**
- VL VERY LOOSE
- L LOOSE
- MD MEDIUM DENSE
- D DENSE
- VD VERY DENSE

**COMPACTION:**
- WC WELL COMPACTED
- MC MODERATELY COMPACTED
- PC POORLY COMPACTED

**MOISTURE:**
- D DRY
- M MOIST
- W WET

**SAMPLING/ IN-SITU TESTING:**
- INTACT CORE SAMPLE
- T INTACT TUBE SAMPLE
- D DISTURBED SAMPLE
- B DISTURBED BULK SAMPLE
- H.B. HAMMER BOUNCING
- PP POCKET PENETROMETER
- STANDARD PENETRATION TEST (SPT)
- HSV FIELD VANE SHEAR TEST (UNCORRECTED)
- DCP DYNAMIC CONE PENETRATION TEST
- CPT CONTINOUOS CONE PENETRATION TEST

**WATER:**
- WATER LEVEL
- WATER LEVEL RISEN TO
- WATER INFLOW
- WATER LOSS

# DCP TEST RESULTS

| Depth from top of water (m) | Blows/100mm Penetration | | |
|---|---|---|---|
| | DCP1 | DCP2 | DCP3 |
| 0.0-0.1 | - | - | - |
| 0.1-0.2 | - | - | - |
| 0.2-0.3 | - | - | - |
| 0.3-0.4 | - | - | - |
| 0.4-0.5 | - | - | - |
| 0.5-0.6 | - | - | - |
| 0.6-0.7 | - | - | - |
| 0.7-0.8 | 2 | 3 | 1 |
| 0.8-0.9 | 3 | 2 | 3 |
| 0.9-1.0 | 2 | 2 | 2 |
| 1.0-1.1 | 3 | 3 | 2 |
| 1.1-1.2 | 4 | 5 | 3 |
| 1.2-1.3 | 3 | 4 | 6 |
| 1.3-1.4 | 4 | 7 | 6 |
| 1.4-1.5 | 5 | 8 | 13 |
| 1.5-1.6 | 6 | 8 | 15 |
| 1.6-1.7 | 11 | 11 | 16 |
| 1.7-1.8 | 10 | 13 | 15 |
| 1.8-1.9 | 9 | 13 | 17 |
| 1.9-2.0 | 8 | 12 | 16 |

X - Effective Refusal (>25/50mm)

H.B - Hammer Bouncing (Solid Refusal)

# Appendix B– Laboratory Test Results

# Material Test Report

**Report Number:** **L3005-1**
**Issue Number:** 1
**Date Issued:** 06/02/2024
**Client:** Geotesta Pty Ltd (Melbourne Office)

**Contact:** Abishek G Martin
**Project Number:** L3005
**Project Name:**
**Project Location:** Seagull Drive Boat Ramp, Loch Sport
**Client Reference:** GE 13574-23 - Docket 6522
**Work Request:** 1775
**Sample Number:** S-1775B
**Date Sampled:** 23/01/2024
**Dates Tested:** 24/01/2024 - 01/02/2024
**Sampling Method:** AS 1289.1.2.1 6.5.3 - Power auger drilling
**Preparation Method:** AS 1289.1.1 - Sampling and Preparation of Soils
**Site Selection:** Selected by Client
**Sample Location:** **BH1, Depth: 1.50-2.00m**
**Material:** SAND trace Silt and Gravel, dark brown

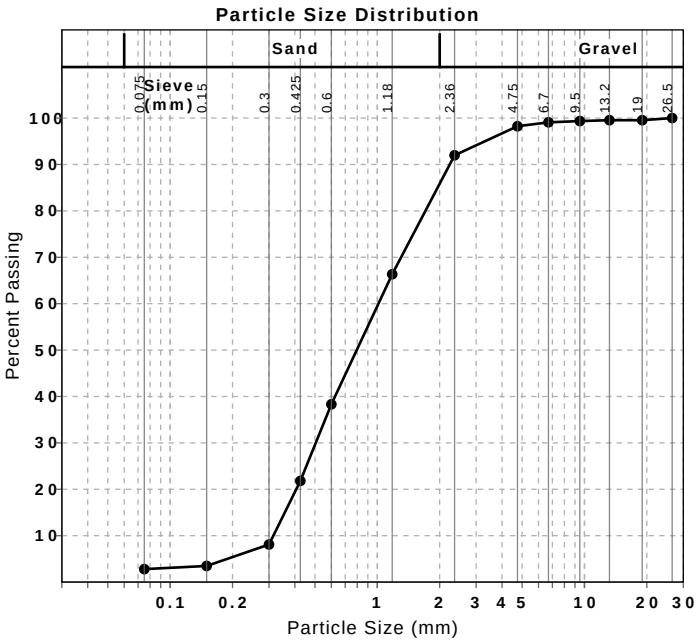

Geotesta Pty Ltd
Melbourne Laboratory
9 Redwood Drive Notting Hill VIC 3168
Phone: 1300 852 216
Email: info@geotesta.com.au


Accredited for compliance with ISO/IEC 17025 - Testing

Approved Signatory: Michael Chen
Clean Lab Manager
NATA Accredited Laboratory Number: 19167

| Particle Size Distribution (AS1289 3.6.1) | | | | | | |
|---|---|---|---|---|---|---|
| Sieve | Passed % | Passing Limits | | Retained % | Retained Limits | |
| 26.5 mm | **100** | | | 0 | | |
| 19 mm | **100** | | | 0 | | |
| 13.2 mm | **100** | | | 0 | | |
| 9.5 mm | **99** | | | 0 | | |
| 6.7 mm | **99** | | | 0 | | |
| 4.75 mm | **98** | | | 1 | | |
| 2.36 mm | **92** | | | 6 | | |
| 1.18 mm | **66** | | | 26 | | |
| 0.6 mm | **38** | | | 28 | | |
| 0.425 mm | **22** | | | 17 | | |
| 0.3 mm | **8** | | | 14 | | |
| 0.15 mm | **3** | | | 5 | | |
| 0.075 mm | **3** | | | 1 | | |

| Moisture Content (AS1289.2.1.1) | | Min | Max |
|---|---|---|---|
| Moisture Content (%) | 10.7 | | |



# Material Test Report

**Report Number:** **L3005-1**
**Issue Number:** 1
**Date Issued:** 06/02/2024
**Client:** Geotesta Pty Ltd (Melbourne Office)

**Contact:** Abishek G Martin
**Project Number:** L3005
**Project Name:**
**Project Location:** Seagull Drive Boat Ramp, Loch Sport
**Client Reference:** GE 13574-23 - Docket 6522
**Work Request:** 1775
**Sample Number:** S-1775E
**Date Sampled:** 23/01/2024
**Dates Tested:** 24/01/2024 - 01/02/2024
**Sampling Method:** AS 1289.1.2.1 6.5.3 - Power auger drilling
**Preparation Method:** AS 1289.1.1 - Sampling and Preparation of Soils
**Site Selection:** Selected by Client
**Sample Location:** **BH1, Depth: 5.00-5.50m**
**Material:** SAND with gravel and silt, brown grey and white

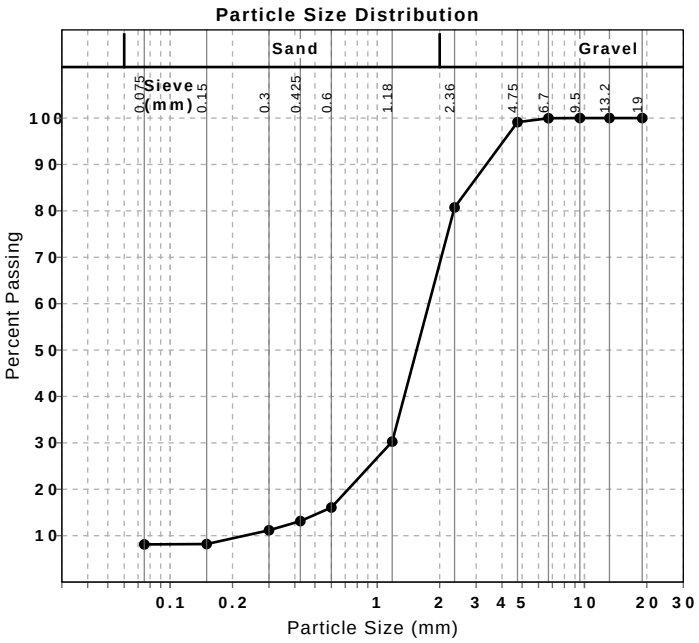

Geotesta Pty Ltd
Melbourne Laboratory
9 Redwood Drive Notting Hill VIC 3168
Phone: 1300 852 216
Email: info@geotesta.com.au


Accredited for compliance with ISO/IEC 17025 - Testing

Approved Signatory: Michael Chen
Clean Lab Manager
NATA Accredited Laboratory Number: 19167

| Particle Size Distribution (AS1289 3.6.1) | | | | | | |
|---|---|---|---|---|---|---|
| Sieve | Passed % | Passing Limits | | Retained % | Retained Limits | |
| 19 mm | **100** | | | 0 | | |
| 13.2 mm | **100** | | | 0 | | |
| 9.5 mm | **100** | | | 0 | | |
| 6.7 mm | **100** | | | 0 | | |
| 4.75 mm | **99** | | | 1 | | |
| 2.36 mm | **81** | | | 18 | | |
| 1.18 mm | **30** | | | 50 | | |
| 0.6 mm | **16** | | | 14 | | |
| 0.425 mm | **13** | | | 3 | | |
| 0.3 mm | **11** | | | 2 | | |
| 0.15 mm | **8** | | | 3 | | |
| 0.075 mm | **8** | | | 0 | | |

| Moisture Content (AS1289.2.1.1) | | Min | Max |
|---|---|---|---|
| Moisture Content (%) | 5.8 | | |



# Material Test Report

**Report Number:** **L3005-1**
**Issue Number:** 1
**Date Issued:** 06/02/2024
**Client:** Geotesta Pty Ltd (Melbourne Office)

**Contact:** Abishek G Martin
**Project Number:** L3005
**Project Name:**
**Project Location:** Seagull Drive Boat Ramp, Loch Sport
**Client Reference:** GE 13574-23 - Docket 6522
**Work Request:** 1775
**Dates Tested:** 24/01/2024 - 24/01/2024

Geotesta Pty Ltd
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9 Redwood Drive Notting Hill VIC 3168
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Approved Signatory: Michael Chen
Clean Lab Manager
NATA Accredited Laboratory Number: 19167

| Moisture Content AS 1289 2.1.1 | | | | | |
|---|---|---|---|---|---|
| Sample Number | Sample Location | Moisture Content (%) | Min | Max | Material |
| S-1775A | BH1 , Depth: 1.50m | 16.2 % | ** | ** | SAND, dark brown |
| S-1775C | BH1 , Depth: 3.00m | 29.1 % | ** | ** | SAND, dark grey |
| S-1775D | BH1 , Depth: 4.50m | 19.8 % | ** | ** | SAND, grey |
| S-1775F | BH1 , Depth: 6.00m | 26.2 % | ** | ** | SAND, orange brown |
| S-1775G | BH1 , Depth: 7.50m | 25.4 % | ** | ** | SAND, orange brown |
| S-1775H | BH1 , Depth: 9.00m | 18.7 % | ** | ** | SAND, orange brown |
| S-1775I | BH1 , Depth: 10.00m | 22.8 % | ** | ** | SAND trace clay, orange brown |

**Geotesta P/L**
**Level 1, 7 Business Park Drive,**
**Notting Hill**
**VIC 3168**



**Attention:** **Dasun Premachandra**

**Report** **1061623-S**
Project name Seagull Drive Loch Sport
Project ID GE13574
Received Date Jan 23, 2024

| **Client Sample ID** | | | **L1 0.8M** | **L1 1.3M** | **L2 0.8M** | **L2 1.3M** |
|---|---|---|---|---|---|---|
| **Sample Matrix** | | | **Soil** | **Soil** | **Soil** | **Soil** |
| **Eurofins Sample No.** | | | **M24-Ja0032472** | **M24-Ja0032473** | **M24-Ja0032474** | **M24-Ja0032475** |
| **Date Sampled** | | | **Jan 22, 2024** | **Jan 22, 2024** | **Jan 22, 2024** | **Jan 22, 2024** |
| Test/Reference | LOR | Unit | | | | |
| **Acid Sulfate Soils Field pH Test** | | | | | | |
| pH-F (Field pH test)* | 0.1 | pH Units | 5.8 | 5.5 | 5.5 | 6.2 |
| pH-FOX (Field pH Peroxide test)* | 0.1 | pH Units | 2.3 | 2.1 | 2.3 | 2.2 |
| Reaction Ratings*[S05] | 0 | comment | 4.0 | 4.0 | 4.0 | 4.0 |
| **Actual Acidity (NLM-3.2)** | | | | | | |
| pH-KCL (NLM-3.1) | 0.1 | pH Units | 6.2 | 5.0 | 5.9 | 6.0 |
| Titratable Actual Acidity (NLM-3.2) | 2 | mol H+/t | < 2 | < 2 | < 2 | < 2 |
| Titratable Actual Acidity (NLM-3.2) | 0.003 | % pyrite S | < 0.003 | < 0.003 | < 0.003 | < 0.003 |
| **Potential Acidity - Titratable Peroxide** | | | | | | |
| pH-OX | 0.1 | pH Units | 2.7 | 2.5 | 3.0 | 2.5 |
| Titratable Peroxide Acidity (s-TPA) | 0.02 | % pyrite S | < 0.02 | 0.06 | < 0.02 | 0.06 |
| Titratable Peroxide Acidity (a-TPA) | 2 | mol H+/t | < 2 | 36 | < 2 | 39 |
| Titratable Sulfidic Acidity (a-TSA) | 2 | mol H+/t | < 2 | 36 | < 2 | 39 |
| Titratable Sulfidic Acidity (s-TSA) | 0.02 | % pyrite S | < 0.02 | 0.06 | < 0.02 | 0.06 |
| **Extractable Sulfur** | | | | | | |
| Sulfur - KCl Extractable | 0.005 | % S | 0.021 | 0.025 | 0.014 | 0.031 |
| Peroxide Extractable Sulfur | 0.005 | % S | 0.14 | 0.21 | 0.081 | 0.24 |
| HCl Extractable Sulfur | 0.005 | % S | N/A | N/A | N/A | N/A |
| **Potential Acidity (SPOS)** | | | | | | |
| Peroxide Oxidisable Sulfur (s-SPOS) (NLM 2.2) | 0.005 | % S | 0.12 | 0.19 | 0.067 | 0.21 |
| Peroxide Oxidisable Sulfur (a-SPOS) (NLM 2.2) | 2 | mol H+/t | 74 | 120 | 42 | 130 |
| **Retained Acidity (S-NAS)** | | | | | | |
| Net Acid soluble sulfur (s-SNAS) NLM-4.1[S02] | 0.005 | % S | N/A | N/A | N/A | N/A |
| Net Acid soluble sulfur (a-SNAS) NLM-4.1 | 2 | mol H+/t | N/A | N/A | N/A | N/A |
| HCl Extractable Sulfur Correction Factor | 1 | factor | 2.0 | 2.0 | 2.0 | 2.0 |
| **Extractable Calcium** | | | | | | |
| Calcium - KCl Extractable | 0.005 | % Ca | 0.024 | 0.011 | 0.011 | 0.022 |
| Calcium - Peroxide | 0.005 | % Ca | 0.030 | 0.015 | 0.016 | 0.031 |
| Calcium - Acid Reacted | 0.005 | % Ca | 0.006 | < 0.005 | < 0.005 | 0.010 |
| Calcium - Acid Reacted (s-aCa) | 0.005 | % S | < 0.005 | < 0.005 | < 0.005 | 0.008 |
| Calcium - Acid Reacted (a-aCa) | 0.005 | mol H+/t | 2.7 | < 0.005 | < 0.005 | 4.7 |

| Client Sample ID | | | L1 0.8M | L1 1.3M | L2 0.8M | L2 1.3M |
|---|---|---|---|---|---|---|
| Sample Matrix | | | Soil | Soil | Soil | Soil |
| Eurofins Sample No. | | | M24-Ja0032472 | M24-Ja0032473 | M24-Ja0032474 | M24-Ja0032475 |
| Date Sampled | | | Jan 22, 2024 | Jan 22, 2024 | Jan 22, 2024 | Jan 22, 2024 |
| Test/Reference | LOR | Unit | | | | |
| **Extractable Magnesium** | | | | | | |
| Magnesium - KCl Extractable | 0.005 | % Mg | 0.007 | 0.007 | 0.009 | 0.011 |
| Magnesium - Peroxide | 0.005 | % Mg | 0.008 | 0.007 | 0.009 | 0.014 |
| Magnesium - Acid Reacted | 0.005 | % Mg | < 0.005 | < 0.005 | < 0.005 | < 0.005 |
| Magnesium - Acid Reacted (s-aCa) | 0.005 | % S | < 0.005 | < 0.005 | < 0.005 | < 0.005 |
| Magnesium - Acid Reacted (a-aCa) | 0.005 | mol H+/t | < 0.005 | < 0.005 | < 0.005 | < 0.005 |
| **Acid Neutralising Capacity (ANCE)** | | | | | | |
| Acid Neutralising Capacity - (ANCE) | 0.02 | % CaCO3 | N/A | N/A | N/A | N/A |
| Acid Neutralising Capacity - (s-ANCE) | 0.02 | % S | N/A | N/A | N/A | N/A |
| Acid Neutralising Capacity - (a-ANCE) | 10 | mol H+/t | n/a | n/a | n/a | n/a |
| **Acid Neutralising Capacity (ANCbt)** | | | | | | |
| ANC Fineness Factor | | factor | 1.5 | 1.5 | 1.5 | 1.5 |
| **Net Acidity (Including ANC)** | | | | | | |
| SPOCAS - Net Acidity - ASSMAC (Acidity Units) | 10 | mol H+/t | 74 | 120 | 42 | 130 |
| SPOCAS - Net Acidity - ASSMAC (Sulfur Units) | 0.02 | % S | 0.12 | 0.19 | 0.07 | 0.21 |
| SPOCAS - Liming rate - ASSMAC | 1 | kg CaCO3/t | 5.5 | 8.9 | 3.1 | 9.8 |
| **Extraneous Material** | | | | | | |
| <2mm Fraction | 0.005 | g | 150 | 260 | 280 | 380 |
| >2mm Fraction | 0.005 | g | < 0.005 | < 0.005 | < 0.005 | < 0.005 |
| Analysed Material | 0.1 | % | 100 | 100 | 100 | 100 |
| Extraneous Material | 0.1 | % | < 0.1 | < 0.1 | < 0.1 | < 0.1 |

| Client Sample ID | | | L3 0.8M | L3 1.3M | BH1 2M | BH1 9M |
|---|---|---|---|---|---|---|
| Sample Matrix | | | Soil | Soil | Soil | Soil |
| Eurofins Sample No. | | | M24-Ja0032476 | M24-Ja0032477 | M24-Ja0032478 | M24-Ja0032479 |
| Date Sampled | | | Jan 22, 2024 | Jan 22, 2024 | Jan 22, 2024 | Jan 22, 2024 |
| Test/Reference | LOR | Unit | | | | |
| **Acid Sulfate Soils Field pH Test** | | | | | | |
| pH-F (Field pH test)* | 0.1 | pH Units | 6.7 | 6.5 | - | - |
| pH-FOX (Field pH Peroxide test)* | 0.1 | pH Units | 2.6 | 2.2 | - | - |
| Reaction Ratings*[S05] | 0 | comment | 4.0 | 4.0 | - | - |
| **Actual Acidity (NLM-3.2)** | | | | | | |
| pH-KCL (NLM-3.1) | 0.1 | pH Units | 7.3 | 8.2 | - | - |
| Titratable Actual Acidity (NLM-3.2) | 2 | mol H+/t | < 2 | < 2 | - | - |
| Titratable Actual Acidity (NLM-3.2) | 0.003 | % pyrite S | < 0.003 | < 0.003 | - | - |
| **Potential Acidity - Titratable Peroxide** | | | | | | |
| pH-OX | 0.1 | pH Units | 3.0 | 2.9 | - | - |
| Titratable Peroxide Acidity (s-TPA) | 0.02 | % pyrite S | < 0.02 | < 0.02 | - | - |
| Titratable Peroxide Acidity (a-TPA) | 2 | mol H+/t | < 2 | < 2 | - | - |
| Titratable Sulfidic Acidity (a-TSA) | 2 | mol H+/t | < 2 | < 2 | - | - |
| Titratable Sulfidic Acidity (s-TSA) | 0.02 | % pyrite S | < 0.02 | < 0.02 | - | - |
| **Extractable Sulfur** | | | | | | |
| Sulfur - KCl Extractable | 0.005 | % S | 0.019 | 0.033 | - | - |
| Peroxide Extractable Sulfur | 0.005 | % S | 0.086 | 0.14 | - | - |
| HCl Extractable Sulfur | 0.005 | % S | N/A | N/A | - | - |
| **Potential Acidity (SPOS)** | | | | | | |
| Peroxide Oxidisable Sulfur (s-SPOS) (NLM 2.2) | 0.005 | % S | 0.067 | 0.10 | - | - |
| Peroxide Oxidisable Sulfur (a-SPOS) (NLM 2.2) | 2 | mol H+/t | 42 | 65 | - | - |

| Client Sample ID | | | L3 0.8M | L3 1.3M | BH1 2M | BH1 9M |
|---|---|---|---|---|---|---|
| Sample Matrix | | | Soil | Soil | Soil | Soil |
| Eurofins Sample No. | | | M24-Ja0032476 | M24-Ja0032477 | M24-Ja0032478 | M24-Ja0032479 |
| Date Sampled | | | Jan 22, 2024 | Jan 22, 2024 | Jan 22, 2024 | Jan 22, 2024 |
| Test/Reference | LOR | Unit | | | | |
| **Retained Acidity (S-NAS)** | | | | | | |
| Net Acid soluble sulfur (s-SNAS) NLM-4.1[S02] | 0.005 | % S | N/A | N/A | - | - |
| Net Acid soluble sulfur (a-SNAS) NLM-4.1 | 2 | mol H+/t | N/A | N/A | - | - |
| HCl Extractable Sulfur Correction Factor | 1 | factor | 2.0 | 2.0 | - | - |
| **Extractable Calcium** | | | | | | |
| Calcium - KCl Extractable | 0.005 | % Ca | 0.031 | 0.059 | - | - |
| Calcium - Peroxide | 0.005 | % Ca | 0.035 | 0.069 | - | - |
| Calcium - Acid Reacted | 0.005 | % Ca | < 0.005 | 0.010 | - | - |
| Calcium - Acid Reacted (s-aCa) | 0.005 | % S | < 0.005 | 0.008 | - | - |
| Calcium - Acid Reacted (a-aCa) | 0.005 | mol H+/t | < 0.005 | 4.9 | - | - |
| **Extractable Magnesium** | | | | | | |
| Magnesium - KCl Extractable | 0.005 | % Mg | 0.008 | 0.008 | - | - |
| Magnesium - Peroxide | 0.005 | % Mg | 0.009 | 0.010 | - | - |
| Magnesium - Acid Reacted | 0.005 | % Mg | < 0.005 | < 0.005 | - | - |
| Magnesium - Acid Reacted (s-aCa) | 0.005 | % S | < 0.005 | < 0.005 | - | - |
| Magnesium - Acid Reacted (a-aCa) | 0.005 | mol H+/t | < 0.005 | < 0.005 | - | - |
| **Acid Neutralising Capacity (ANCE)** | | | | | | |
| Acid Neutralising Capacity - (ANCE) | 0.02 | % CaCO3 | N/A | N/A | - | - |
| Acid Neutralising Capacity - (s-ANCE) | 0.02 | % S | N/A | N/A | - | - |
| Acid Neutralising Capacity - (a-ANCE) | 10 | mol H+/t | n/a | n/a | - | - |
| **Acid Neutralising Capacity (ANCbt)** | | | | | | |
| ANC Fineness Factor | | factor | 1.5 | 1.5 | - | - |
| **Net Acidity (Including ANC)** | | | | | | |
| SPOCAS - Net Acidity - ASSMAC (Acidity Units) | 10 | mol H+/t | 14 | 22 | - | - |
| SPOCAS - Net Acidity - ASSMAC (Sulfur Units) | 0.02 | % S | 0.02 | 0.04 | - | - |
| SPOCAS - Liming rate - ASSMAC | 1 | kg CaCO3/t | 1.0 | 1.6 | - | - |
| **Extraneous Material** | | | | | | |
| <2mm Fraction | 0.005 | g | 210 | 220 | - | - |
| >2mm Fraction | 0.005 | g | < 0.005 | < 0.005 | - | - |
| Analysed Material | 0.1 | % | 100 | 100 | - | - |
| Extraneous Material | 0.1 | % | < 0.1 | < 0.1 | - | - |
| | | | | | | |
| Chloride | 5 | mg/kg | - | - | 94 | < 5 |
| Conductivity (1:5 aqueous extract at 25 °C as rec.) | 10 | uS/cm | - | - | 110 | 680 |
| pH (1:5 Aqueous extract at 25 °C as rec.) | 0.1 | pH Units | - | - | 4.9 | 7.0 |
| Resistivity* | 0.5 | ohm.m | - | - | 92 | 15 |
| Sulphate (as SO4) | 30 | mg/kg | - | - | < 30 | < 30 |
| **Sample Properties** | | | | | | |
| % Moisture | 1 | % | - | - | 6.1 | 16 |

## Sample History

Where samples are submitted/analysed over several days, the last date of extraction is reported.

If the date and time of sampling are not provided, the Laboratory will not be responsible for compromised results should testing be performed outside the recommended holding time.

| Description | Testing Site | Extracted | Holding Time |
|---|---|---|---|
| Acid Sulfate Soils Field pH Test | Brisbane | Feb 01, 2024 | 7 Days |
| - Method: LTM-GEN-7060 Determination of field pH (pHF) and field pH peroxide (pHFOX) tests | | | |
| SPOCAS Suite | | | |
| SPOCAS Suite | Brisbane | Feb 01, 2024 | 6 Week |
| - Method: LTM-GEN-7050 | | | |
| Extraneous Material | Brisbane | Feb 01, 2024 | 6 Week |
| - Method: LTM-GEN-7050/7070 | | | |
| Chloride | Melbourne | Jan 27, 2024 | 28 Days |
| - Method: LTM-INO-4090 Chloride by Discrete Analyser | | | |
| Conductivity (1:5 aqueous extract at 25 °C as rec.) | Melbourne | Jan 27, 2024 | 7 Days |
| - Method: LTM-INO-4030 Conductivity | | | |
| pH (1:5 Aqueous extract at 25 °C as rec.) | Melbourne | Jan 27, 2024 | 7 Days |
| - Method: LTM-GEN-7090 pH in soil by ISE | | | |
| Sulphate (as SO4) | Melbourne | Jan 27, 2024 | 28 Days |
| - Method: LTM-INO-4110 Sulfate by Discrete Analyser | | | |
| % Moisture | Melbourne | Jan 23, 2024 | 14 Days |
| - Method: LTM-GEN-7080 Moisture | | | |

eurofins

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**Eurofins Environment Testing Australia Pty Ltd**
ABN: 50 005 085 521

| Melbourne | Geelong | Sydney | Canberra | Brisbane | Newcastle |
|---|---|---|---|---|---|
| 6 Monterey Road | 19/8 Lewalan Street | 179 Magowar Road | Unit 1,2 Dacre Street | 1/21 Smallwood Place | 1/2 Frost Drive |
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| NATA# 1261 | NATA# 1261 | NATA# 1261 | NATA# 1261 | NATA# 1261 | NATA# 1261 |
| Site# 1254 | Site# 25403 | Site# 18217 | Site# 25466 | Site# 20794 | Site# 25079 & 25289 |

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| 35 O'Rorke Road | Unit C1/4 Pacific Rise, | 43 Detroit Drive | 1277 Cameron Road, |
| Penrose, | Mount Wellington, | Rolleston, | Gate Pa, |
| Auckland 1061 | Auckland 1061 | Christchurch 7675 | Tauranga 3112 |
| +64 9 526 4551 | +64 9 525 0568 | +64 3 343 5201 | +64 9 525 0568 |
| IANZ# 1327 | IANZ# 1308 | IANZ# 1290 | IANZ# 1402 |

**Company Name:** Geotesta P/L
**Address:** Level 1, 7 Business Park Drive,
Notting Hill
VIC 3168

**Project Name:** Seagull Drive Loch Sport
**Project ID:** GE13574

**Order No.:**
**Report #:** 1061623
**Phone:** 03 9562 8808
**Fax:**

**Received:** Jan 23, 2024 11:00 AM
**Due:** Jan 31, 2024
**Priority:** 5 Day
**Contact Name:** Dasun Premachandra

**Eurofins Analytical Services Manager : Amy Meunier**

| Sample Detail | | | | | | Acid Sulfate Soils Field pH Test | Aggressivity Soil Set | SPOCAS Suite | Moisture Set |
|---|---|---|---|---|---|---|---|---|---|
| **Melbourne Laboratory - NATA # 1261 Site # 1254** | | | | | | | X | | X |
| **Brisbane Laboratory - NATA # 1261 Site # 20794** | | | | | | X | | X | |
| **External Laboratory** | | | | | | | | | |
| **No** | **Sample ID** | **Sample Date** | **Sampling Time** | **Matrix** | **LAB ID** | | | | |
| 1 | L1 0.8M | Jan 22, 2024 | | Soil | M24-Ja0032472 | X | | X | |
| 2 | L1 1.3M | Jan 22, 2024 | | Soil | M24-Ja0032473 | X | | X | |
| 3 | L2 0.8M | Jan 22, 2024 | | Soil | M24-Ja0032474 | X | | X | |
| 4 | L2 1.3M | Jan 22, 2024 | | Soil | M24-Ja0032475 | X | | X | |
| 5 | L3 0.8M | Jan 22, 2024 | | Soil | M24-Ja0032476 | X | | X | |
| 6 | L3 1.3M | Jan 22, 2024 | | Soil | M24-Ja0032477 | X | | X | |
| 7 | BH1 2M | Jan 22, 2024 | | Soil | M24-Ja0032478 | | X | | X |
| 8 | BH1 9M | Jan 22, 2024 | | Soil | M24-Ja0032479 | | X | | X |
| **Test Counts** | | | | | | 6 | 2 | 6 | 2 |

## Internal Quality Control Review and Glossary

### General

1. Laboratory QC results for Method Blanks, Duplicates, Matrix Spikes, and Laboratory Control Samples follow guidelines delineated in the National Environment Protection (Assessment of Site Contamination) Measure 1999, as amended May 2013. They are included in this QC report where applicable. Additional QC data may be available on request.
2. All soil/sediment/solid results are reported on a dry weight basis unless otherwise stated.
3. All biota/food results are reported on a wet weight basis on the edible portion unless otherwise stated.
4. For CEC results where the sample's origin is unknown or environmentally contaminated, the results should be used advisedly.
5. Actual LORs are matrix dependent. Quoted LORs may be raised where sample extracts are diluted due to interferences.
6. Results are uncorrected for matrix spikes or surrogate recoveries except for PFAS compounds.
7. SVOC analysis on waters is performed on homogenised, unfiltered samples unless noted otherwise.
8. Samples were analysed on an 'as received' basis.
9. Information identified in this report with blue colour indicates data provided by customers that may have an impact on the results.
10. This report replaces any interim results previously issued.

### Holding Times

Please refer to the 'Sample Preservation and Container Guide' for holding times (QS3001).

For samples received on the last day of holding time, notification of testing requirements should have been received at least 6 hours before sample receipt deadlines as stated on the SRA.

If the Laboratory did not receive the information in the required timeframe, and despite any other integrity issues, suitably qualified results may still be reported.

Holding times apply from the date of sampling; therefore, compliance with these may be outside the laboratory's control.

For VOCs containing vinyl chloride, styrene and 2-chloroethyl vinyl ether, the holding time is 7 days; however, for all other VOCs, such as BTEX or C6-10 TRH, the holding time is 14 days.

### Units

| | | |
|---|---|---|
| **mg/kg:** milligrams per kilogram | **mg/L:** milligrams per litre | **ppm:** parts per million |
| **µg/L:** micrograms per litre | **ppb:** parts per billion | **%:** Percentage |
| **org/100 mL:** Organisms per 100 millilitres | **NTU:** Nephelometric Turbidity Units | **MPN/100 mL:** Most Probable Number of organisms per 100 millilitres |
| **CFU:** Colony forming unit | **Colour:** Pt-Co Units | |

### Terms

| | |
|---|---|
| **APHA** | American Public Health Association |
| **CEC** | Cation Exchange Capacity |
| **COC** | Chain of Custody |
| **CP** | Client Parent - QC was performed on samples pertaining to this report |
| **CRM** | Certified Reference Material (ISO17034) - reported as percent recovery. |
| **Dry** | Where moisture has been determined on a solid sample, the result is expressed on a dry weight basis. |
| **Duplicate** | A second piece of analysis from the same sample and reported in the same units as the result to show comparison. |
| **LOR** | Limit of Reporting. |
| **LCS** | Laboratory Control Sample - reported as percent recovery. |
| **Method Blank** | In the case of solid samples, these are performed on laboratory-certified clean sands and in the case of water samples, these are performed on de-ionised water. |
| **NCP** | Non-Client Parent - QC performed on samples not pertaining to this report, QC represents the sequence or batch that client samples were analysed within. |
| **RPD** | Relative Percent Difference between two Duplicate pieces of analysis. |
| **SPIKE** | Addition of the analyte to the sample and reported as percentage recovery. |
| **SRA** | Sample Receipt Advice |
| **Surr - Surrogate** | The addition of a similar compound to the analyte target is reported as percentage recovery. See below for acceptance criteria. |
| **TBTO** | Tributyltin oxide (*bis*-tributyltin oxide) - individual tributyltin compounds cannot be identified separately in the environment; however, free tributyltin was measured, and its values were converted stoichiometrically into tributyltin oxide for comparison with regulatory limits. |
| **TCLP** | Toxicity Characteristic Leaching Procedure |
| **TEQ** | Toxic Equivalency Quotient or Total Equivalence |
| **QSM** | US Department of Defense Quality Systems Manual Version 5.4 |
| **US EPA** | United States Environmental Protection Agency |
| **WA DWER** | Sum of PFBA, PFPeA, PFHxA, PFHpA, PFOA, PFBS, PFHxS, PFOS, 6:2 FTSA, 8:2 FTSA |

### QC - Acceptance Criteria

The acceptance criteria should only be used as a guide and may be different when site-specific Sampling Analysis and Quality Plan (SAQP) have been implemented.

RPD Duplicates: Global RPD Duplicates Acceptance Criteria is ≤30%; however, the following acceptance guidelines are equally applicable:

| | |
|---|---|
| Results <10 times the LOR: | No Limit |
| Results between 10-20 times the LOR: | RPD must lie between 0-50% |
| Results >20 times the LOR: | RPD must lie between 0-30% |

NOTE: pH duplicates are reported as a range, not as RPD

Surrogate Recoveries: Recoveries must lie between 20-130% for Speciated Phenols & 50-150% for PFAS. SVOCs recoveries 20 – 150%, VOC recoveries 70 – 130%

PFAS field samples containing surrogate recoveries above the QC limit designated in QSM 5.4, where no positive PFAS results have been reported or reviewed, and no data was affected.

### QC Data General Comments

1. Where a result is reported as less than (<), higher than the nominated LOR, this is due to either matrix interference, extract dilution required due to interferences or contaminant levels within the sample, high moisture content or insufficient sample provided.
2. Duplicate data shown within this report that states the word "BATCH" is a Batch Duplicate from outside of your sample batch but within the laboratory sample batch at a 1:10 ratio. The Parent and Duplicate data shown are not data from your samples.
3. pH and Free Chlorine analysed in the laboratory - Analysis on this test must begin within 30 minutes of sampling. Therefore, laboratory analysis is unlikely to be completed within holding time.Analysis will begin as soon as possible after sample receipt.
4. Recovery Data (Spikes & Surrogates) - where chromatographic interference does not allow the determination of recovery, the term "INT" appears against that analyte.
5. For Matrix Spikes and LCS results, a dash "-" in the report means that the specific analyte was not added to the QC sample.
6. Duplicate RPDs are calculated from raw analytical data; thus, it is possible to have two sets of data.

**Quality Control Results**

| Test | Units | Result 1 | | | Acceptance Limits | Pass Limits | Qualifying Code |
|---|---|---|---|---|---|---|---|
| **Method Blank** | | | | | | | |
| Chloride | mg/kg | < 5 | | | 5 | Pass | |
| Sulphate (as SO4) | mg/kg | < 30 | | | 30 | Pass | |
| **LCS - % Recovery** | | | | | | | |
| **Actual Acidity (NLM-3.2)** | | | | | | | |
| pH-KCL (NLM-3.1) | % | 99 | | | 80-120 | Pass | |
| **LCS - % Recovery** | | | | | | | |
| **Extractable Sulfur** | | | | | | | |
| HCl Extractable Sulfur | % | 107 | | | 80-120 | Pass | |
| **LCS - % Recovery** | | | | | | | |
| Chloride | % | 112 | | | 70-130 | Pass | |
| Conductivity (1:5 aqueous extract at 25 °C as rec.) | % | 97 | | | 70-130 | Pass | |

| Test | Lab Sample ID | QA Source | Units | Result 1 | | | Acceptance Limits | Pass Limits | Qualifying Code |
|---|---|---|---|---|---|---|---|---|---|
| **Duplicate** | | | | | | | | | |
| **Acid Sulfate Soils Field pH Test** | | | | Result 1 | Result 2 | RPD | | | |
| pH-F (Field pH test)* | M24-Ja0030627 | NCP | pH Units | 7.9 | 7.9 | pass | 20% | Pass | |
| **Duplicate** | | | | | | | | | |
| **Actual Acidity (NLM-3.2)** | | | | Result 1 | Result 2 | RPD | | | |
| pH-KCL (NLM-3.1) | M24-Ja0032476 | CP | pH Units | 7.3 | 7.3 | <1 | 20% | Pass | |
| Titratable Actual Acidity (NLM-3.2) | M24-Ja0032476 | CP | mol H+/t | < 2 | < 2 | <1 | 20% | Pass | |
| Titratable Actual Acidity (NLM-3.2) | M24-Ja0032476 | CP | % pyrite S | < 0.003 | < 0.003 | <1 | 30% | Pass | |
| **Duplicate** | | | | | | | | | |
| **Potential Acidity - Titratable Peroxide** | | | | Result 1 | Result 2 | RPD | | | |
| pH-OX | M24-Ja0032476 | CP | pH Units | 3.0 | 3.0 | <1 | 20% | Pass | |
| Titratable Peroxide Acidity (s-TPA) | M24-Ja0032476 | CP | % pyrite S | < 0.02 | < 0.02 | <1 | 30% | Pass | |
| Titratable Peroxide Acidity (a-TPA) | M24-Ja0032476 | CP | mol H+/t | < 2 | < 2 | <1 | 20% | Pass | |
| Titratable Sulfidic Acidity (a-TSA) | M24-Ja0032476 | CP | mol H+/t | < 2 | < 2 | <1 | 30% | Pass | |
| Titratable Sulfidic Acidity (s-TSA) | M24-Ja0032476 | CP | % pyrite S | < 0.02 | < 0.02 | <1 | 30% | Pass | |
| **Duplicate** | | | | | | | | | |
| **Extractable Sulfur** | | | | Result 1 | Result 2 | RPD | | | |
| Sulfur - KCl Extractable | M24-Ja0032476 | CP | % S | 0.019 | 0.019 | 1.8 | 30% | Pass | |
| Peroxide Extractable Sulfur | M24-Ja0032476 | CP | % S | 0.086 | 0.087 | <1 | 20% | Pass | |
| HCl Extractable Sulfur | M24-Ja0032476 | CP | % S | N/A | N/A | N/A | 20% | Pass | |
| **Duplicate** | | | | | | | | | |
| **Potential Acidity (SPOS)** | | | | Result 1 | Result 2 | RPD | | | |
| Peroxide Oxidisable Sulfur (s-SPOS) (NLM 2.2) | M24-Ja0032476 | CP | % S | 0.067 | 0.068 | 1.3 | 30% | Pass | |
| Peroxide Oxidisable Sulfur (a-SPOS) (NLM 2.2) | M24-Ja0032476 | CP | mol H+/t | 42 | 42 | 1.3 | 30% | Pass | |
| **Duplicate** | | | | | | | | | |
| **Retained Acidity (S-NAS)** | | | | Result 1 | Result 2 | RPD | | | |
| Net Acid soluble sulfur (s-SNAS) NLM-4.1 | M24-Ja0032476 | CP | % S | N/A | N/A | N/A | 30% | Pass | |
| Net Acid soluble sulfur (a-SNAS) NLM-4.1 | M24-Ja0032476 | CP | mol H+/t | N/A | N/A | N/A | 30% | Pass | |
| **Duplicate** | | | | | | | | | |
| **Extractable Calcium** | | | | Result 1 | Result 2 | RPD | | | |
| Calcium - KCl Extractable | M24-Ja0032476 | CP | % Ca | 0.031 | 0.031 | <1 | 30% | Pass | |
| Calcium - Peroxide | M24-Ja0032476 | CP | % Ca | 0.035 | 0.034 | 2.9 | 20% | Pass | |
| Calcium - Acid Reacted | M24-Ja0032476 | CP | % Ca | < 0.005 | < 0.005 | <1 | 30% | Pass | |
| Calcium - Acid Reacted (s-aCa) | M24-Ja0032476 | CP | % S | < 0.005 | < 0.005 | <1 | 30% | Pass | |
| Calcium - Acid Reacted (a-aCa) | M24-Ja0032476 | CP | mol H+/t | < 0.005 | < 0.005 | <1 | 30% | Pass | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Duplicate** | | | | | | | | | |
| **Extractable Magnesium** | | | | Result 1 | Result 2 | RPD | | | |
| Magnesium - KCl Extractable | M24-Ja0032476 | CP | % Mg | 0.008 | 0.008 | <1 | 30% | Pass | |
| Magnesium - Peroxide | M24-Ja0032476 | CP | % Mg | 0.009 | 0.009 | 1.9 | 20% | Pass | |
| Magnesium - Acid Reacted | M24-Ja0032476 | CP | % Mg | < 0.005 | < 0.005 | <1 | 30% | Pass | |
| Magnesium - Acid Reacted (s-aCa) | M24-Ja0032476 | CP | % S | < 0.005 | < 0.005 | <1 | 30% | Pass | |
| Magnesium - Acid Reacted (a-aCa) | M24-Ja0032476 | CP | mol H+/t | < 0.005 | < 0.005 | <1 | 30% | Pass | |
| **Duplicate** | | | | | | | | | |
| **Acid Neutralising Capacity (ANCE)** | | | | Result 1 | Result 2 | RPD | | | |
| Acid Neutralising Capacity - (ANCE) | M24-Ja0032476 | CP | % CaCO3 | N/A | N/A | N/A | 30% | Pass | |
| Acid Neutralising Capacity - (a-ANCE) | M24-Ja0032476 | CP | mol H+/t | n/a | n/a | N/A | 30% | Pass | |
| **Duplicate** | | | | | | | | | |
| **Acid Neutralising Capacity (ANCbt)** | | | | Result 1 | Result 2 | RPD | | | |
| ANC Fineness Factor | M24-Ja0032476 | CP | factor | 1.5 | 1.5 | <1 | 30% | Pass | |
| **Duplicate** | | | | | | | | | |
| **Net Acidity (Including ANC)** | | | | Result 1 | Result 2 | RPD | | | |
| SPOCAS - Net Acidity - ASSMAC (Acidity Units) | M24-Ja0032476 | CP | mol H+/t | 14 | 14 | 1.3 | 30% | Pass | |
| SPOCAS - Net Acidity - ASSMAC (Sulfur Units) | M24-Ja0032476 | CP | % S | 0.02 | 0.02 | 1.3 | 30% | Pass | |
| SPOCAS - Liming rate - ASSMAC | M24-Ja0032476 | CP | kg CaCO3/t | 1.0 | 1.1 | 1.3 | 30% | Pass | |
| **Duplicate** | | | | | | | | | |
| | | | | Result 1 | Result 2 | RPD | | | |
| Chloride | M24-Ja0032478 | CP | mg/kg | 94 | 93 | <1 | 30% | Pass | |
| Conductivity (1:5 aqueous extract at 25 °C as rec.) | M24-Ja0032374 | NCP | uS/cm | 130 | 140 | 7.0 | 30% | Pass | |
| pH (1:5 Aqueous extract at 25 °C as rec.) | M24-Ja0032374 | NCP | pH Units | 5.9 | 5.9 | pass | 30% | Pass | |
| Resistivity* | M24-Ja0032374 | NCP | ohm.m | 79 | 74 | 7.0 | 30% | Pass | |
| Sulphate (as SO4) | M24-Ja0032478 | CP | mg/kg | < 30 | < 30 | <1 | 30% | Pass | |
| **Duplicate** | | | | | | | | | |
| **Sample Properties** | | | | Result 1 | Result 2 | RPD | | | |
| % Moisture | M24-Ja0031657 | NCP | % | 14 | 15 | 4.7 | 30% | Pass | |

## Comments

## Sample Integrity

| | |
|---|---|
| Custody Seals Intact (if used) | N/A |
| Attempt to Chill was evident | Yes |
| Sample correctly preserved | Yes |
| Appropriate sample containers have been used | Yes |
| Sample containers for volatile analysis received with minimal headspace | Yes |
| Samples received within HoldingTime | Yes |
| Some samples have been subcontracted | No |

## Qualifier Codes/Comments

| Code | Description |
|---|---|
| S02 | Retained Acidity is Reported when the pHKCl is less than pH 4.5 |
| S05 | Field Screen uses the following fizz rating to classify the rate the samples reacted to the peroxide: 1.0; No reaction to slight. 2.0; Moderate reaction. 3.0; Strong reaction with persistent froth. 4.0; Extreme reaction. |

## Authorised by:

| | |
|---|---|
| Amy Meunier | Analytical Services Manager |
| Jonathon Angell | Senior Analyst-SPOCAS |
| Mary Makarios | Senior Analyst-Inorganic |
| Mary Makarios | Senior Analyst-Sample Properties |

**Glenn Jackson**
**Managing Director**

Final Report – this report replaces any previously issued Report

- Indicates Not Requested

* Indicates NATA accreditation does not cover the performance of this service

Measurement uncertainty of test data is available on request or please click here.


| | |
|---|---|
| **Project** | **Preliminary Coast Acid Sulfate Soil Investigation – Seagull Drive, Lock Sport** |
| **CLIENT** | **BMT Commercial Australia Pty Ltd** |
| **DATE** | **16 February 2024** |
| **REPORT No** | **EP0444Rpt1V1** |

GEOTESTA

GEOTESTA PTY LTD ABN 91 851 620 815
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1300 852 216 info@geotesta.com.au geotesta.com.au

# Table of Contents

| | |
|---|---|
| Client | BMT Commercial Australia Pty Ltd |
| Issued | 03/02/2024 |
| Version | 1 |
| Prepared by | Dasun Premachandra |
| Checked by | Patrick O'Neill |
| Project Number | EP0444 |

# 1 Introduction

Geotesta was commissioned by BMT Commercial Australia Pty Ltd to conduct a Preliminary Coastal Acid Sulfate Soil (CASS) Investigation at Seagull Drive in Lock Sport. This CASS Report outlines the CASS hazard assessment using six samples taken from three locations along the proposed work area.

# 2 Limitations

This assessment was conducted according to Geotesta's proposal document PR13574-23, 15 December 2023. Professional advice and opinion provided in this report EP0444Rpt1.V1, February 2024 are for BMT Commercial Australia Pty Ltd requesting the work in accordance with the agreed scope of work.

Advice and interpretation are provided on the basis that subsequent site work will be undertaken by Geotesta. Should other parties be engaged to implement recommendations made by Geotesta, or undertake further assessment work on the site, Geotesta is not responsible for how the information in this report is used by those other parties or any other party.

A report is provided inclusive of all documentation sections, tables, figures and appendices and should not be provided or copied in part without all supporting documentation for any reason, because misinterpretation may occur.

Sub-surface conditions can change by natural processes and site activities. This report presents the conditions assessed at the time the investigation/desk study was undertaken. Consequently, project decisions should not be based on environmental site assessment or data that may have been affected by time. The consultant should be requested to advise if additional information is required.

This site has been assessed for a particular proposed or existing land use based on the limitations of the scope of works. No warranty or guarantee is made regarding any other use, only to the depth tested. Fill, soil, groundwater and rock to the depth tested on the site may be fit for the specified use.

# 3 Site Characteristics

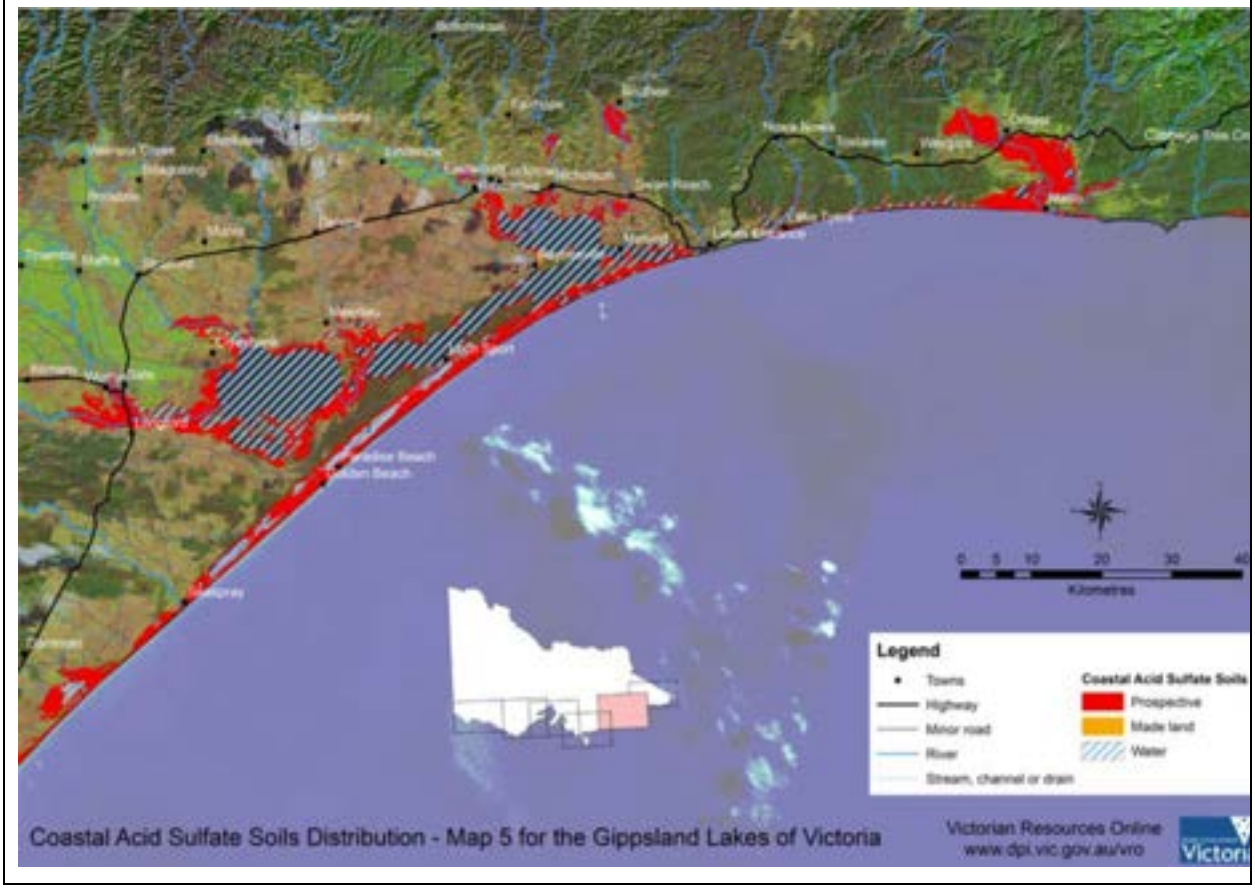
## 3.1 Geology

The Geological Map of Gippsland indicates that the site is underlined by Inland Dune Deposits comprised of sand, silt and clay.

## 3.2 Regional Coastal Acid Sulfate Soils

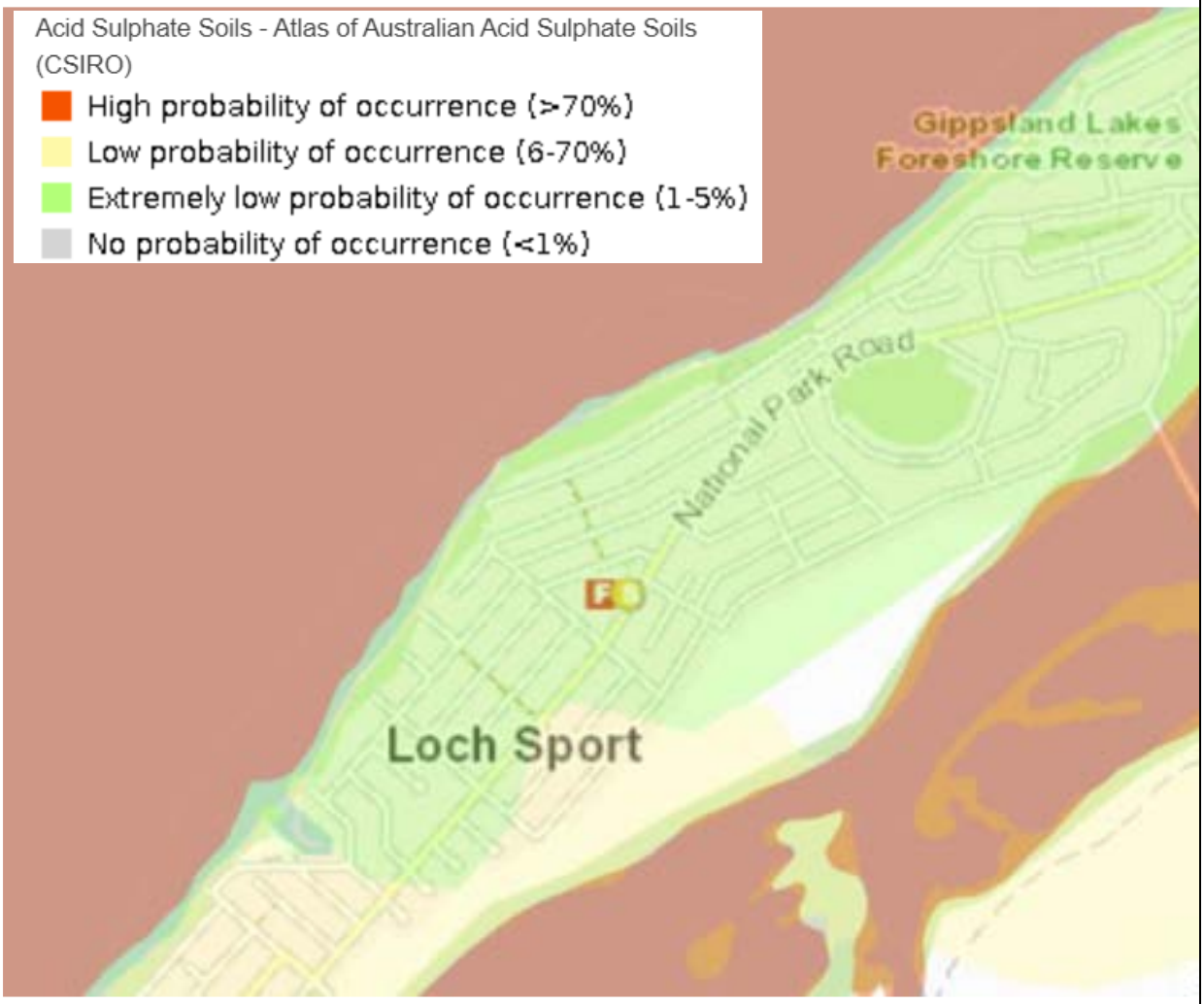
Review of The Victorian Resources Online Coastal Acid Sulfate Soils Distribution Map 5 indicates there is a high probability of CASS occurrence at Lock Sport.

*Figure 1. Coastal Acid Sulfate Soil Distribution Map*




The Soil Health Knowledge Base online mapping database details acid sulfate soil probability zones utilising publicly available information. The database details a high probability of occurrence (with high confidence) for Lake Victoria and within the coastal dune formations along the of the Study Area.

*Figure 2. Acid Sulfate Soil Map*




# 4 Investigation

## 4.1 Method of Investigation

The site inspection was carried out on 22 January 2024 by Geotesta. The position of sampling locations was selected along the proposed work area. The soil samples were collected using a hand auger and drilled to a depth of 1.6m from surface of the water. Two distinctive samples were taken from each location with a total of six samples.

### 4.2 Laboratory Analysis and Sampling

Soil samples collected by Geotesta during the site investigation. Samples were collected at 0.8m and 1.3m in each location. Samples were put in zip locked bags and expelled air immediately and sealed.

All samples were collected with new disposable sampling and protective equipment. Following collections, samples were immediately placed into cooler box with ice and dispatched with Chain of Custody to the NATA accredited laboratory.

## 5 Assessment Criteria

### 5.1 Field Screen Analysis

Field screen testing with pH field (pHF) and pH field oxidised ($pH_{FOX}$) was conducted as preliminary and qualitative screening analysis on all representative samples. Field screening testing results are assessed by the pre and post oxidation pH levels to indicate the presence of Actual ASS and Protentional ASS. The below Table extracted from EPA guidelines and technical notes on Acid Sulphate Soil and Rock Publication 655.1 July 2009 indicates the actions required based on the field pH test results.

*Table 2. Interpretation of field pH results*

| pH | pHFOX | ΔpH | Reaction Rate | Action Required |
|---|---|---|---|---|
| >5.0 | 5.0 | >2 | 1-2 | If no other field indicators or acid sulfate soil risk indicators are present, no further action is required |
| >4.0 and <5.0 | >3.0 and <5.0 | >2 | >2 | PASS may be present, further assessment is required |
| <4.0 | <3.0 | >2 | >2 | ASSS or PASS are likely to be present, further assessment is required |

### 5.2 SPOCAS Analysis

Quantitative laboratory analyses by SPOCAS suite in accordance with AS4969 were undertaken on selected samples to assess the level and nature of acidity or potential acidity present in the soil samples.

## 6 Laboratory Test Results

*Table 2. Field pH testing and SPOCAS results*

| Location | Depth(m) | $pH_F$ | $pH_{FOX}$ | ΔpH | Reaction Rate | Net Acidity (Sulfur Unit) %S | Net Acidity (Acidity Unit) mol H+/t |
|---|---|---|---|---|---|---|---|
| L1 | 0.8 | 5.8 | 2.3 | 3.2 | 4 (Extreme) | 0.12 | 74 |
| | 1.3 | 5.5 | 2.1 | 3.4 | 4 (Extreme) | 0.19 | 120 |
| L2 | 0.8 | 5.5 | 2.3 | 3.2 | 4 (Extreme) | 0.07 | 42 |
| | 1.3 | 6.2 | 2.2 | 4.0 | 4 (Extreme) | 0.21 | 130 |
| L3 | 0.8 | 6.7 | 2.6 | 4.1 | 4 (Extreme) | 0.02 | 14 |
| | 1.3 | 6.5 | 2.2 | 4.3 | 4 (Extreme) | 0.04 | 22 |

Field screen results indicate that pH field levels range between 5.5 to 6.7 with field oxidised pH levels ranging between 3.2 to 4.3. Reaction ratings were all extreme, however shell fragments observed during the investigation and responsive material such as calcium carbonate can influence the laboratory results. Results in Table 2 indicate generally mildly acidic conditions in the samples tested with additional testing (SPOCAS suite) required to confirm and the nature of the acidity.

# 7 Discussion and Recommendations

The preliminary acid sulfate soil investigation covered by this report includes onsite observations and laboratory analysis of the selected soil samples.

The maximum net acidity value recorded within all samples analysed was 130 mol H+/t or 0.21 %S which was above the adopted guideline of 0.03 %S. The BPMG (Victorian Best Practice Guidelines for Assessing and Managing Coastal Acid Sulfate Soils 2010) stipulates that any soils that exceed the acid soil action criterion of 0.03 %S must have a CASS management strategy developed.

Laboratory test results indicate five samples of the six samples analysed had net acidity ranging from 0.04% S (14 mol H+/t) to 0.21% S (130 mol H+/t). Treatment would need to be managed to ensure soils and neutralisation agent is thoroughly mixed, evenly distributed and material is homogenous. The calculation of this liming rate assumes the use of fine-grained agricultural lime with purity of not less than 90%.

Based on the results of the CASS sampling and analysis program, it is recommended that a CASS Management Plan be developed and implemented. The management strategy for the CASS will depend on the volumes of material to be excavated and how that material is excavated and exposed to oxygen. It may be possible to keep all sediments below water level and avoid exposure to air.

DOCUMENT CONTROL

| Date: | Version: | Report Prepared By: | Report Reviewed By: |
|---|---|---|---|
| 14 February 2024 | EP0444Rpt1V1 | Dasun Premachandra<br>Environmental Scientist | Patrick O'Neill<br>Principal Environmental Scientist |

# 8 References

Australian and New Zealand Environment and Conservation Council (1992) – Australian and New Zealand Guidelines for the Assessment and Management of Contaminated Sites.

Australian & New Zealand Environment & Conservation Council/Agriculture & Resource Management Council of Australia & New Zealand (2000) — Australian and New Zealand guidelines for fresh and marine water quality.

National Environmental Protection Authority (2013) – National Environmental Protection (Assessment of Site Contamination) Measure (NEPM).

Standards Australia AS4482.1 (2005) – Guide to the investigation and sampling of sites with potentially contaminated soil. Part 1: Non-volatile and semi-volatile compounds.

Standards Australia AS 4482.2 (1999) – Guide to the sampling and investigation of potentially contaminated soil. Part 2: Volatile Substances.

Victoria Government Gazette (1997) – State Environmental Protection Policy (Groundwaters of Victoria). Victorian Government Printer.

Victorian Government (2002) – State Environment Protection Policy (Prevention and Management of Contamination of Land). Government Printer, Melbourne.

Victorian Government (2010) Victorian Best Practice Guidelines for Assessing and Managing Coastal Acid Sulfate Soil. Melbourne Victoria

Victoria Government Gazette (2003) — State Environment Protection Policy (Waters of Victoria). Victorian Government Printer.

# Appendix A Laboratory Test Results

**Geotesta P/L**
**Level 1, 7 Business Park Drive,**
**Notting Hill**
**VIC 3168**



**Attention:** **Dasun Premachandra**

**Report** **1061623-S**
Project name Seagull Drive Loch Sport
Project ID GE13574
Received Date Jan 23, 2024

| **Client Sample ID** | | | **L1 0.8M** | **L1 1.3M** | **L2 0.8M** | **L2 1.3M** |
|---|---|---|---|---|---|---|
| **Sample Matrix** | | | **Soil** | **Soil** | **Soil** | **Soil** |
| **Eurofins Sample No.** | | | **M24-Ja0032472** | **M24-Ja0032473** | **M24-Ja0032474** | **M24-Ja0032475** |
| **Date Sampled** | | | **Jan 22, 2024** | **Jan 22, 2024** | **Jan 22, 2024** | **Jan 22, 2024** |
| Test/Reference | LOR | Unit | | | | |
| **Acid Sulfate Soils Field pH Test** | | | | | | |
| pH-F (Field pH test)* | 0.1 | pH Units | 5.8 | 5.5 | 5.5 | 6.2 |
| pH-FOX (Field pH Peroxide test)* | 0.1 | pH Units | 2.3 | 2.1 | 2.3 | 2.2 |
| Reaction Ratings*[S05] | 0 | comment | 4.0 | 4.0 | 4.0 | 4.0 |
| **Actual Acidity (NLM-3.2)** | | | | | | |
| pH-KCL (NLM-3.1) | 0.1 | pH Units | 6.2 | 5.0 | 5.9 | 6.0 |
| Titratable Actual Acidity (NLM-3.2) | 2 | mol H+/t | < 2 | < 2 | < 2 | < 2 |
| Titratable Actual Acidity (NLM-3.2) | 0.003 | % pyrite S | < 0.003 | < 0.003 | < 0.003 | < 0.003 |
| **Potential Acidity - Titratable Peroxide** | | | | | | |
| pH-OX | 0.1 | pH Units | 2.7 | 2.5 | 3.0 | 2.5 |
| Titratable Peroxide Acidity (s-TPA) | 0.02 | % pyrite S | < 0.02 | 0.06 | < 0.02 | 0.06 |
| Titratable Peroxide Acidity (a-TPA) | 2 | mol H+/t | < 2 | 36 | < 2 | 39 |
| Titratable Sulfidic Acidity (a-TSA) | 2 | mol H+/t | < 2 | 36 | < 2 | 39 |
| Titratable Sulfidic Acidity (s-TSA) | 0.02 | % pyrite S | < 0.02 | 0.06 | < 0.02 | 0.06 |
| **Extractable Sulfur** | | | | | | |
| Sulfur - KCl Extractable | 0.005 | % S | 0.021 | 0.025 | 0.014 | 0.031 |
| Peroxide Extractable Sulfur | 0.005 | % S | 0.14 | 0.21 | 0.081 | 0.24 |
| HCl Extractable Sulfur | 0.005 | % S | N/A | N/A | N/A | N/A |
| **Potential Acidity (SPOS)** | | | | | | |
| Peroxide Oxidisable Sulfur (s-SPOS) (NLM 2.2) | 0.005 | % S | 0.12 | 0.19 | 0.067 | 0.21 |
| Peroxide Oxidisable Sulfur (a-SPOS) (NLM 2.2) | 2 | mol H+/t | 74 | 120 | 42 | 130 |
| **Retained Acidity (S-NAS)** | | | | | | |
| Net Acid soluble sulfur (s-SNAS) NLM-4.1[S02] | 0.005 | % S | N/A | N/A | N/A | N/A |
| Net Acid soluble sulfur (a-SNAS) NLM-4.1 | 2 | mol H+/t | N/A | N/A | N/A | N/A |
| HCl Extractable Sulfur Correction Factor | 1 | factor | 2.0 | 2.0 | 2.0 | 2.0 |
| **Extractable Calcium** | | | | | | |
| Calcium - KCl Extractable | 0.005 | % Ca | 0.024 | 0.011 | 0.011 | 0.022 |
| Calcium - Peroxide | 0.005 | % Ca | 0.030 | 0.015 | 0.016 | 0.031 |
| Calcium - Acid Reacted | 0.005 | % Ca | 0.006 | < 0.005 | < 0.005 | 0.010 |
| Calcium - Acid Reacted (s-aCa) | 0.005 | % S | < 0.005 | < 0.005 | < 0.005 | 0.008 |
| Calcium - Acid Reacted (a-aCa) | 0.005 | mol H+/t | 2.7 | < 0.005 | < 0.005 | 4.7 |

| Client Sample ID | | | L1 0.8M | L1 1.3M | L2 0.8M | L2 1.3M |
|---|---|---|---|---|---|---|
| Sample Matrix | | | Soil | Soil | Soil | Soil |
| Eurofins Sample No. | | | M24-Ja0032472 | M24-Ja0032473 | M24-Ja0032474 | M24-Ja0032475 |
| Date Sampled | | | Jan 22, 2024 | Jan 22, 2024 | Jan 22, 2024 | Jan 22, 2024 |
| Test/Reference | LOR | Unit | | | | |
| **Extractable Magnesium** | | | | | | |
| Magnesium - KCl Extractable | 0.005 | % Mg | 0.007 | 0.007 | 0.009 | 0.011 |
| Magnesium - Peroxide | 0.005 | % Mg | 0.008 | 0.007 | 0.009 | 0.014 |
| Magnesium - Acid Reacted | 0.005 | % Mg | < 0.005 | < 0.005 | < 0.005 | < 0.005 |
| Magnesium - Acid Reacted (s-aCa) | 0.005 | % S | < 0.005 | < 0.005 | < 0.005 | < 0.005 |
| Magnesium - Acid Reacted (a-aCa) | 0.005 | mol H+/t | < 0.005 | < 0.005 | < 0.005 | < 0.005 |
| **Acid Neutralising Capacity (ANCE)** | | | | | | |
| Acid Neutralising Capacity - (ANCE) | 0.02 | % CaCO3 | N/A | N/A | N/A | N/A |
| Acid Neutralising Capacity - (s-ANCE) | 0.02 | % S | N/A | N/A | N/A | N/A |
| Acid Neutralising Capacity - (a-ANCE) | 10 | mol H+/t | n/a | n/a | n/a | n/a |
| **Acid Neutralising Capacity (ANCbt)** | | | | | | |
| ANC Fineness Factor | | factor | 1.5 | 1.5 | 1.5 | 1.5 |
| **Net Acidity (Including ANC)** | | | | | | |
| SPOCAS - Net Acidity - ASSMAC (Acidity Units) | 10 | mol H+/t | 74 | 120 | 42 | 130 |
| SPOCAS - Net Acidity - ASSMAC (Sulfur Units) | 0.02 | % S | 0.12 | 0.19 | 0.07 | 0.21 |
| SPOCAS - Liming rate - ASSMAC | 1 | kg CaCO3/t | 5.5 | 8.9 | 3.1 | 9.8 |
| **Extraneous Material** | | | | | | |
| <2mm Fraction | 0.005 | g | 150 | 260 | 280 | 380 |
| >2mm Fraction | 0.005 | g | < 0.005 | < 0.005 | < 0.005 | < 0.005 |
| Analysed Material | 0.1 | % | 100 | 100 | 100 | 100 |
| Extraneous Material | 0.1 | % | < 0.1 | < 0.1 | < 0.1 | < 0.1 |

| Client Sample ID | | | L3 0.8M | L3 1.3M | BH1 2M | BH1 9M |
|---|---|---|---|---|---|---|
| Sample Matrix | | | Soil | Soil | Soil | Soil |
| Eurofins Sample No. | | | M24-Ja0032476 | M24-Ja0032477 | M24-Ja0032478 | M24-Ja0032479 |
| Date Sampled | | | Jan 22, 2024 | Jan 22, 2024 | Jan 22, 2024 | Jan 22, 2024 |
| Test/Reference | LOR | Unit | | | | |
| **Acid Sulfate Soils Field pH Test** | | | | | | |
| pH-F (Field pH test)* | 0.1 | pH Units | 6.7 | 6.5 | - | - |
| pH-FOX (Field pH Peroxide test)* | 0.1 | pH Units | 2.6 | 2.2 | - | - |
| Reaction Ratings*[S05] | 0 | comment | 4.0 | 4.0 | - | - |
| **Actual Acidity (NLM-3.2)** | | | | | | |
| pH-KCL (NLM-3.1) | 0.1 | pH Units | 7.3 | 8.2 | - | - |
| Titratable Actual Acidity (NLM-3.2) | 2 | mol H+/t | < 2 | < 2 | - | - |
| Titratable Actual Acidity (NLM-3.2) | 0.003 | % pyrite S | < 0.003 | < 0.003 | - | - |
| **Potential Acidity - Titratable Peroxide** | | | | | | |
| pH-OX | 0.1 | pH Units | 3.0 | 2.9 | - | - |
| Titratable Peroxide Acidity (s-TPA) | 0.02 | % pyrite S | < 0.02 | < 0.02 | - | - |
| Titratable Peroxide Acidity (a-TPA) | 2 | mol H+/t | < 2 | < 2 | - | - |
| Titratable Sulfidic Acidity (a-TSA) | 2 | mol H+/t | < 2 | < 2 | - | - |
| Titratable Sulfidic Acidity (s-TSA) | 0.02 | % pyrite S | < 0.02 | < 0.02 | - | - |
| **Extractable Sulfur** | | | | | | |
| Sulfur - KCl Extractable | 0.005 | % S | 0.019 | 0.033 | - | - |
| Peroxide Extractable Sulfur | 0.005 | % S | 0.086 | 0.14 | - | - |
| HCl Extractable Sulfur | 0.005 | % S | N/A | N/A | - | - |
| **Potential Acidity (SPOS)** | | | | | | |
| Peroxide Oxidisable Sulfur (s-SPOS) (NLM 2.2) | 0.005 | % S | 0.067 | 0.10 | - | - |
| Peroxide Oxidisable Sulfur (a-SPOS) (NLM 2.2) | 2 | mol H+/t | 42 | 65 | - | - |

| Client Sample ID | | | L3 0.8M | L3 1.3M | BH1 2M | BH1 9M |
|---|---|---|---|---|---|---|
| Sample Matrix | | | Soil | Soil | Soil | Soil |
| Eurofins Sample No. | | | M24-Ja0032476 | M24-Ja0032477 | M24-Ja0032478 | M24-Ja0032479 |
| Date Sampled | | | Jan 22, 2024 | Jan 22, 2024 | Jan 22, 2024 | Jan 22, 2024 |
| Test/Reference | LOR | Unit | | | | |
| **Retained Acidity (S-NAS)** | | | | | | |
| Net Acid soluble sulfur (s-SNAS) NLM-4.1[S02] | 0.005 | % S | N/A | N/A | - | - |
| Net Acid soluble sulfur (a-SNAS) NLM-4.1 | 2 | mol H+/t | N/A | N/A | - | - |
| HCl Extractable Sulfur Correction Factor | 1 | factor | 2.0 | 2.0 | - | - |
| **Extractable Calcium** | | | | | | |
| Calcium - KCl Extractable | 0.005 | % Ca | 0.031 | 0.059 | - | - |
| Calcium - Peroxide | 0.005 | % Ca | 0.035 | 0.069 | - | - |
| Calcium - Acid Reacted | 0.005 | % Ca | < 0.005 | 0.010 | - | - |
| Calcium - Acid Reacted (s-aCa) | 0.005 | % S | < 0.005 | 0.008 | - | - |
| Calcium - Acid Reacted (a-aCa) | 0.005 | mol H+/t | < 0.005 | 4.9 | - | - |
| **Extractable Magnesium** | | | | | | |
| Magnesium - KCl Extractable | 0.005 | % Mg | 0.008 | 0.008 | - | - |
| Magnesium - Peroxide | 0.005 | % Mg | 0.009 | 0.010 | - | - |
| Magnesium - Acid Reacted | 0.005 | % Mg | < 0.005 | < 0.005 | - | - |
| Magnesium - Acid Reacted (s-aCa) | 0.005 | % S | < 0.005 | < 0.005 | - | - |
| Magnesium - Acid Reacted (a-aCa) | 0.005 | mol H+/t | < 0.005 | < 0.005 | - | - |
| **Acid Neutralising Capacity (ANCE)** | | | | | | |
| Acid Neutralising Capacity - (ANCE) | 0.02 | % CaCO3 | N/A | N/A | - | - |
| Acid Neutralising Capacity - (s-ANCE) | 0.02 | % S | N/A | N/A | - | - |
| Acid Neutralising Capacity - (a-ANCE) | 10 | mol H+/t | n/a | n/a | - | - |
| **Acid Neutralising Capacity (ANCbt)** | | | | | | |
| ANC Fineness Factor | | factor | 1.5 | 1.5 | - | - |
| **Net Acidity (Including ANC)** | | | | | | |
| SPOCAS - Net Acidity - ASSMAC (Acidity Units) | 10 | mol H+/t | 14 | 22 | - | - |
| SPOCAS - Net Acidity - ASSMAC (Sulfur Units) | 0.02 | % S | 0.02 | 0.04 | - | - |
| SPOCAS - Liming rate - ASSMAC | 1 | kg CaCO3/t | 1.0 | 1.6 | - | - |
| **Extraneous Material** | | | | | | |
| <2mm Fraction | 0.005 | g | 210 | 220 | - | - |
| >2mm Fraction | 0.005 | g | < 0.005 | < 0.005 | - | - |
| Analysed Material | 0.1 | % | 100 | 100 | - | - |
| Extraneous Material | 0.1 | % | < 0.1 | < 0.1 | - | - |
| | | | | | | |
| Chloride | 5 | mg/kg | - | - | 94 | < 5 |
| Conductivity (1:5 aqueous extract at 25 °C as rec.) | 10 | uS/cm | - | - | 110 | 680 |
| pH (1:5 Aqueous extract at 25 °C as rec.) | 0.1 | pH Units | - | - | 4.9 | 7.0 |
| Resistivity* | 0.5 | ohm.m | - | - | 92 | 15 |
| Sulphate (as SO4) | 30 | mg/kg | - | - | < 30 | < 30 |
| **Sample Properties** | | | | | | |
| % Moisture | 1 | % | - | - | 6.1 | 16 |

## Sample History

Where samples are submitted/analysed over several days, the last date of extraction is reported.

If the date and time of sampling are not provided, the Laboratory will not be responsible for compromised results should testing be performed outside the recommended holding time.

| Description | Testing Site | Extracted | Holding Time |
|---|---|---|---|
| Acid Sulfate Soils Field pH Test | Brisbane | Feb 01, 2024 | 7 Days |
| - Method: LTM-GEN-7060 Determination of field pH (pHF) and field pH peroxide (pHFOX) tests | | | |
| SPOCAS Suite | | | |
| SPOCAS Suite | Brisbane | Feb 01, 2024 | 6 Week |
| - Method: LTM-GEN-7050 | | | |
| Extraneous Material | Brisbane | Feb 01, 2024 | 6 Week |
| - Method: LTM-GEN-7050/7070 | | | |
| Chloride | Melbourne | Jan 27, 2024 | 28 Days |
| - Method: LTM-INO-4090 Chloride by Discrete Analyser | | | |
| Conductivity (1:5 aqueous extract at 25 °C as rec.) | Melbourne | Jan 27, 2024 | 7 Days |
| - Method: LTM-INO-4030 Conductivity | | | |
| pH (1:5 Aqueous extract at 25 °C as rec.) | Melbourne | Jan 27, 2024 | 7 Days |
| - Method: LTM-GEN-7090 pH in soil by ISE | | | |
| Sulphate (as SO4) | Melbourne | Jan 27, 2024 | 28 Days |
| - Method: LTM-INO-4110 Sulfate by Discrete Analyser | | | |
| % Moisture | Melbourne | Jan 23, 2024 | 14 Days |
| - Method: LTM-GEN-7080 Moisture | | | |

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**Eurofins Environment Testing Australia Pty Ltd**
ABN: 50 005 085 521

| Melbourne | Geelong | Sydney | Canberra | Brisbane | Newcastle |
|---|---|---|---|---|---|
| 6 Monterey Road | 19/8 Lewalan Street | 179 Magowar Road | Unit 1,2 Dacre Street | 1/21 Smallwood Place | 1/2 Frost Drive |
| Dandenong South | Grovedale | Girraween | Mitchell | Murarrie | Mayfield West |
| VIC 3175 | VIC 3216 | NSW 2145 | ACT 2911 | QLD 4172 | NSW 2304 |
| +61 3 8564 5000 | +61 3 8564 5000 | +61 2 9900 8400 | +61 2 6113 8091 | T: +61 7 3902 4600 | +61 2 4968 8448 |
| NATA# 1261 | NATA# 1261 | NATA# 1261 | NATA# 1261 | NATA# 1261 | NATA# 1261 |
| Site# 1254 | Site# 25403 | Site# 18217 | Site# 25466 | Site# 20794 | Site# 25079 & 25289 |

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|---|---|---|---|
| 35 O'Rorke Road | Unit C1/4 Pacific Rise, | 43 Detroit Drive | 1277 Cameron Road, |
| Penrose, | Mount Wellington, | Rolleston, | Gate Pa, |
| Auckland 1061 | Auckland 1061 | Christchurch 7675 | Tauranga 3112 |
| +64 9 526 4551 | +64 9 525 0568 | +64 3 343 5201 | +64 9 525 0568 |
| IANZ# 1327 | IANZ# 1308 | IANZ# 1290 | IANZ# 1402 |

**Company Name:** Geotesta P/L
**Address:** Level 1, 7 Business Park Drive,
Notting Hill
VIC 3168

**Project Name:** Seagull Drive Loch Sport
**Project ID:** GE13574

**Order No.:**
**Report #:** 1061623
**Phone:** 03 9562 8808
**Fax:**

**Received:** Jan 23, 2024 11:00 AM
**Due:** Jan 31, 2024
**Priority:** 5 Day
**Contact Name:** Dasun Premachandra

**Eurofins Analytical Services Manager : Amy Meunier**

| Sample Detail | | | | | | Acid Sulfate Soils Field pH Test | Aggressivity Soil Set | SPOCAS Suite | Moisture Set |
|---|---|---|---|---|---|---|---|---|---|
| **Melbourne Laboratory - NATA # 1261 Site # 1254** | | | | | | | X | | X |
| **Brisbane Laboratory - NATA # 1261 Site # 20794** | | | | | | X | | X | |
| **External Laboratory** | | | | | | | | | |
| **No** | **Sample ID** | **Sample Date** | **Sampling Time** | **Matrix** | **LAB ID** | | | | |
| 1 | L1 0.8M | Jan 22, 2024 | | Soil | M24-Ja0032472 | X | | X | |
| 2 | L1 1.3M | Jan 22, 2024 | | Soil | M24-Ja0032473 | X | | X | |
| 3 | L2 0.8M | Jan 22, 2024 | | Soil | M24-Ja0032474 | X | | X | |
| 4 | L2 1.3M | Jan 22, 2024 | | Soil | M24-Ja0032475 | X | | X | |
| 5 | L3 0.8M | Jan 22, 2024 | | Soil | M24-Ja0032476 | X | | X | |
| 6 | L3 1.3M | Jan 22, 2024 | | Soil | M24-Ja0032477 | X | | X | |
| 7 | BH1 2M | Jan 22, 2024 | | Soil | M24-Ja0032478 | | X | | X |
| 8 | BH1 9M | Jan 22, 2024 | | Soil | M24-Ja0032479 | | X | | X |
| **Test Counts** | | | | | | 6 | 2 | 6 | 2 |

## Internal Quality Control Review and Glossary

### General

1. Laboratory QC results for Method Blanks, Duplicates, Matrix Spikes, and Laboratory Control Samples follow guidelines delineated in the National Environment Protection (Assessment of Site Contamination) Measure 1999, as amended May 2013. They are included in this QC report where applicable. Additional QC data may be available on request.
2. All soil/sediment/solid results are reported on a dry weight basis unless otherwise stated.
3. All biota/food results are reported on a wet weight basis on the edible portion unless otherwise stated.
4. For CEC results where the sample's origin is unknown or environmentally contaminated, the results should be used advisedly.
5. Actual LORs are matrix dependent. Quoted LORs may be raised where sample extracts are diluted due to interferences.
6. Results are uncorrected for matrix spikes or surrogate recoveries except for PFAS compounds.
7. SVOC analysis on waters is performed on homogenised, unfiltered samples unless noted otherwise.
8. Samples were analysed on an 'as received' basis.
9. Information identified in this report with blue colour indicates data provided by customers that may have an impact on the results.
10. This report replaces any interim results previously issued.

### Holding Times

Please refer to the 'Sample Preservation and Container Guide' for holding times (QS3001).

For samples received on the last day of holding time, notification of testing requirements should have been received at least 6 hours before sample receipt deadlines as stated on the SRA.

If the Laboratory did not receive the information in the required timeframe, and despite any other integrity issues, suitably qualified results may still be reported.

Holding times apply from the date of sampling; therefore, compliance with these may be outside the laboratory's control.

For VOCs containing vinyl chloride, styrene and 2-chloroethyl vinyl ether, the holding time is 7 days; however, for all other VOCs, such as BTEX or C6-10 TRH, the holding time is 14 days.

### Units

| | | |
|---|---|---|
| **mg/kg:** milligrams per kilogram | **mg/L:** milligrams per litre | **ppm:** parts per million |
| **µg/L:** micrograms per litre | **ppb:** parts per billion | **%:** Percentage |
| **org/100 mL:** Organisms per 100 millilitres | **NTU:** Nephelometric Turbidity Units | **MPN/100 mL:** Most Probable Number of organisms per 100 millilitres |
| **CFU:** Colony forming unit | **Colour:** Pt-Co Units | |

### Terms

| | |
|---|---|
| **APHA** | American Public Health Association |
| **CEC** | Cation Exchange Capacity |
| **COC** | Chain of Custody |
| **CP** | Client Parent - QC was performed on samples pertaining to this report |
| **CRM** | Certified Reference Material (ISO17034) - reported as percent recovery. |
| **Dry** | Where moisture has been determined on a solid sample, the result is expressed on a dry weight basis. |
| **Duplicate** | A second piece of analysis from the same sample and reported in the same units as the result to show comparison. |
| **LOR** | Limit of Reporting. |
| **LCS** | Laboratory Control Sample - reported as percent recovery. |
| **Method Blank** | In the case of solid samples, these are performed on laboratory-certified clean sands and in the case of water samples, these are performed on de-ionised water. |
| **NCP** | Non-Client Parent - QC performed on samples not pertaining to this report, QC represents the sequence or batch that client samples were analysed within. |
| **RPD** | Relative Percent Difference between two Duplicate pieces of analysis. |
| **SPIKE** | Addition of the analyte to the sample and reported as percentage recovery. |
| **SRA** | Sample Receipt Advice |
| **Surr - Surrogate** | The addition of a similar compound to the analyte target is reported as percentage recovery. See below for acceptance criteria. |
| **TBTO** | Tributyltin oxide (*bis*-tributyltin oxide) - individual tributyltin compounds cannot be identified separately in the environment; however, free tributyltin was measured, and its values were converted stoichiometrically into tributyltin oxide for comparison with regulatory limits. |
| **TCLP** | Toxicity Characteristic Leaching Procedure |
| **TEQ** | Toxic Equivalency Quotient or Total Equivalence |
| **QSM** | US Department of Defense Quality Systems Manual Version 5.4 |
| **US EPA** | United States Environmental Protection Agency |
| **WA DWER** | Sum of PFBA, PFPeA, PFHxA, PFHpA, PFOA, PFBS, PFHxS, PFOS, 6:2 FTSA, 8:2 FTSA |

### QC - Acceptance Criteria

The acceptance criteria should only be used as a guide and may be different when site-specific Sampling Analysis and Quality Plan (SAQP) have been implemented.

RPD Duplicates: Global RPD Duplicates Acceptance Criteria is ≤30%; however, the following acceptance guidelines are equally applicable:

| | |
|---|---|
| Results <10 times the LOR: | No Limit |
| Results between 10-20 times the LOR: | RPD must lie between 0-50% |
| Results >20 times the LOR: | RPD must lie between 0-30% |

NOTE: pH duplicates are reported as a range, not as RPD

Surrogate Recoveries: Recoveries must lie between 20-130% for Speciated Phenols & 50-150% for PFAS. SVOCs recoveries 20 – 150%, VOC recoveries 70 – 130%

PFAS field samples containing surrogate recoveries above the QC limit designated in QSM 5.4, where no positive PFAS results have been reported or reviewed, and no data was affected.

### QC Data General Comments

1. Where a result is reported as less than (<), higher than the nominated LOR, this is due to either matrix interference, extract dilution required due to interferences or contaminant levels within the sample, high moisture content or insufficient sample provided.
2. Duplicate data shown within this report that states the word "BATCH" is a Batch Duplicate from outside of your sample batch but within the laboratory sample batch at a 1:10 ratio. The Parent and Duplicate data shown are not data from your samples.
3. pH and Free Chlorine analysed in the laboratory - Analysis on this test must begin within 30 minutes of sampling. Therefore, laboratory analysis is unlikely to be completed within holding time.Analysis will begin as soon as possible after sample receipt.
4. Recovery Data (Spikes & Surrogates) - where chromatographic interference does not allow the determination of recovery, the term "INT" appears against that analyte.
5. For Matrix Spikes and LCS results, a dash "-" in the report means that the specific analyte was not added to the QC sample.
6. Duplicate RPDs are calculated from raw analytical data; thus, it is possible to have two sets of data.

**Quality Control Results**

| Test | Units | Result 1 | | | Acceptance Limits | Pass Limits | Qualifying Code |
|---|---|---|---|---|---|---|---|
| **Method Blank** | | | | | | | |
| Chloride | mg/kg | < 5 | | | 5 | Pass | |
| Sulphate (as SO4) | mg/kg | < 30 | | | 30 | Pass | |
| **LCS - % Recovery** | | | | | | | |
| **Actual Acidity (NLM-3.2)** | | | | | | | |
| pH-KCL (NLM-3.1) | % | 99 | | | 80-120 | Pass | |
| **LCS - % Recovery** | | | | | | | |
| **Extractable Sulfur** | | | | | | | |
| HCl Extractable Sulfur | % | 107 | | | 80-120 | Pass | |
| **LCS - % Recovery** | | | | | | | |
| Chloride | % | 112 | | | 70-130 | Pass | |
| Conductivity (1:5 aqueous extract at 25 °C as rec.) | % | 97 | | | 70-130 | Pass | |

| Test | Lab Sample ID | QA Source | Units | Result 1 | | | Acceptance Limits | Pass Limits | Qualifying Code |
|---|---|---|---|---|---|---|---|---|---|
| **Duplicate** | | | | | | | | | |
| **Acid Sulfate Soils Field pH Test** | | | | Result 1 | Result 2 | RPD | | | |
| pH-F (Field pH test)* | M24-Ja0030627 | NCP | pH Units | 7.9 | 7.9 | pass | 20% | Pass | |
| **Duplicate** | | | | | | | | | |
| **Actual Acidity (NLM-3.2)** | | | | Result 1 | Result 2 | RPD | | | |
| pH-KCL (NLM-3.1) | M24-Ja0032476 | CP | pH Units | 7.3 | 7.3 | <1 | 20% | Pass | |
| Titratable Actual Acidity (NLM-3.2) | M24-Ja0032476 | CP | mol H+/t | < 2 | < 2 | <1 | 20% | Pass | |
| Titratable Actual Acidity (NLM-3.2) | M24-Ja0032476 | CP | % pyrite S | < 0.003 | < 0.003 | <1 | 30% | Pass | |
| **Duplicate** | | | | | | | | | |
| **Potential Acidity - Titratable Peroxide** | | | | Result 1 | Result 2 | RPD | | | |
| pH-OX | M24-Ja0032476 | CP | pH Units | 3.0 | 3.0 | <1 | 20% | Pass | |
| Titratable Peroxide Acidity (s-TPA) | M24-Ja0032476 | CP | % pyrite S | < 0.02 | < 0.02 | <1 | 30% | Pass | |
| Titratable Peroxide Acidity (a-TPA) | M24-Ja0032476 | CP | mol H+/t | < 2 | < 2 | <1 | 20% | Pass | |
| Titratable Sulfidic Acidity (a-TSA) | M24-Ja0032476 | CP | mol H+/t | < 2 | < 2 | <1 | 30% | Pass | |
| Titratable Sulfidic Acidity (s-TSA) | M24-Ja0032476 | CP | % pyrite S | < 0.02 | < 0.02 | <1 | 30% | Pass | |
| **Duplicate** | | | | | | | | | |
| **Extractable Sulfur** | | | | Result 1 | Result 2 | RPD | | | |
| Sulfur - KCl Extractable | M24-Ja0032476 | CP | % S | 0.019 | 0.019 | 1.8 | 30% | Pass | |
| Peroxide Extractable Sulfur | M24-Ja0032476 | CP | % S | 0.086 | 0.087 | <1 | 20% | Pass | |
| HCl Extractable Sulfur | M24-Ja0032476 | CP | % S | N/A | N/A | N/A | 20% | Pass | |
| **Duplicate** | | | | | | | | | |
| **Potential Acidity (SPOS)** | | | | Result 1 | Result 2 | RPD | | | |
| Peroxide Oxidisable Sulfur (s-SPOS) (NLM 2.2) | M24-Ja0032476 | CP | % S | 0.067 | 0.068 | 1.3 | 30% | Pass | |
| Peroxide Oxidisable Sulfur (a-SPOS) (NLM 2.2) | M24-Ja0032476 | CP | mol H+/t | 42 | 42 | 1.3 | 30% | Pass | |
| **Duplicate** | | | | | | | | | |
| **Retained Acidity (S-NAS)** | | | | Result 1 | Result 2 | RPD | | | |
| Net Acid soluble sulfur (s-SNAS) NLM-4.1 | M24-Ja0032476 | CP | % S | N/A | N/A | N/A | 30% | Pass | |
| Net Acid soluble sulfur (a-SNAS) NLM-4.1 | M24-Ja0032476 | CP | mol H+/t | N/A | N/A | N/A | 30% | Pass | |
| **Duplicate** | | | | | | | | | |
| **Extractable Calcium** | | | | Result 1 | Result 2 | RPD | | | |
| Calcium - KCl Extractable | M24-Ja0032476 | CP | % Ca | 0.031 | 0.031 | <1 | 30% | Pass | |
| Calcium - Peroxide | M24-Ja0032476 | CP | % Ca | 0.035 | 0.034 | 2.9 | 20% | Pass | |
| Calcium - Acid Reacted | M24-Ja0032476 | CP | % Ca | < 0.005 | < 0.005 | <1 | 30% | Pass | |
| Calcium - Acid Reacted (s-aCa) | M24-Ja0032476 | CP | % S | < 0.005 | < 0.005 | <1 | 30% | Pass | |
| Calcium - Acid Reacted (a-aCa) | M24-Ja0032476 | CP | mol H+/t | < 0.005 | < 0.005 | <1 | 30% | Pass | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Duplicate** | | | | | | | | | |
| **Extractable Magnesium** | | | | Result 1 | Result 2 | RPD | | | |
| Magnesium - KCl Extractable | M24-Ja0032476 | CP | % Mg | 0.008 | 0.008 | <1 | 30% | Pass | |
| Magnesium - Peroxide | M24-Ja0032476 | CP | % Mg | 0.009 | 0.009 | 1.9 | 20% | Pass | |
| Magnesium - Acid Reacted | M24-Ja0032476 | CP | % Mg | < 0.005 | < 0.005 | <1 | 30% | Pass | |
| Magnesium - Acid Reacted (s-aCa) | M24-Ja0032476 | CP | % S | < 0.005 | < 0.005 | <1 | 30% | Pass | |
| Magnesium - Acid Reacted (a-aCa) | M24-Ja0032476 | CP | mol H+/t | < 0.005 | < 0.005 | <1 | 30% | Pass | |
| **Duplicate** | | | | | | | | | |
| **Acid Neutralising Capacity (ANCE)** | | | | Result 1 | Result 2 | RPD | | | |
| Acid Neutralising Capacity - (ANCE) | M24-Ja0032476 | CP | % CaCO3 | N/A | N/A | N/A | 30% | Pass | |
| Acid Neutralising Capacity - (a-ANCE) | M24-Ja0032476 | CP | mol H+/t | n/a | n/a | N/A | 30% | Pass | |
| **Duplicate** | | | | | | | | | |
| **Acid Neutralising Capacity (ANCbt)** | | | | Result 1 | Result 2 | RPD | | | |
| ANC Fineness Factor | M24-Ja0032476 | CP | factor | 1.5 | 1.5 | <1 | 30% | Pass | |
| **Duplicate** | | | | | | | | | |
| **Net Acidity (Including ANC)** | | | | Result 1 | Result 2 | RPD | | | |
| SPOCAS - Net Acidity - ASSMAC (Acidity Units) | M24-Ja0032476 | CP | mol H+/t | 14 | 14 | 1.3 | 30% | Pass | |
| SPOCAS - Net Acidity - ASSMAC (Sulfur Units) | M24-Ja0032476 | CP | % S | 0.02 | 0.02 | 1.3 | 30% | Pass | |
| SPOCAS - Liming rate - ASSMAC | M24-Ja0032476 | CP | kg CaCO3/t | 1.0 | 1.1 | 1.3 | 30% | Pass | |
| **Duplicate** | | | | | | | | | |
| | | | | Result 1 | Result 2 | RPD | | | |
| Chloride | M24-Ja0032478 | CP | mg/kg | 94 | 93 | <1 | 30% | Pass | |
| Conductivity (1:5 aqueous extract at 25 °C as rec.) | M24-Ja0032374 | NCP | uS/cm | 130 | 140 | 7.0 | 30% | Pass | |
| pH (1:5 Aqueous extract at 25 °C as rec.) | M24-Ja0032374 | NCP | pH Units | 5.9 | 5.9 | pass | 30% | Pass | |
| Resistivity* | M24-Ja0032374 | NCP | ohm.m | 79 | 74 | 7.0 | 30% | Pass | |
| Sulphate (as SO4) | M24-Ja0032478 | CP | mg/kg | < 30 | < 30 | <1 | 30% | Pass | |
| **Duplicate** | | | | | | | | | |
| **Sample Properties** | | | | Result 1 | Result 2 | RPD | | | |
| % Moisture | M24-Ja0031657 | NCP | % | 14 | 15 | 4.7 | 30% | Pass | |

## Comments

## Sample Integrity

| | |
|---|---|
| Custody Seals Intact (if used) | N/A |
| Attempt to Chill was evident | Yes |
| Sample correctly preserved | Yes |
| Appropriate sample containers have been used | Yes |
| Sample containers for volatile analysis received with minimal headspace | Yes |
| Samples received within HoldingTime | Yes |
| Some samples have been subcontracted | No |

## Qualifier Codes/Comments

| Code | Description |
|---|---|
| S02 | Retained Acidity is Reported when the pHKCl is less than pH 4.5 |
| S05 | Field Screen uses the following fizz rating to classify the rate the samples reacted to the peroxide: 1.0; No reaction to slight. 2.0; Moderate reaction. 3.0; Strong reaction with persistent froth. 4.0; Extreme reaction. |

## Authorised by:

| | |
|---|---|
| Amy Meunier | Analytical Services Manager |
| Jonathon Angell | Senior Analyst-SPOCAS |
| Mary Makarios | Senior Analyst-Inorganic |
| Mary Makarios | Senior Analyst-Sample Properties |

**Glenn Jackson**
**Managing Director**

Final Report – this report replaces any previously issued Report

- Indicates Not Requested

* Indicates NATA accreditation does not cover the performance of this service

Measurement uncertainty of test data is available on request or please click here.

# APPENDIX C DESIGN DRAWINGS

# LOCH SPORT EROSION PROTECTION


LOCALITY PLAN
NOT TO SCALE

| DRAWING INDEX | |
|---|---|
| DRAWING No. | TITLE |
| 250094-CST-DRG-001 | COVER SHEET, LOCALITY PLAN & DRAWING INDEX |
| 250094-CST-DRG-002 | GENERAL NOTES |
| | |
| 250094-CST-DRG-011 | GROYNE GENERAL ARRANGEMENT PLAN |
| 250094-CST-DRG-012 | BEACH NOURISHMENT PLAN |
| | |
| 250094-CST-DRG-021 | TYPICAL SECTIONS AND ELEVATIONS |

| Rev. | Date | Description | Des. | Verif. | Appd. |
|---|---|---|---|---|---|
| C | 04.09.2025 | ISSUED FOR TENDER | TS | AWP | AWP |
| B | 29.08.2025 | ISSUED FOR TENDER - DRAFT | TS | AWP | AWP |
| A | 04.08.2025 | DETAILED DESIGN - LOCH SPORT EROSION PROTECTION | TS | AWP | AWP |

VICTORIA State Government | Energy, Environment and Climate Action

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| | | | |
|---|---|---|---|
| Drawn | LP | Date | 04.08.2025 |
| Checked | TS | Date | 04.08.2025 |
| Designed | TS | Date | 04.08.2025 |
| Verified | AWP | Date | 04.08.2025 |
| Approved | AWP | Date | 04.08.2025 |

Client: DEPARTMENT OF ENERGY, ENVIRONMENT AND CLIMATE ACTION - VICTORIA
Project: LOCH SPORT EROSION PROTECTION
Title: COVER SHEET, LOCALITY PLAN AND DRAWING INDEX
Status: ISSUED FOR TENDER
NOT TO BE USED FOR CONSTRUCTION PURPOSES
DATUM: AHD | Scale: N.T.S | Size: A3
Drawing Number: 250094-CST-DRG-001 | Revision: C

## GENERAL NOTES:

1. THESE DRAWINGS SHALL BE READ IN CONJUNCTION WITH THE CONTRACT CONDITIONS AND WITH SUCH OTHER WRITTEN INSTRUCTIONS AS MAY BE ISSUED DURING THE COURSE OF THE CONTRACT.
2. IN THE EVENT OF ANY INCONSISTENCIES, THE FOLLOWING DOCUMENT HIERARCHY SHOULD BE FOLLOWED,
    1. DESIGN DRAWINGS (THIS DOCUMENT)
    2. TECHNICAL SPECIFICATION (250094 – LOCH SPORT EROSION PROTECTION - TECHNICAL SPECIFICATION)
    3. RELEVANT MANUFACTURERS SPECIFICATIONS.
3. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS STATED OTHERWISE.
4. ALL LEVELS ARE WITH RESPECT TO AUSTRALIAN HEIGHT DATUM (AHD).
5. ALL DATUMS ARE WITH RESPECT TO GEOCENTRIC DATUM OF AUSTRALIA 2020 (GDA 2020).
6. DIMENSIONS SHALL NOT BE OBTAINED BY SCALING THE DRAWINGS.
7. ALL DIMENSIONS RELEVANT TO SETTING OUT SHALL BE CONFIRMED AND VERIFIED BY THE CONTRACTOR BEFORE CONSTRUCTION IS COMMENCED. THE CONTRACTOR SHALL REPORT ANY DISCREPANCIES.
8. ALL EXISTING SERVICES LOCATIONS IN SO FAR AS THOSE THAT COULD BE IMPACTED IN THE COURSE OF CARRYING OUT THE WORKS OR ANY ASSOCIATED ACTIVITY SHALL BE VERIFIED ON SITE BY THE CONTRACTOR BEFORE COMMENCING ANY ACTIVITY.
9. PRIOR TO ANY DEMOLITION, EXCAVATION OR CONSTRUCTION ON SITE, THE CONTRACTOR SHALL CONTACT THE RELEVANT AUTHORITIES TO ASCERTAIN THE POSSIBLE LOCATION OF FURTHER SERVICES AND DETAILED LOCATION AND DEPTH OF ALL SERVICES AND ARRANGE FOR THEIR RELOCATION WHERE NECESSARY.
10. THE CONTRACTOR SHALL MAINTAIN ALL WORK SITES IN A SAFE AND STABLE CONDITION.
11. WORKMANSHIP AND MATERIALS ARE TO BE IN ACCORDANCE WITH THE RELEVANT STANDARDS PLUS LOCAL STATUTORY AUTHORITIES' REQUIREMENTS, EXCEPT WHERE VARIED BY THE CONTRACT DOCUMENTS.
12. NOMINATION OF PROPRIETARY ITEMS DOES NOT INDICATE EXCLUSIVE PREFERENCE BUT INDICATES THE REQUIRED PROPERTIES OF THE ITEM, SIMILAR ALTERNATIVES HAVING THE REQUIRED PROPERTIES MAY BE OFFERED FOR APPROVAL. INSTALL PROPRIETARY ITEMS IN ACCORDANCE WITH THE MANUFACTURER'S SPECIFICATIONS. REFER ANY DISCREPANCY TO THE SUPERINTENDENT BEFORE PROCEEDING WITH THE WORK.
13. THE WORKS ARE SHOWN AS SEPARABLE PORTIONS OF WORK, IDENTIFIED HEREIN AS STAGES (EG. STAGE 1, 2, 3, 4). THE SCOPE OF STAGES TO BE DELIVERED UNDER THE CURRENT CONTRACT WILL BE DEFINED IN THE CONTRACT AND/OR TENDER DOCUMENTS AND MAY INCLUDE PORTIONS OF A STAGE, AN ENTIRE STAGE OR MULTIPLE STAGES.
14. THE CONTRACTOR SHALL SUBMIT AND COMPLY WITH A CONSTRUCTION ENVIRONMENTAL MANAGEMENT PLAN ADDRESSING, AT A MINIMUM, MANAGEMENT OF ACID SULPHATE SOIL, EROSION, TURBIDITY, DUST, FLORA/FAUNA PROTECTION AND RELATED ENVIRONMENTAL RISKS, CONSISTENT WITH THE TECHNICAL SPECIFICATION.

## LOCATION NOTES

1. LOCH SPORT TIDAL DATUMS HAVE BEEN APPROXIMATED FROM AVAILABLE INFORMATION. NO FORMAL TIDE DATA IS AVAILABLE FOR THE AREA.
2. LOCH SPORT TIDAL DATUMS:
    - MEAN HIGH WATER (MHW) 0.55m (AHD)
    - MEAN LOW WATER (MLW) 0.1m (AHD)
    - 2100 SEA LEVEL RISE (SLR) 0.8m

## GEOTEXTILE:

1. GEOTEXTILE FABRIC SHALL BE TEXCEL 600R OR APPROVED EQUIVALENT.
2. THE FABRIC SHALL BE A NON-WOVEN PRODUCT CONSTRUCTED BY NEEDLE PUNCHING VIRGIN STAPLE FIBRES OF POLYPROPYLENE.
3. GEOTEXTILE CONSTRUCTED FROM FIBRES OF MORE THAN ONE POLYMER WILL NOT BE PERMITTED.
4. ALL GEOTEXTILE USED SHALL BE MARKED WITH MANUFACTURING CHARACTERISTICS AS STATED IN AS 3705. ANY CERTIFICATION OF TESTING USING THE METHODS STATED IN AS 3705 SHALL ALSO BE OBTAINED.
5. THE CONTRACTOR SHALL SUBMIT TO THE SUPERINTENDENT FOR APPROVAL A SAMPLE OF THE PROPOSED GEOTEXTILE, OF MINIMUM SIZE 300mm x 300mm, TOGETHER WITH A MATERIAL PROPERTY DATA SHEET, IF A GEOTEXTILE OTHER THAN TEXCEL 600R IS PROPOSED.
6. THE DATA SHEET SHALL BE SUBSTANTIATED BY INDEX AND PERFORMANCE COMPLIANCE CERTIFICATES CERTIFIED BY AN ACCREDITED GEOTEXTILE FABRIC TESTING ORGANISATION.
7. GEOTEXTILES SHALL BE DELIVERED TO SITE AND STORED IN SUCH A MANNER WHICH PROTECTS THE ROLLS FROM DEGRADATION OR OTHER DAMAGE.
8. GEOTEXTILE SHALL BE INSTALLED IN ACCORDANCE WITH THE MANUFACTURE'S INSTRUCTIONS WITH A MINIMUM 1000mm OVERLAP AT JOINTS.
9. GEOTEXTILE SHALL BE LAID WITH ITS LONGITUDINAL AXIS DOWN THE SLOPE WITHOUT JOINTS.
10. GEOTEXTILE SHALL BE LAID TO THE LINES AND LEVELS DESCRIBED ON THE DESIGN DRAWINGS.
11. PRIOR TO PLACEMENT OF GEOTEXTILE, THE SURFACE IS TO BE SCREED TO MINIMISE SURFACE IRREGULARITIES AND SHARP OBJECTS THAT MAY CAUSE DAMAGE TO THE FABRIC.
12. CONSTRUCTION PLANT MUST NOT OPERATE OVER THE GEOTEXTILE.
13. CONTRACTOR SHALL ENSURE SUFFICIENT CARE IS TAKEN TO PREVENT DAMAGE TO THE GEOTEXTILE DURING THE PLACEMENT OF ALL ROCK.

## ROCK WORKS:

1. ROCK SHALL CONSIST OF MATERIAL WHICH COMPLIES WITH THESE NOTES AND THE SPECIFICATIONS.
2. THE CONTRACTOR SHALL SUPPLY A METHOD STATEMENT DETAILING THEIR PROPOSED METHOD OF ROCK PLACEMENT AND CONTROL FOR APPROVAL BY THE SUPERINTENDENT. THE METHOD OF ROCK PLACEMENT SHALL BE SUCH AS TO:
   (A) MINIMISE ITS BREAKDOWN ON HANDLING AND PRODUCTION OF FINES.
   (B) MINIMISE THE SEGREGATION OF VARIOUS GRADES OF ROCK.
   (C) RESTRICT WATER CONTAMINATION.
3. THE CONTRACTOR SHALL PROVIDE DETAILED PETROLOGICAL DESCRIPTIONS OF ALL ROCK TYPES AND SHALL SUBMIT TO THE SUPERINTENDENT FOR APPROVAL TEST RESULTS FOR THE PROPOSED SOURCE FROM AN INDEPENDENT LABORATORY, DEMONSTRATING COMPLIANCE WITH THE FOLLOWING CRITERIA. THE SUBMISSION SHALL INCLUDE THE PROPOSED MASS GRADING DISTRIBUTIONS, DEMONSTRATING COMPLIANCE WITH THE MINIMUM VALUES SHOWN IN THE ROCK GRADATION TABLE BELOW.
4. ROCK TYPE AND INTEGRITY
   4.1. ROCK ARMOUR SHALL BE IGNEOUS ROCK ONLY.
   4.2. INDIVIDUAL ROCKS SHALL BE ROUGH AND ANGULAR.
   4.3. INDIVIDUAL ROCKS SHALL BE FREE FROM CRACKS, CLEAVAGE PLANES, SEAM AND DEFECTS WHICH WOULD RESULT IN THE BREAKDOWN OF THE ROCK IN A MARITIME ENVIRONMENT.
   4.4. ROCKS SHALL BE FREE FROM VISUALLY OBSERVABLE CRACKS, VEINS, FISSURES, SHALE LAYERS, STYLOLITE SEAMS, LAMINATIONS, FOLIATION PLANES, CLEAVAGE PLANES, UNIT CONTACTS OR OTHER SUCH FLAWS WHICH COULD LEAD TO BREAKAGE DURING LOADING, UNLOADING OR PLACING.
5. MATERIAL PROPERTIES
   5.1. DRY DENSITY
   ROCK SHALL HAVE A MINIMUM DRY DENSITY OF 2600 kg/m$^3$.
   5.2. MINERALOGICAL CONTENT
   ROCK SHALL HAVE NO MORE THAN 10% (BY VOLUME) OLIVINE MATERIAL AND SHALL EXHIBIT NO ZONES OF SECONDARY ALTERATION SUCH AS CHLORITISATION.
   5.3. SHAPE RATIO
   THE RATIO OF THE MAXIMUM DIMENSION TO THE MINIMUM DIMENSION, MEASURED AT RIGHT ANGLES TO THE MAXIMUM DIMENSION, SHALL NOT EXCEED 2.5. TESTING FOR SHAPE RATIO DETERMINATION SHALL BE UNDERTAKEN ON SAMPLES OF AT LEAST 50 PIECES TAKEN AT RANDOM FROM ROCK OF MASS M15 OR GREATER.
   5.4. MASS GRADING
   THE MINIMUM ROCK MASS AND GRADATION VALUES SHALL BE AS SHOWN IN THE ROCK GRADATION TABLE SHOWN IN THESE NOTES. THESE VALUES REPRESENT MINIMUM SPECIFIED REQUIREMENTS FOR ACCEPTANCE. MASS GRADING SHALL BE DETERMINED BY WEIGHING OF INDIVIDUAL PIECES IN ACCORDANCE WITH THE METHODS OF EN 13383-2:2002. WEIGHING SCALES MAY BE USED ON SITE OR IN THE QUARRY, PROVIDED THEY MEET THE EN 13383 REQUIREMENTS ON PRECISION.
   5.5. THE STRENGTH OF THE ROCK SHALL SATISFY EITHER:
   (A) THE SATURATED POINT LOAD STRENGTH INDEX SHALL NOT BE LESS THAN 5.0 MPA, OR
   (B) THE WET UNCONFINED UNIAXIAL COMPRESSIVE STRENGTH SHALL BE GREATER THAN 100 MPA FOR 90% OF THE ROCK SAMPLED.
   5.6. WATER ABSORPTION
   THE AVERAGE WATER ABSORPTION SHALL BE NO MORE THAN 1.5 PERCENT WITH 90% OF THE ROCKS HAVING A WATER ABSORPTION LESS THAN 2.5% TESTED AND REPORTED IN ACCORDANCE WITH AS 1141.6.1.
   5.7. RESISTANCE TO WEATHERING
   SODIUM SULPHATE SOUNDNESS SHALL BE LESS THAN 5% FOR 90% OF ROCK SAMPLED. SAMPLE TESTING AND REPORTING SHALL BE IN ACCORDANCE WITH AS 1141.24.
   IF THE ROCK IS BASALTIC, THERE SHALL BE NO OCCURRENCES OF THE SONNENBRAND EFFECT IN THE FIRST 20 ROCKS TESTED OR NO MORE THAN ONE OCCURRENCE IN THE FIRST TWO ROCKS TESTED WHEN SAMPLED, TESTED AND REPORTED IN ACCORDANCE WITH EN 13383.
   5.8. ABRASION RESISTANCE
   WHEN TESTED IN ACCORDANCE WITH AS 1141.23, THE LOS ANGELES ABRASION VALUE SHALL BE LESS THAN 30% FOR 90% OF THE ROCK SAMPLED.
6. ROCK PLACEMENT
   6.1. ROCK SHALL BE PLACED SUCH THAT THE SPECIFIED REQUIREMENTS FOR MASS (MAXIMUM, MINIMUM AND 50% OR MEDIAN), FINISHED SIDE SLOPES, CREST AND TOE LEVELS, LAYER THICKNESSES AND DENSITY REQUIREMENTS ARE SATISFIED.
   6.2. IN ADDITION, ROCKS SHALL BE WEDGED AND LOCKED TOGETHER SUCH THAT THEY ARE NOT FREE TO MOVE. ARMOUR STONE SHALL NOT BE ROLLED OR DROPPED INTO POSITION; IT SHALL BE PLACED.

| CLASS | DRY WEIGHT (kg) | | | | | NOMINAL DIAMETER (mm) |
|---|---|---|---|---|---|---|
| | $M_{min}$ | $M_{15}$ | $M_{50}$ | $M_{85}$ | $M_{max}$ | $D_{n50}$ |
| I | 20 | 40 | 70 | 100 | 165 | 300 |

## BEACH NOURISHMENT WORKS:

1. SAND FOR BEACH NOURISHMENT SHALL BE IMPORTED OR LOCALLY WON FROM AN APPROVED BORROW SITE AS DIRECTED BY THE SUPERINTENDENT.
2. SAND MATERIAL, SAMPLING AND TESTING SHALL COMPLY WITH THE TECHNICAL SPECIFICATION.
3. ALL SET-OUT POINTS SHALL BE CONFIRMED ON SITE AND APPROVED BY THE SUPERINTENDENT PRIOR TO COMMENCEMENT. THE NOURISHED PROFILE SHALL COMMENCE ALONG THE 1.0m AHD CONTOUR FOR THE FULL ALIGNMENT AND BE GRADED TO A SMOOTH SURFACE.
4. THE CONTRACTOR SHALL CONSTRUCT THE NOURISHED BEACH TO THE DESIGN BEACH BERM LEVEL, WIDTH AND SLOPE SHOWN ON THE DRAWINGS, WITHIN TOLERANCES AS PER THE TECHNICAL SPECIFICATION.
5. TRANSITIONS AT GROYNES, FLANKS AND LANDWARD TIE-INS SHALL BE SMOOTH, WITH NO ABRUPT STEPS OR DEPRESSIONS.
6. NOURISHMENT IS SHOWN IN STAGES AND NUMBERED CELLS. THE STAGES AND CELLS TO BE DELIVERED UNDER THIS CONTRACT WILL BE DEFINED IN THE CONTRACT DOCUMENTS.

| Rev. | Date | Description | Des. | Verif. | Appd. |
|---|---|---|---|---|---|
| C | 04.09.2025 | ISSUED FOR TENDER | TS | AWP | AWP |
| B | 29.08.2025 | ISSUED FOR TENDER - DRAFT | TS | AWP | AWP |
| A | 04.08.2025 | DETAILED DESIGN - LOCH SPORT EROSION PROTECTION | TS | AWP | AWP |

VICTORIA State Government | Energy, Environment and Climate Action

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Phone: 1300 372 477
Email: range@fscgroup.com.au
Web: www.fscgroup.com.au

| | | | |
|---|---|---|---|
| Drawn LP | Date 04.08.2025 | Client | DEPARTMENT OF ENERGY, ENVIRONMENT AND CLIMATE ACTION - VICTORIA |
| Checked TS | Date 04.08.2025 | Project | LOCH SPORT EROSION PROTECTION |
| Designed TS | Date 04.08.2025 | Status | ISSUED FOR TENDER<br>NOT TO BE USED FOR CONSTRUCTION PURPOSES |
| Verified AWP | Date 04.08.2025 | Title | GENERAL NOTES |
| Approved AWP | Date 04.08.2025 | DATUM AHD / Scale N.T.S / Size A3 | Drawing Number 250094-CST-DRG-002 / Revision C |

| LEGEND | |
|---|---|
| PROPOSED STAGE 1 GROYNE STRUCTURE | |
| PROPOSED STAGE 2 GROYNE EXTENSION | |
| FENCE | |
| TOE OF BANK | |
| EDGE OF BITUMEN | |
| CONTOURS | -0.5 |

**STAGE 1 (SHORT GROYNES) SETOUT POINTS**

| GROYNE NUMBER | POINT NUMBER | EASTING | NORTHING | EXISTING RL (AHD) | FINISHED GROYNE RL (AHD) |
|---|---|---|---|---|---|
| 1 | SOP-1 | 552072.615 | 5790135.490 | 0.7m | 1.25m |
| | SOP-2 | 552061.612 | 5790147.107 | -0.7m | 0.5m |
| 2 | SOP-3 | 552114.280 | 5790144.520 | 0.8m | 1.25m |
| | SOP-4 | 552103.039 | 5790155.911 | -0.7m | 0.5m |
| 3 | SOP-5 | 552150.891 | 5790161.918 | 0.4m | 1.25m |
| | SOP-6 | 552140.024 | 5790173.576 | -0.5m | 0.5m |
| 4 | SOP-7 | 552187.254 | 5790181.245 | 0.7m | 1.25m |
| | SOP-8 | 552176.830 | 5790192.120 | -0.5m | 0.5m |
| 5 | SOP-9 | 552225.930 | 5790192.720 | 0.2m | 1.25m |
| | SOP-10 | 552216.333 | 5790204.238 | -0.6m | 0.5m |

**STAGE 2 (GROYNE EXTENSION) SETOUT POINTS**

| GROYNE NUMBER | POINT NUMBER | EASTING | NORTHING | EXISTING RL (AHD) | FINISHED GROYNE RL (AHD) |
|---|---|---|---|---|---|
| 1 | SOP-2 | 552061.612 | 5790147.107 | -0.7m | 1.25m |
| | SOP-11 | 552054.741 | 5790154.372 | -0.8m | 0.5m |
| 2 | SOP-4 | 552103.039 | 5790155.911 | -0.7m | 1.25m |
| | SOP-12 | 552095.988 | 5790163.025 | -0.8m | 0.5m |
| 3 | SOP-6 | 552140.024 | 5790173.576 | -0.5m | 1.25m |
| | SOP-13 | 552133.271 | 5790180.958 | -0.7m | 0.5m |
| 4 | SOP-8 | 552176.830 | 5790192.120 | -0.5m | 1.25m |
| | SOP-14 | 552169.935 | 5790199.394 | -0.8m | 0.5m |
| 5 | SOP-10 | 552216.333 | 5790204.238 | -0.6m | 1.25m |
| | SOP-15 | 552209.917 | 5790211.931 | -0.8m | 0.5m |


NOTE:
1. AERIAL IMAGERY AND SURVEY DATA FROM GIPPSLAND PORTS, DATED 18/06/2025.
2. THIS IS A DYNAMIC AREA AND GROUND LEVELS MAY HAVE CHANGED SINCE SURVEY. CONTRACTOR TO CONFIRM LEVELS ON SITE PRIOR TO CONSTRUCTION.
3. CONTRACTOR TO VERIFY SET OUT POINTS ON SITE AND OBTAIN SUPERINTENDENT'S APPROVAL PRIOR TO COMMENCEMENT OF CONSTRUCTION.
4. LANDWARD GROYNE TOE TO BE POSITIONED AT TOE OF BANK.

## GROYNE GENERAL ARRANGEMENT PLAN

SCALE 1:1000

0 20 40m

SCALE 1:1000 @ A3

| Rev. | Date | Description | Des. | Verif. | Appd. |
|---|---|---|---|---|---|
| C | 04.09.2025 | ISSUED FOR TENDER | TS | AWP | AWP |
| B | 29.08.2025 | ISSUED FOR TENDER - DRAFT | TS | AWP | AWP |
| A | 04.08.2025 | DETAILED DESIGN - LOCH SPORT EROSION PROTECTION | TS | AWP | AWP |

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| | | | |
|---|---|---|---|
| Drawn LP | Date 04.08.2025 | Client | DEPARTMENT OF ENERGY, ENVIRONMENT AND CLIMATE ACTION - VICTORIA |
| Checked TS | Date 04.08.2025 | Project | LOCH SPORT EROSION PROTECTION |
| Designed TS | Date 04.08.2025 | | |
| Verified AWP | Date 04.08.2025 | Title | GROYNE GENERAL ARRANGEMENT PLAN |
| Approved AWP | Date 04.08.2025 | | |

| | | | |
|---|---|---|---|
| Status | ISSUED FOR TENDER<br>NOT TO BE USED FOR CONSTRUCTION PURPOSES | | |
| DATUM AHD | | Scale 1:1000 | Size A3 |
| Drawing Number 250094-CST-DRG-011 | | | Revision C |

| LEGEND | |
|---|---|
| PROPOSED STAGE 1 GROYNE STRUCTURE | |
| PROPOSED STAGE 2 GROYNE EXTENSION | |
| FENCE | |
| TOE OF BANK | |
| EDGE OF BITUMEN | |
| CONTOURS | 0.5 |
| BEACH NOURISHMENT STAGE 3 | |
| BEACH NOURISHMENT STAGE 4 EXTENSION | |

## STAGE 3 - BEACH NOURISHMENT

| POINT NUMBER | EASTING | NORTHING | EXISTING RL (AHD) |
|---|---|---|---|
| SOP-A | 552026.652 | 5790134.663 | 1.0m |
| SOP-B | 552250.838 | 5790198.594 | 1.0m |
| REFER TO NOTE 3 AND 4 | | | |


NOTE:
1. AERIAL IMAGERY AND SURVEY DATA FROM GIPPSLAND PORTS, DATED 18/06/2025.
2. THIS IS A DYNAMIC AREA AND GROUND LEVELS MAY HAVE CHANGED SINCE SURVEY. CONTRACTOR TO CONFIRM LEVELS ON SITE PRIOR TO CONSTRUCTION.
3. CONTRACTOR TO VERIFY SET OUT POINTS ON SITE AND OBTAIN SUPERINTENDENT'S APPROVAL PRIOR TO COMMENCEMENT OF CONSTRUCTION.
4. THE NOURISHED PROFILE SHALL COMMENCE ALONG THE 1.0m AHD CONTOUR FOR THE FULL ALIGNMENT.
5. NOURISHMENT IS SHOWN AS SEPARABLE PORTIONS OF WORK AS STAGES AND NUMBERED GROYNE COMPARTMENTS (CELLS). THE SCOPE OF STAGES AND CELLS TO BE DELIVERED UNDER THIS CONTRACT WILL BE DEFINED IN THE CONTRACT DOCUMENTS. FOR SCOPE DEFINITION, PRIORITY SHALL BE GIVEN TO THE EASTERNMOST CELLS, WITH ADDITIONAL CELLS TO THE WEST INCLUDED AS BUDGET ALLOWS.

## BEACH NOURISHMENT PLAN
SCALE 1:1000

0 20 40m
SCALE 1:1000 @ A3

| Rev. | Date | Description | Des. | Verif. | Appd. |
|---|---|---|---|---|---|
| B | 04.09.2025 | ISSUED FOR TENDER | TS | AWP | AWP |
| A | 29.08.2025 | ISSUED FOR TENDER - DRAFT | TS | AWP | AWP |

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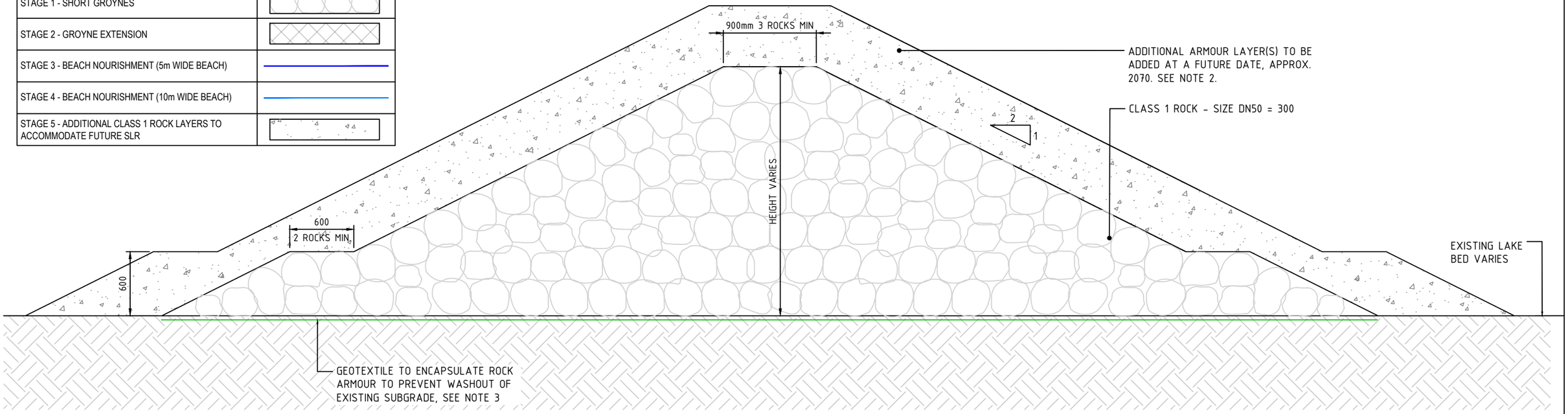
| | | | |
|---|---|---|---|
| Drawn | LP | Date | 04.08.2025 |
| Checked | TS | Date | 04.08.2025 |
| Designed | TS | Date | 04.08.2025 |
| Verified | AWP | Date | 04.08.2025 |
| Approved | AWP | Date | 04.08.2025 |

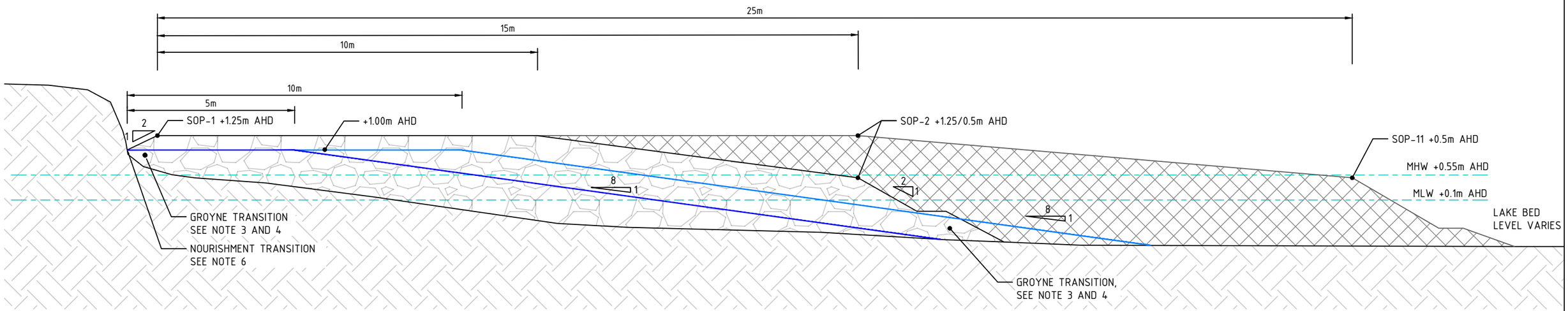
Client: DEPARTMENT OF ENERGY, ENVIRONMENT AND CLIMATE ACTION - VICTORIA
Project: LOCH SPORT EROSION PROTECTION
Title: BEACH NOURISHMENT PLAN
Status: ISSUED FOR TENDER
NOT TO BE USED FOR CONSTRUCTION PURPOSES
DATUM: AHD | Scale: 1:1000 | Size: A3
Drawing Number: 250094-CST-DRG-012 | Revision: B

DATE PLOTTED: 4 September 2025 2:02 PM BY : LINDSAY POLKINGHORNE
BY : LP

| LEGEND | |
|---|---|
| STAGE 1 - SHORT GROYNES | |
| STAGE 2 - GROYNE EXTENSION | |
| STAGE 3 - BEACH NOURISHMENT (5m WIDE BEACH) | |
| STAGE 4 - BEACH NOURISHMENT (10m WIDE BEACH) | |
| STAGE 5 - ADDITIONAL CLASS 1 ROCK LAYERS TO ACCOMMODATE FUTURE SLR | |




SECTION VIEW




ELEVATION VIEW

NOTES:

1. GROYNE STRUCTURES ARE SHOWN IN TWO STAGES: STAGE 1 (SHORT GROYNES) AND STAGE 2 (EXTENDED GROYNES). THIS DRAWING ILLUSTRATES THE FULL DESIGN INTENT; HOWEVER, THE STAGES TO BE CONSTRUCTED UNDER THIS CONTRACT WILL BE AS DEFINED IN THE CONTRACT DOCUMENTS.
2. ADDITIONAL LAYERS TO BE ADDED AT A FUTURE DATE TO ACCOMMODATE SEA LEVEL RISE. INCREASE IN CREST HEIGHT TO MATCH SEA LEVEL RISE SINCE CONSTRUCTION DATE. DIMENSIONS, INCLUDING CREST AND TOE WIDTHS, PROFILES, SLOPES, AND MATERIALS TO BE CONSISTENT WITH THESE DRAWINGS AND CONTRACT DOCUMENTATION.
3. ENSURE GEOTEXTILE IS ADEQUATELY CONCEALED UPON COMPLETION.
4. GROYNE TO TRANSITION TO EXISTING TOE OF BANK AND LAKE BED. SLOPE AND TOE DETAIL AT TRANSITIONS ARE CONSISTENT WITH CROSS SECTION VIEW.
5. BEACH NOURISHMENT IS SHOWN IN TWO STAGES: STAGE 1 (5m WIDE BEACH) AND STAGE 2 (10m WIDE BEACH). THIS DRAWING SHOWS THE FULL DESIGN INTENT; HOWEVER, THE SCOPE OF STAGES TO BE CONSTRUCTED UNDER THIS CONTRACT WILL BE AS DEFINED IN THE CONTRACT DOCUMENTS.
6. BEACH NOURISHMENT TO COMMENCE AT THE EXISTING 1.0m AHD CONTOUR, TO TRANSITION SMOOTHLY TO THE EXISTING ELEVATION.

| Rev. | Date | Description | Des. | Verif. | Appd. |
|---|---|---|---|---|---|
| C | 04.09.2025 | ISSUED FOR TENDER | TS | AWP | AWP |
| B | 29.08.2025 | ISSUED FOR TENDER - DRAFT | TS | AWP | AWP |
| A | 04.08.2025 | DETAILED DESIGN - LOCH SPORT EROSION PROTECTION | TS | AWP | AWP |

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|---|---|---|---|
| Drawn LP | Date 04.08.2025 | Client | DEPARTMENT OF ENERGY, ENVIRONMENT AND CLIMATE ACTION - VICTORIA |
| Checked TS | Date 04.08.2025 | Project | LOCH SPORT EROSION PROTECTION |
| Designed TS | Date 04.08.2025 | | |
| Verified AWP | Date 04.08.2025 | Title | TYPICAL SECTIONS AND ELEVATIONS |
| Approved AWP | Date 04.08.2025 | Status | ISSUED FOR TENDER<br>NOT TO BE USED FOR CONSTRUCTION PURPOSES |
| | | DATUM AHD | Scale N.T.S / Size A3 |
| | | Drawing Number | 250094-CST-DRG-021 / Revision C |

XREFs: FSC-GEN-XRF-Titleblock A3; FSC-GEN-XRF-Logos A3; 250094-CST-XRF-Ex_Survey
CAD File: C:\Users\Lindsay\Polkinghorne\FSC\250094 - Documents\03 Dwgs\03. Drawing Sheets\250094-CST-DRG-001-021.dwg

# APPENDIX D BILL OF QUANTITIES

A Bill of Quantities has been prepared to assist in procurement. The contractor is to confirm the quantity listed for all items prior to construction.

| Item | Description | Quantity | UOM |
|---|---|---|---|
| **1.0** | **General** | | |
| 1.1 | Mobilisation | 1 | no. |
| 1.2 | Permits | 1 | no. |
| 1.3 | Environmental Management | 1 | no. |
| 1.4 | Traffic and Pedestrian Management | 1 | no. |
| 1.5 | Survey and Service Locating | 1 | no. |
| 1.6 | Demobilisation | 1 | no. |
| **2.0** | **Stage 1: Short Rock Groynes** | | |
| 2.1 | Earthworks, Grading, Site Levelling and Access Preparation | 1 | no. |
| 2.2 | Supply and Install Geofabric at Base (Texcel 600R or approved equivalent) | 780 | $m^2$ |
| 2.3 | Supply Class 1 Rock | 1110 | ton |
| 2.4 | Install Class 1 Rock | 505 | $m^3$ |
| **3.0** | **Stage 2: Extension of Rock Groynes** | | |
| 3.1 | Earthworks, Grading, Site Levelling and Access Preparation | 1 | no. |
| 3.2 | Supply and Install Geofabric at Base (Texcel 600R or approved equivalent) | 635 | $m^2$ |
| 3.3 | Supply Class 1 Rock | 957 | ton |
| 3.4 | Install Class 1 Rock | 435 | $m^3$ |
| **4.0** | **Stage 3: Beach Nourishment (5m Beach Berm Width)** | | |
| 4.1 | Earthworks, Grading, Site Levelling and Access Preparation | 1 | no. |
| 4.2 | Supply Sand Material | 2370 | $m^3$ |
| 4.3 | Placement of Sand Material | 2370 | $m^3$ |
| **5.0** | **Stage 4: Extension of Beach Nourishment (Additional 5m Beach Berm Width)** | | |
| 5.1 | Earthworks, Grading, Site Levelling and Access Preparation | 1 | no. |
| 5.2 | Supply Sand Material | 1470 | $m^3$ |
| 5.3 | Placement of Sand Material | 1470 | $m^3$ |

# APPENDIX E SAFETY IN DESIGN REGISTER

FSC | RANGE

**SAFETY IN DESIGN REGISTER**

Simplified View

**Project:** Loch Sport Erosion Protection West of Seagull Drive - Detailed Design
**Project No:** 250094
**Client:** DEECA
**Area:** Loch Sport, Vic
**Project Manager:** Tessa Syvertsen


| Item | RISK IDENTIFICATION | | | | INITIAL RISK | | | RECOMMENDED ACTIONS | | RESIDUAL RISK | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Potential Hazard | Potential Consequence | Existing Control Measures | Raised By | Likelihood | Consequence | Risk Score | Proposed Control Measures | Action By | Likelihood | Consequence | Risk Score | Risk Owner |
| 1 | Construction | | | | | | | | | | | | |
| 1 01 | Working near water | Injury and drowning | None | FSC | Unlikely | Catastrophic | High | Contractor to implement safety measures including appropriate PPE floating devices | Contractor | Rare | Catastrophic | High | Conractor |
| 1 02 | Placement of heavy armour rock - Structure falls during construction | Increased construction time, injury from rock falling | Structure has been designed for stability. | FSC | Unlikely | Moderate | Medium | Contractor to ensure trained operators only, implement exclusion zones, use of spotters, and staged placement to maintain stability | Conractor | Unlikely | Moderate | Medium | Contractor |
| 1 03 | Weather Condition - Bad weather or high water levels/waves ceasing construction | Increased construction time | Design specifications and controls considers weather implications. | FSC | Likely | Minor | High | Ensure management plan takes into account the possibility of this occurring and project schedule planned to provide sufficient time regarding plant and equipment hire, plant to be secured as required and adequate contingency. | Conractor | Likely | Insignificant | Medium | Contractor |
| 1 04 | Plant & Equipment - Access and operating on sand/soft ground | Increased construction time, costs and risks of overtuning/bogging | Techincal Specifications require contractor to implement appropriate temporary means to facilitate construction (e.g. construction mats or other) | FSC | Unlikely | Minor | Low | Contractor to ensure safe plant selection, geotechnical checks of bearing capacity, defined access routes, and recovery plan in place | Contractor | Unlikely | Minor | Low | Contractor |
| 1 05 | Plant & Equipment - Safe handling | Injury to operator | None | FSC | Possible | Moderate | High | Ensure trained and professional operators utilising plant | Contractor | Unlikely | Moderate | Medium | Contractor |
| 1 06 | Heavy vehicle access to foreshore (rock and sand deliveries) | Traffic collision, interaction with public | Technical Specfication require traffic and pedestrian management during construction | FSC | Unlikely | Moderate | Medium | Contractor to implement suitable construction management plan with clear delineation of construction zone | Contractor | Unlikely | Moderate | Medium | Contractor |
| 1 07 | Public entering construction site | Injury from plant, trucks, unstable rock | Technical Specfication require traffic and pedestrian management during construction | FSC | Possible | Moderate | High | Contractor to implement suitable construction management plan with clear delineation of construction zone | Contractor | Unlikely | Moderate | Medium | Contractor |
| 1 08 | Sand nourishment stockpiles | Dust, compaction hazards, truck interaction | Sand nourishment design and Technical specifications specifiy controls to minimize impacts | FSC | Possible | Moderate | High | Contractor to produce Construction management plan and suitable environmental controls | Contractor | Unlikely | Moderate | Medium | Contractor |
| 1 09 | Contamination of waterway from sand or fines | Environmental damage, turbidity | Sand nourishment design and Technical specifications specifiy controls to minimize impacts | FSC | Possible | Minor | Medium | Prefabricate concrete sections where possible | Contractor | Possible | Minor | Medium | Contractor |
| 1 10 | Competency of contractor | Misplacement of rock, poor workmanship | None | FSC | Possible | Minor | Medium | Implement quality control for selection of contractor, minimise number of contractors, ask contractors to provide photographic evidence of their work, checking the completed works against the specifications | DEECA & Contractor | Unlikely | Minor | Low | Contractor |
| 1 11 | Flora - Impact to surrounding flora during construction | Damaged habitat | Ecological assessment has been undertaken, no sensitive habitats identified within design footprint. Technical Specifications also require CEMP and sufficient measures taken to mitigate envoronmental risks | FSC | Rare | Moderate | Low | Locations for important flora should be identified. Construction to be undertaken in accordance with environmental approvals & safeguards to minimise/avoid impact. Affected areas to be rehabilitated as required. | Contractor | Rare | Moderate | Low | Contractor |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1 12** | Fauna - Impact to surrounding Fauna during construction | Displacement of species | Ecological assessment has been undertaken, no sensitive habitats identified within design footprint. Technical Specifications also require CEMP and sufficient measures taken to mitigate envoronmental risks | FSC | Rare | Moderate | **Low** | Construction to be undertaken in accordance with any environmental approvals & safeguards to minimise/avoid impact. All construction to remain on proposed footprint. | Contractor | Rare | Moderate | **Low** | Contractor |
| **1 13** | Flora & Fauna - Invasive non-native plant species my be introduced into the local habitat perhaps on plant and equipment brought in from elsewhere | Introduction of new and possibly invasive species to region | None | FSC | Possible | Moderate | **High** | Ensure that equipment and materials from elsewhere is cleaned and free of debris before bringing onto construction site | Contractor | Rare | Moderate | **Low** | Contractor |
| **2** | **Operation** | | | | | | | | | | | | |
| **2 01** | Public climbing on groynes | Pedestrian injury | None | FSC | Possible | Moderate | **High** | Possibly implement signage at access points, public education, rock surface checks for stability | DEECA/Gippsland Ports | Unlikely | Moderate | **Medium** | DEECA |
| **2 02** | Scour/erosion at groyne flanks or within compartments | Undermining of adjacent beach or assets | Design with nourishment mitigates this risk, Design report recommeneds potential interim protection in a specific area of concern in front of the carpark | FSC | Possible | Minor | **Medium** | Shoreline monitoring, particularly if all cells are not nourished, and particularly in front of the carpark | DEECA | Unlikely | Minor | **Low** | DEECA |
| **2 03** | Rock displacement during storm events | Structural instability, hazard to public | Design based on stable rock size with FoS included | FSC | Unlikely | Moderate | **Medium** | Annual monitoring surveys, repair displaced armour, reinstate profile | DEECA | Unlikely | Minor | **Low** | DEECA |
| **2 04** | Vessels collision with groyne structure | Injury. Inconvenience. | Nearshore structures in limited water depth make collision unlikely | FSC | Possible | Minor | **Medium** | Possibly consider signage or markers to identify groynes | DEECA/Gippsland Ports | Unlikely | Minor | **Low** | DEECA |

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