



# **Douglas Partners**

*Geotechnics | Environment | Groundwater*

Report on  
Acid Sulfate Soil Management Plan

Proposed Foreshore Stabilisation  
Captain Cook Reserve, Green Point

Prepared for  
Central Coast Council

Project 83414.01  
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**Integrated Practical Solutions**





# Douglas Partners

Geotechnics | Environment | Groundwater

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

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## Table of Contents

	<b>Page</b>
1. Introduction.....	1
2. Site Description and Information.....	1
3. Review of Previous Assessment (DP, 2018).....	2
4. Proposed Development.....	3
5. Acid Sulfate Management Plan.....	3
5.1 Overview.....	3
5.2 Risk Categorisation.....	3
5.3 Excavation Procedure and Disposal / Reuse Options.....	4
5.4 Liming Rates.....	4
5.5 Soil Treatment and Neutralisation Rates.....	4
5.6 Placement of a Guard Layer.....	5
5.7 Neutralising Materials.....	5
5.8 Dewatering.....	6
5.9 Verification Testing.....	7
5.10 Emergency Response Procedures (Contingency Plan).....	8
5.11 Reporting.....	9
6. References.....	10
7. Limitations.....	10
 Appendix A:	
About This Report	
Notes on Descriptive Terms	
Proposed Development Plans	
 Appendix B:	
Information from Previous Assessment:	
Drawing 1	
Borehole Logs	
Table C1	
Laboratory Test Report, Chain of Custody and Sample Receipt Advice	

# Report on Acid Sulfate Soil Management Plan

## Proposed Foreshore Stabilisation

### Captain Cook Reserve, Green Point

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## 1. Introduction

This report presents an Acid Sulfate Soil Management Plan (ASSMP) for the proposed foreshore stabilisation works at Captain Cooke Reserve, Green Point. This ASSMP was prepared with reference to the Douglas Partners Pty Ltd (DP)'s proposal CCT190395 dated 4 November 2019 and confirmation received from Kristy McQueen of Central Coast Council (CCC) on 5 November 2019.

DP prepared *Report on Preliminary Acid Sulfate Soil Assessment and Preliminary Waste Classification, Proposed Foreshore Stabilisation, Captain Cook Reserve, Bayside Drive, Green Point, NSW* (DP, 2018). The report concluded that alluvial soils encountered between depths of 0.3 m and 1.5 m would require management for acid sulfate soil conditions.

It is understood that the proposed development comprises the foreshore stabilisation at parts of the Captain Cook Reserve which will involve excavation of existing soils to maximum depths of 1.5 m over a maximum area of 2,000 m<sup>2</sup>. It is understood that, if suitable, some of the excavated materials may be reused on site and the remainder will be surplus to the development and require disposal off site. Refer to Drawing 1 in Appendix B.

This ASSMP is based on results from the previous assessment (DP, 2018). No further investigation, sampling or analysis was undertaken. This management plan has been prepared with reference to Stone et al (1998), Ahern et al (2004) and Dear et al (2014).

This report must be read in conjunction with the attached notes entitled '*About this Report*' and other explanatory information provided. It should be kept in its entirety without separation of individual pages or sections.

## 2. Site Description and Information

The site (Captain Cook Reserve) is located along the eastern foreshore of Brisbane Water at Green Point. The reserved is bounded by Brisbane Water to the north, north-east and west, Orana Street to the south and residential allotments to the east and south-east. According to a survey plan provided by the client at the time of the previous assessment (DP, 2018), the site ranged between 25 m and 30 m in width and the surface levels ranged between approximately 0.8 m and 1.4 m. The site was generally covered by short grass and some large trees. Brick and concrete fragments were encountered in the fill and are likely to be disturbed during the proposed works.

Review of the provisional 1:25,000 geology mapping for Gosford indicates that the site is underlain by Quaternary aged gravel, sand, silt and clay formed by alluvium, swamp, estuarine and tidal flats.



Reference to the 1:100,000 NSW Sydney-Newcastle-Wollongong Soils mapping indicates that the site is underlain by the Erina Erosional Soils landscape group.

According to the Gosford 1:25,000 Acid Sulfate Soil Map, dated 1997, the site is mapped as being in an area of disturbed terrain in which soil investigations are required to assess the area for acid sulfate soil potential.

### 3. Review of Previous Assessment (DP, 2018)

The scope of work completed comprised drilling four bores to depths of between 1.6 m and 2.0 m, using a utility-mounted push tube rig. Soil samples were collected and screened for signs of acid sulfate soils (ASS). Selected samples were despatched to an external analytical laboratory for Chromium reducible suite testing.

Given the area of the site (approximately 2,000 m<sup>2</sup> / 0.2 hectare), the sampling density completed for the previous assessment (four test locations) was considered sufficient given that Ahern (1998) recommends a minimum of four sampling location for sites up to 1 hectare in area.

The ground conditions encountered comprised

- Fill - between 0.15 m and 0.3 m of brown silt topsoil fill with abundant rootlets and trace sand (Bores 1 and 2), then orange brown and grey clay and silt filling with some sand, brick and concrete fragments to depths of between 0.3 m and 0.65 m; then
- Alluvium - then grey, yellow brown and dark brown clayey sand to depths of between 0.8 m and 1.5 m; overlying
- Residual - red brown and grey gravelly clay (Bore 1), red brown and grey clay (Bores 2 and 3) and dark brown sand to the base of the boreholes at depths of between 1.6 m and 2.0 m.

Groundwater was observed in all boreholes at depths of between 0.25 m and 0.5 m. However, it should be noted that groundwater levels are variable and can be affected by factors such as soil permeability and recent climatic conditions, and can vary with time.

It was anticipated that less than 1,000 tonnes of soil will be disturbed during the proposed foreshore stabilisation works. It should be noted that if more than 1,000 tonnes of soil were to be disturbed, then further advice should be sought from Douglas Partners.

Based on the results of the screening and laboratory testing, the following comments are made:

- The fill and residual soils do not require management for acid sulfate soils:
- The alluvial soils do require management for acid sulfate soils (net acidity results were recorded between 0.02 %S and 0.60 %S). Thus the grey, yellow brown and dark brown clayey sand from depths of between 0.3 m and 1.5 m require management.

Therefore, the excavation works associated with the proposed foreshore stabilisation works will need to be carried out with reference to an ASSMP.

The laboratory calculated liming rates ranged between 1.2 kg CaCO<sub>3</sub> / tonne and 28 kg CaCO<sub>3</sub> / tonne.

## 4. Proposed Development

It is understood that the proposed development comprises foreshore stabilisation at parts of the Captain Cook Reserve which will involve excavation to depths of up to 1.5 m over a maximum area of 2,000 m<sup>2</sup>. It is understood that, if suitable, some of the excavated materials may be reused on site and the remainder will be surplus to the development and will require disposal off site. Refer to Drawing 1 in Appendix B.

## 5. Acid Sulfate Management Plan

### 5.1 Overview

The previous assessment (DP, 2018) results suggest that alluvial soils described as grey, yellow brown and dark brown clayey sand to depths of between 0.3 m and 1.5 m are acid sulfate soils which require treatment if disturbed by the proposed works. It is estimated that less than 1,000 tonnes of acid sulfate soils will be disturbed as part of the proposed works.

Disturbance of acid sulfate soils must be managed to avoid the release of acidity into the environment. It is essential that the acid sulfate soils be managed to ensure that impact to the surrounding environment is minimised, in particular, Brisbane Water, located north, north-east and west of the site.

### 5.2 Risk Categorisation

Dear et al (2014) relates environmental risk from ASS by the treatment level and tonnage of disturbance of ASS. This document indicates that the proposed disturbance of the natural alluvial soils to a depth of 1.5 m is likely to be considered "Category H or high level of treatment.

Dear et al (2014) confirms that the following practices (at a minimum) are to be included in the ASSMP:

- Soils are treated with an amount of neutralising agent that will counter their existing plus potential acidity;
- The neutralising agent is thoroughly mixed with the soil; and
- Management of site run-on, run-off and infiltration.

In addition, given the site's close proximity to Brisbane Water, it is considered that the following also be included in the ASSMP:

- Dewatering and monitoring of any accumulated waters within the construction area;
- Verification testing;
- Provide a construction environmental management plan; and

- Preparation of a simple closure report commenting on ASS management activities and final placement / use of disturbed soils.

### 5.3 Excavation Procedure and Disposal / Reuse Options

It is understood that some of the excavated material may be re-used on site. Based on the results of the previous assessment (DP, 2018), the materials classified as VENM would be suitable for re-use on-site, that being the natural soils described as residual, red brown and grey gravelly clay.

The remaining fill and alluvial soils (acid sulfate soils) may be reused on-site, if suitable from a geotechnical perspective. However, given the presence of brick and concrete in the fill, this may not be possible. Unsuitable excavated material will be disposed of to a licenced facility.

It is anticipated that segregation of the excavated soils (fill and alluvial soils) may be possible, depending on suitability for on-site reuse.

The previous assessment (DP, 2018) concluded that fill and treated alluvial ASS would be provisionally classified as General Solid Waste (non-putrescible).

Any fill or natural soils different to the soils encountered in the previous assessment (DP, 2018) (refer to Section 3), should be segregated to stockpile on-site for further assessment. It is recommended that appropriately experienced and trained staff inspect soils during excavation to ensure that appropriate segregation is completed.

### 5.4 Liming Rates

Based on the results of the previous assessment (DP, 2018), the acid sulfate soils to be disturbed / excavated are to be treated using lime prior to re-use or disposal. Liming rates of between 1.2 kg CaCO<sub>3</sub> and 28 kg CaCO<sub>3</sub> / tonne were provided by the analytical laboratory.

Given that the excavated ASS will likely be mixed and treated in the same manner, it is recommended that a conservative approach be adopted and a liming rate of 28 kg CaCO<sub>3</sub> / tonne be used; which is the highest liming rate provided by the analytical laboratory.

### 5.5 Soil Treatment and Neutralisation Rates

Neutralisation of ASS should be carried out as follows:

- Excavation and stockpiling of soils to be managed within a “designated stockpile area”. The “designated stockpile area”, the stockpiling of soils should be managed in accordance with the contractors Construction Environmental Management Plan (CEMP); however, appropriate management of site run-on, runoff and infiltration should be incorporated into the plan.
- The neutralising agent and acid sulfate soil should be thoroughly mixed within the “designated stockpile area”, using the bucket of an excavator and / or rotary plough. The actual liming rate may need to change due to the natural variations in the pyritic components in the soil and may

require adjustment based on monitoring results obtained during the treatment process. Additional lime will be required if monitoring results indicate that appropriate neutralisation has not been achieved. Grade 1 Agricultural Lime should be placed and mixed at a rate of 28 kg / tonne  $\text{CaCO}_3$  to the disturbed soils. Given that the liming rate proposed is the highest reported by the analytical laboratory, it is likely this rate will be sufficient, however, natural variations in the pyritic components of the soil cannot be predicted.

- Placement of a guard layer at a rate of approximately 1 kg / m<sup>2</sup> on the exposed base and walls of the excavation (where appropriate) to counteract the generation of acidic leachate due to the soils being exposed to air.
- For off-site disposal of material not already classified for disposal (if required), temporary stockpiling / management would be required until waste classification assessment has been completed. The waste classified spoil can then be loaded into trucks for transport to the appropriately licensed facility for disposal.

## 5.6 Placement of a Guard Layer

Following completion of excavation activities, and where there are exposed ASS remaining in the work area (i.e. not below the water level) then a guard layer of agricultural lime should be placed onto the soil surface at a rate of 1 kg  $\text{CaCO}_3$  / m<sup>2</sup> of soil. This is to counteract the generation of acidic leachate due to the soils being exposed to air during the construction period.

Where possible, the excavation area should then be completed with a geomembrane or layer of non-ASS and then revegetated (if appropriate) to minimise the potential for the release of acidity into the environment following completion of construction works.

## 5.7 Neutralising Materials

Agricultural lime ('ag' lime) should be used as the preferred neutralisation material for the management of ASS as it is usually the cheapest and most readily available product for soil neutralisation. This material is strongly alkaline (pH of 8.5 to 9.5), it is of low solubility, and does not present any handling problems. The 'ag' lime comprises calcium carbonate, typically made from limestone that has been finely ground and sieved to a fine powder.

The 'ag' lime purity should preferably be 95% or better, (i.e. NV >95, where NV is the neutralising value, a term used to rate the neutralising power of different forms of materials relative to pure, fine calcium carbonate which is designated NV = 100). 'Ag' lime is typically sold at an NV of 95% to 98%. There could be economic justification for using a less pure grade of ag lime; however, under these circumstances, the individual lime dosing rates should be increased by a factor of 100/NV.

Due to its low solubility in water, 'ag' lime is not suitable for the neutralisation of leachate, which requires a product with a very quick reaction and high solubility. The most suitable neutralising agent for leachate and retained drainage water is slaked lime or quicklime (calcium hydroxide). This is made by treating burnt lime (calcium oxide) with water (slaking) and comes as a fine white powder. It has a typical NV of about 135. Due to its very strong alkalinity (pH of about 12.5 to 13), slaked lime or quicklime should not be allowed to come into contact with the skin or be inhaled.

## 5.8 Dewatering

Groundwater was encountered at depths of between 0.25 m and 0.5 m in the previous assessment. If groundwater is encountered during the construction works, then it should be managed using a water treatment system that enables management of water pH and turbidity levels. A number of proprietary systems are available for use.

The following procedure is recommended in order to minimise potential adverse impacts resulting from excavation and dewatering of ASS during construction:

- Minimise the dewatering depth required for excavation;
- Minimise the time and volume of exposed ASS (i.e. staged dewatering and excavation over relatively short durations);
- Extracted groundwater should be discharged through a water treatment system that enables management of water pH and turbidity levels; and
- The pH of the extracted water should be monitored prior to discharge. Neutralisation should be undertaken if discharge water pH falls below natural groundwater levels or regulatory requirements.

The amount of neutraliser required to be added to the leachate or discharged groundwater can be calculated from the equation below:

$$\text{Alkali Material Required (kg)} = \frac{M_{\text{Alkali}} \times 10^{-\text{pH initial}}}{2 \times 10^3} \times V$$

Where:  $\text{pH initial} = \text{initial pH of leachate}$

$V = \text{volume of leachate or collected water (litres)}$

$M_{\text{Alkali}} = \text{molecular weight of alkali material (g/mole)}$

**Note:**  $\text{molecular weight of calcined magnesite } (M_{\text{MgO}}) = 40 \text{ g/mole.}$

The alkali should be added to the leachate / discharged groundwater water as a slurry. Mixing of the slurry is best achieved using an agitator.

Whilst agricultural lime is well suited to the treatment of acid sulfate soils, it does not dissolve readily in water; hence it should not be used for adjusting the pH of water which requires a product with a very quick reaction and high solubility.

Furthermore, it should be added incrementally with care and thoroughly mixed to prevent overshooting the desired pH.

As a guide, the approximate quantities of hydrated lime would be required to neutralise acidic water to pH 7 are provided in Table 1.

**Table 1: Recommended Approximate Liming Rates for Water**

Water pH	Water Extraction Rate		
	2 m <sup>3</sup> /hr	5 m <sup>3</sup> /hr	10 m <sup>3</sup> /hr
2	0.74	1.85	3.7
3	0.074	0.185	0.37
4	0.0074	0.0185	0.037
5	0.00074	0.00185	0.0037
6	0.000074	0.000185	0.00037

Notes: Liming rates are for hydrated lime (kg of  $Ca(OH)_2$ )

It should be recognised that portable holding and treatment tanks will be required to allow on-site neutralisation of water generated by dewatering activities prior to on-site infiltration or discharge.

## 5.9 Verification Testing

Verification testing on soil and any collected water to be disposed of is required to be conducted following the addition / mixing of lime to confirm that these materials have been appropriately managed, and to reduce the potential risk of harm to the environment.

Based on the intensity of testing during investigation, the net acidity of the soil prior to treatment and the quantity of soil to be treated, it is recommended that verification testing should comprise regular field pH screening on at least ten samples spread across the full depth and area of the site and further  $S_{CR}$  suite testing on two representative samples.

The pH of all collected water around the confines of the managed stockpiles or during dewatering should be measured daily and results assessed against the criteria provided in Table 2. The soil and water contained within the bunded areas should not be removed until the target values presented in Table 2 below have been achieved.

**Table 2: Target Levels of Neutralised Soil and Water**

Test	Component	Target Level
Monitoring of water	pH	6.5 < pH < 8.5
	Turbidity	To comply with either values determined in consultation with the Authority (i.e. CCC) or less than local background levels (baseline monitoring required).
	Aluminium (Al) and Iron (Fe)	Establish local water quality data prior to site disturbance and ensure that these values are not exceeded.
	Dissolved Oxygen	To comply with either values determined in consultation with the Authority (i.e. CCC) or less than local background levels (baseline monitoring required).
Field screening of soil	pH <sub>F</sub>	5.5 < pH <sub>F</sub> ≤ 8.5
Acid based accounting of soil (Chromium Suite test method)*	Net acidity (using appropriate fine factor)	Zero or negative
	pH <sub>KCL</sub>	pH <sub>KCL</sub> ≥ 6.5
	TAA	Zero

\* Based on Section 3.6 of Chapter A (Overview) of the Ahern et al (2004)

It should be noted that chromium suite tests will require at least four days turnaround, possibly longer, and hence sufficient time should be allowed in the treatment programme for such verification testing. Only appropriately skilled staff, such as available through DP, should collect and test verification samples. In addition to normal daily supervision of the soil management process, it is suggested that regular formal inspections be undertaken.

## 5.10 Emergency Response Procedures (Contingency Plan)

Construction activities which may cause potential environmental threats are summarised in Table 3 below together with recommendations for “Emergency Response Procedures”.

**Table 3: Emergency Response Procedures**

<b>Construction Activity</b>	<b>Potential Environmental Threat</b>	<b>Emergency Response</b>
Excavations	Flooding of open excavation causing adjacent groundwater levels to rise, leading to potential acid leachate once the excavation is drained	<ul style="list-style-type: none"> <li>• Inform site foreman and project manager/ environmental officer;</li> <li>• Determine pH of groundwater / floodwater in excavation;</li> <li>• Correct groundwater / floodwater pH by application of slaked lime to bring pH in range of 6.5 to 8.5;</li> <li>• Drain pit to tanks for water quality assessment prior to discharge.</li> </ul>
Stockpiling / Neutralisation	Stockpile washes or slips outside of contained area	<ul style="list-style-type: none"> <li>• Inform site foreman and project manager/ environmental officer;</li> <li>• Estimate volume of material breaching bund;</li> <li>• Conduct pH analysis of adjacent watercourses (if any);</li> <li>• Remove breached soil into a bunded limed pad;</li> <li>• Over-excavate contaminated area to 0.2m depth, apply and mix lime at rate as for guard layers (1 kg lime per m<sup>2</sup> of surface).</li> </ul>
	Breach in stockpile containment bund	<ul style="list-style-type: none"> <li>• Inform site foreman and project manager/ environmental officer;</li> <li>• Close breach in bund;</li> <li>• Conduct pH analysis of adjacent watercourses (if any);</li> <li>• Correct pH in any adjacent watercourse (if required).</li> </ul>

For all construction activity incidents which pose an environmental threat, an incident report must be completed in order that:

- The cause of the incident may be determined; determine how the incident occurred;
- Additional control measures may be implemented; and
- Work procedures may be modified to reduce the likelihood of the incident re-occurring.

### 5.11 Reporting

A record of treatment of acid sulfate soils should be maintained by the contractor and should include the following details:



- Date;
- Location / area;
- Time of excavation;
- Neutralisation process undertaken;
- Lime rate utilised;
- Results of monitoring;
- Disposal location; and
- Tonnages and landfill dockets (if applicable).

A record should also be maintained confirming contingency measures and additional treatment if undertaken. A final report should be issued upon completion of the works presenting the monitoring regime and results, and confirming that adverse environmental impact has not occurred during the works.

## 6. References

Stone, Y, Ahern C R, and Blunder B (1998), *Acid Sulfate Soil Manual* , Acid Sulfate Advisory Committee, Wollongbar, NSW, Australia.

Ahern CR, Ahern MR and Powell, B (1998), *Guidelines for Sampling and Analysis of Lowland Acid Sulfate Soils (ASS) in Queensland*, Queensland Department of Natural Resources, Resource Sciences Centre, Indooroopilly, Queensland Australia.

Ahern CR, McElnea AE, Sullivan LA (2004), *Acid Sulfate Soils Laboratory Methods Guidelines*. Queensland Department of Natural Resources, Mines and Energy, Indooroopilly, Queensland, Australia.

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

Douglas Partners Pty Ltd (DP, 2018), *Report on Preliminary Acid Sulfate Soil Assessment and Preliminary Waste Classification, Proposed Foreshore Stabilisation, Captain Cook Reserve, Bayside Drive, Green Point, NSW*, Project 83414.00 dated August 2018.

## 7. Limitations

Douglas Partners (DP) has prepared this report (or services) for this project at Captain Cook Reserve, Green Point in accordance with DP's proposal CCT190395 dated 4 November 2019 and acceptance received from Kristy McQueen of Central Coast Council dated 5 November 2019.

The work was carried out under DP's Conditions of Engagement. This report is provided for the exclusive use of Central Coast Council for this project only and for the purposes as described in the report. It should not be used by or relied upon for other projects or purposes on the same or other site or by a third party. Any party so relying upon this report beyond its exclusive use and purpose as stated above, and without the express written consent of DP, does so entirely at its own risk and without recourse to DP for any loss or damage. In preparing this report DP has necessarily relied upon information provided by the client and / or their agents.

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

DP's advice is based upon the conditions encountered during the previous investigation. The accuracy of the advice provided by DP in this report may be affected by undetected variations in ground conditions across the site between and beyond the sampling and / or testing locations. The advice may also be limited by budget constraints imposed by others or by site accessibility.

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

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

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

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**Douglas Partners Pty Ltd**

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## **Appendix A**

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About This Report

Notes on Descriptive Terms

Proposed Development Plans

# About this Report

# Douglas Partners



## Introduction

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

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

## Copyright

This report is the property of Douglas Partners Pty Ltd. The report may only be used for the purpose for which it was commissioned and in accordance with the Conditions of Engagement for the commission supplied at the time of proposal. Unauthorised use of this report in any form whatsoever is prohibited.

## Borehole and Test Pit Logs

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

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

## Groundwater

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

- In low permeability soils groundwater may enter the hole very slowly or perhaps not at all during the time the hole is left open;

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

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

## Reports

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

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

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

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

# *About this Report*

## **Site Anomalies**

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

## **Information for Contractual Purposes**

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

## **Site Inspection**

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



## Sampling

Sampling is carried out during drilling or test pitting to allow engineering examination (and laboratory testing where required) of the soil or rock.

Disturbed samples taken during drilling provide information on colour, type, inclusions and, depending upon the degree of disturbance, some information on strength and structure.

Undisturbed samples are taken by pushing a thin-walled sample tube into the soil and withdrawing it to obtain a sample of the soil in a relatively undisturbed state. Such samples yield information on structure and strength, and are necessary for laboratory determination of shear strength and compressibility. Undisturbed sampling is generally effective only in cohesive soils.

## Test Pits

Test pits are usually excavated with a backhoe or an excavator, allowing close examination of the in-situ soil if it is safe to enter into the pit. The depth of excavation is limited to about 3 m for a backhoe and up to 6 m for a large excavator. A potential disadvantage of this investigation method is the larger area of disturbance to the site.

## Large Diameter Augers

Boreholes can be drilled using a rotating plate or short spiral auger, generally 300 mm or larger in diameter commonly mounted on a standard piling rig. The cuttings are returned to the surface at intervals (generally not more than 0.5 m) and are disturbed but usually unchanged in moisture content. Identification of soil strata is generally much more reliable than with continuous spiral flight augers, and is usually supplemented by occasional undisturbed tube samples.

## Continuous Spiral Flight Augers

The borehole is advanced using 90-115 mm diameter continuous spiral flight augers which are withdrawn at intervals to allow sampling or in-situ testing. This is a relatively economical means of drilling in clays and sands above the water table. Samples are returned to the surface, or may be collected after withdrawal of the auger flights, but they are disturbed and may be mixed with soils from the sides of the hole. Information from the drilling (as distinct from specific sampling by SPTs or undisturbed samples) is of relatively low

reliability, due to the remoulding, possible mixing or softening of samples by groundwater.

## Non-core Rotary Drilling

The borehole is advanced using a rotary bit, with water or drilling mud being pumped down the drill rods and returned up the annulus, carrying the drill cuttings. Only major changes in stratification can be determined from the cuttings, together with some information from the rate of penetration. Where drilling mud is used this can mask the cuttings and reliable identification is only possible from separate sampling such as SPTs.

## Continuous Core Drilling

A continuous core sample can be obtained using a diamond tipped core barrel, usually with a 50 mm internal diameter. Provided full core recovery is achieved (which is not always possible in weak rocks and granular soils), this technique provides a very reliable method of investigation.

## Standard Penetration Tests

Standard penetration tests (SPT) are used as a means of estimating the density or strength of soils and also of obtaining a relatively undisturbed sample. The test procedure is described in Australian Standard 1289, Methods of Testing Soils for Engineering Purposes - Test 6.3.1.

The test is carried out in a borehole by driving a 50 mm diameter split sample tube under the impact of a 63 kg hammer with a free fall of 760 mm. It is normal for the tube to be driven in three successive 150 mm increments and the 'N' value is taken as the number of blows for the last 300 mm. In dense sands, very hard clays or weak rock, the full 450 mm penetration may not be practicable and the test is discontinued.

The test results are reported in the following form.

- In the case where full penetration is obtained with successive blow counts for each 150 mm of, say, 4, 6 and 7 as:  
4,6,7  
N=13
- In the case where the test is discontinued before the full penetration depth, say after 15 blows for the first 150 mm and 30 blows for the next 40 mm as:  
15, 30/40 mm

# *Sampling Methods*

The results of the SPT tests can be related empirically to the engineering properties of the soils.

## **Dynamic Cone Penetrometer Tests / Perth Sand Penetrometer Tests**

Dynamic penetrometer tests (DCP or PSP) are carried out by driving a steel rod into the ground using a standard weight of hammer falling a specified distance. As the rod penetrates the soil the number of blows required to penetrate each successive 150 mm depth are recorded. Normally there is a depth limitation of 1.2 m, but this may be extended in certain conditions by the use of extension rods. Two types of penetrometer are commonly used.

- Perth sand penetrometer - a 16 mm diameter flat ended rod is driven using a 9 kg hammer dropping 600 mm (AS 1289, Test 6.3.3). This test was developed for testing the density of sands and is mainly used in granular soils and filling.
- Cone penetrometer - a 16 mm diameter rod with a 20 mm diameter cone end is driven using a 9 kg hammer dropping 510 mm (AS 1289, Test 6.3.2). This test was developed initially for pavement subgrade investigations, and correlations of the test results with California Bearing Ratio have been published by various road authorities.



## Description and Classification Methods

The methods of description and classification of soils and rocks used in this report are generally based on Australian Standard AS1726:2017, Geotechnical Site Investigations. In general, the descriptions include strength or density, colour, structure, soil or rock type and inclusions.

## Soil Types

Soil types are described according to the predominant particle size, qualified by the grading of other particles present:

Type	Particle size (mm)
Boulder	>200
Cobble	63 - 200
Gravel	2.36 - 63
Sand	0.075 - 2.36
Silt	0.002 - 0.075
Clay	<0.002

The sand and gravel sizes can be further subdivided as follows:

Type	Particle size (mm)
Coarse gravel	19 - 63
Medium gravel	6.7 - 19
Fine gravel	2.36 – 6.7
Coarse sand	0.6 - 2.36
Medium sand	0.21 - 0.6
Fine sand	0.075 - 0.21

Definitions of grading terms used are:

- Well graded - a good representation of all particle sizes
- Poorly graded - an excess or deficiency of particular sizes within the specified range
- Uniformly graded - an excess of a particular particle size
- Gap graded - a deficiency of a particular particle size with the range

The proportions of secondary constituents of soils are described as follows:

In fine grained soils (>35% fines)

Term	Proportion of sand or gravel	Example
And	Specify	Clay (60%) and Sand (40%)
Adjective	>30%	Sandy Clay
With	15 – 30%	Clay with sand
Trace	0 - 15%	Clay with trace sand

In coarse grained soils (>65% coarse)

- with clays or silts

Term	Proportion of fines	Example
And	Specify	Sand (70%) and Clay (30%)
Adjective	>12%	Clayey Sand
With	5 - 12%	Sand with clay
Trace	0 - 5%	Sand with trace clay

In coarse grained soils (>65% coarse)

- with coarser fraction

Term	Proportion of coarser fraction	Example
And	Specify	Sand (60%) and Gravel (40%)
Adjective	>30%	Gravelly Sand
With	15 - 30%	Sand with gravel
Trace	0 - 15%	Sand with trace gravel

The presence of cobbles and boulders shall be specifically noted by beginning the description with 'Mix of Soil and Cobbles/Boulders' with the word order indicating the dominant first and the proportion of cobbles and boulders described together.



# Soil Descriptions

## Cohesive Soils

Cohesive soils, such as clays, are classified on the basis of undrained shear strength. The strength may be measured by laboratory testing, or estimated by field tests or engineering examination. The strength terms are defined as follows:

Description	Abbreviation	Undrained shear strength (kPa)
Very soft	VS	<12
Soft	S	12 - 25
Firm	F	25 - 50
Stiff	St	50 - 100
Very stiff	VSt	100 - 200
Hard	H	>200
Friable	Fr	-

## Cohesionless Soils

Cohesionless soils, such as clean sands, are classified on the basis of relative density, generally from the results of standard penetration tests (SPT), cone penetration tests (CPT) or dynamic penetrometers (PSP). The relative density terms are given below:

Relative Density	Abbreviation	Density Index (%)
Very loose	VL	<15
Loose	L	15-35
Medium dense	MD	35-65
Dense	D	65-85
Very dense	VD	>85

## Soil Origin

It is often difficult to accurately determine the origin of a soil. Soils can generally be classified as:

- Residual soil - derived from in-situ weathering of the underlying rock;
- Extremely weathered material – formed from in-situ weathering of geological formations. Has soil strength but retains the structure or fabric of the parent rock;
- Alluvial soil – deposited by streams and rivers;

- Estuarine soil – deposited in coastal estuaries;
- Marine soil – deposited in a marine environment;
- Lacustrine soil – deposited in freshwater lakes;
- Aeolian soil – carried and deposited by wind;
- Colluvial soil – soil and rock debris transported down slopes by gravity;
- Topsoil – mantle of surface soil, often with high levels of organic material.
- Fill – any material which has been moved by man.

## Moisture Condition – Coarse Grained Soils

For coarse grained soils the moisture condition should be described by appearance and feel using the following terms:

- Dry (D) Non-cohesive and free-running.
- Moist (M) Soil feels cool, darkened in colour.  
Soil tends to stick together.  
Sand forms weak ball but breaks easily.
- Wet (W) Soil feels cool, darkened in colour.  
Soil tends to stick together, free water forms when handling.

## Moisture Condition – Fine Grained Soils

For fine grained soils the assessment of moisture content is relative to their plastic limit or liquid limit, as follows:

- 'Moist, dry of plastic limit' or 'w < PL' (i.e. hard and friable or powdery).
- 'Moist, near plastic limit' or 'w ≈ PL' (i.e. soil can be moulded at moisture content approximately equal to the plastic limit).
- 'Moist, wet of plastic limit' or 'w > PL' (i.e. soils usually weakened and free water forms on the hands when handling).
- 'Wet' or 'w ≈ LL' (i.e. near the liquid limit).
- 'Wet' or 'w > LL' (i.e. wet of the liquid limit).

# Symbols & Abbreviations

# Douglas Partners



## Introduction

These notes summarise abbreviations commonly used on borehole logs and test pit reports.

## Drilling or Excavation Methods

C	Core drilling
R	Rotary drilling
SFA	Spiral flight augers
NMLC	Diamond core - 52 mm dia
NQ	Diamond core - 47 mm dia
HQ	Diamond core - 63 mm dia
PQ	Diamond core - 81 mm dia

## Water

▷	Water seep
▽	Water level

## Sampling and Testing

A	Auger sample
B	Bulk sample
D	Disturbed sample
E	Environmental sample
U <sub>50</sub>	Undisturbed tube sample (50mm)
W	Water sample
pp	Pocket penetrometer (kPa)
PID	Photo ionisation detector
PL	Point load strength Is(50) MPa
S	Standard Penetration Test
V	Shear vane (kPa)

## Description of Defects in Rock

The abbreviated descriptions of the defects should be in the following order: Depth, Type, Orientation, Coating, Shape, Roughness and Other. Drilling and handling breaks are not usually included on the logs.

## Defect Type

B	Bedding plane
Cs	Clay seam
Cv	Cleavage
Cz	Crushed zone
Ds	Decomposed seam
F	Fault
J	Joint
Lam	Lamination
Pt	Parting
Sz	Sheared Zone
V	Vein

## Orientation

The inclination of defects is always measured from the perpendicular to the core axis.

h	horizontal
v	vertical
sh	sub-horizontal
sv	sub-vertical

## Coating or Infilling Term

cln	clean
co	coating
he	healed
inf	infilled
stn	stained
ti	tight
vn	veneer

## Coating Descriptor

ca	calcite
cbs	carbonaceous
cly	clay
fe	iron oxide
mn	manganese
slt	silty

## Shape

cu	curved
ir	irregular
pl	planar
st	stepped
un	undulating

## Roughness

po	polished
ro	rough
sl	slickensided
sm	smooth
vr	very rough


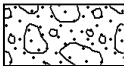
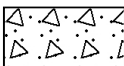

## Other

fg	fragmented
bnd	band
qtz	quartz






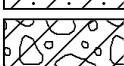


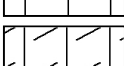
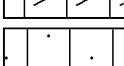

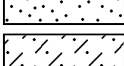
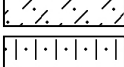
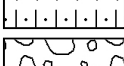
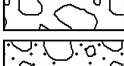
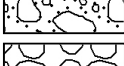

# Symbols & Abbreviations

## Graphic Symbols for Soil and Rock




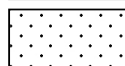
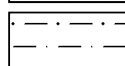
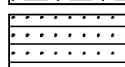
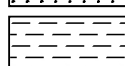

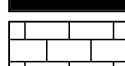
### General

	Asphalt
	Road base
	Concrete
	Filling

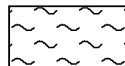
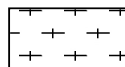
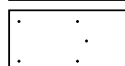
### Soils

	Topsoil
	Peat
	Clay
	Silty clay
	Sandy clay
	Gravelly clay
	Shaly clay
	Silt
	Clayey silt
	Sandy silt
	Sand
	Clayey sand
	Silty sand
	Gravel
	Sandy gravel
	Cobbles, boulders
	Talus

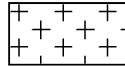

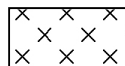
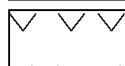

### Sedimentary Rocks

	Boulder conglomerate
	Conglomerate
	Conglomeratic sandstone
	Sandstone
	Siltstone
	Laminite
	Mudstone, claystone, shale
	Coal
	Limestone

### Metamorphic Rocks

	Slate, phyllite, schist
	Gneiss
	Quartzite

### Igneous Rocks

	Granite
	Dolerite, basalt, andesite
	Dacite, epidote
	Tuff, breccia
	Porphyry

# FORESHORE STABILISATION CAPTAIN COOK RESERVE, GREEN POINT



LOCALITY PLAN  
N.T.S

## DRAWING SCHEDULE

DRG No.	TITLE
PA1889-RHD-00-DR-C-0000	TITLE SHEET, LOCALITY PLAN AND DRAWING LIST
PA1889-RHD-00-DR-C-0001	NOTES - SHEET 1
PA1889-RHD-00-DR-C-0002	NOTES - SHEET 2
PA1889-RHD-00-DR-C-0003	NOTES - SHEET 3
PA1889-RHD-00-DR-C-0004	NOTES - SHEET 4
PA1889-RHD-00-DR-C-0005	SITE PLAN
PA1889-RHD-00-DR-C-0006	GENERAL ARRANGEMENT PLAN - SHEET 1
PA1889-RHD-00-DR-C-0007	GENERAL ARRANGEMENT PLAN - SHEET 2
PA1889-RHD-00-DR-C-0008	GENERAL ARRANGEMENT PLAN - SHEET 3
PA1889-RHD-00-DR-C-0009	GENERAL ARRANGEMENT PLAN - SHEET 4
PA1889-RHD-00-DR-C-0010	GENERAL ARRANGEMENT PLAN - SHEET 5
PA1889-RHD-00-DR-C-0011	SECTIONS AND DETAILS - SHEET 1
PA1889-RHD-00-DR-C-0012	SECTIONS AND DETAILS - SHEET 2
PA1889-RHD-00-DR-C-0013	SECTIONS AND DETAILS - SHEET 3
PA1889-RHD-00-DR-C-0014	SECTIONS AND DETAILS - SHEET 4
PA1889-RHD-00-DR-C-0015	SECTIONS AND DETAILS - SHEET 5
PA1889-RHD-00-DR-C-0016	SECTIONS AND DETAILS - SHEET 6
PA1889-RHD-00-DR-C-0017	SECTIONS AND DETAILS - SHEET 7

## SURVEY (STEPHEN THORNE AND ASSOCIATES)

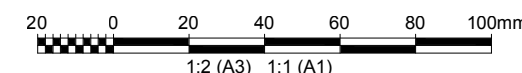
DRG No.	TITLE
6907 - SHEET 1	DETAIL AND CONTOUR SURVEY, CAPTAIN COOK RESERVE, GREEN POINT - SHEET 1
6907 - SHEET 2	DETAIL AND CONTOUR SURVEY, CAPTAIN COOK RESERVE, GREEN POINT - SHEET 2

### GENERAL NOTES:

1. THESE DRAWINGS ARE TO BE READ IN CONJUNCTION WITH ALL OTHER REFERENCE DRAWINGS WHICH SHOW OTHER ASPECTS OF WORK TO BE INCORPORATED.
2. ALL DIMENSIONS ARE IN MILLIMETRES AND ALL LEVELS ARE IN METRES (UNLESS NOTED OTHERWISE).
3. ALL LEVELS REDUCED TO AUSTRALIAN HEIGHT DATUM (AHD).
4. ALL LEVELS ARE FROM SURVEY PROVIDED BY STEPHEN THORNE AND ASSOCIATES PTY LTD, DATED 29/04/2014. ROYAL HASKONINGDHV TAKE NO RESPONSIBILITY FOR THE ACCURACY OF THE SURVEY AND SERVICES SHOWN.
5. CONTRACTOR TO CONFIRM SURVEY PRIOR TO COMMENCEMENT OF WORKS.
6. SERVICES SHOWN ARE INDICATIVE ONLY. LOCATIONS TO BE CONFIRMED ON SITE PRIOR TO CONSTRUCTION.
7. MATURE VEGETATION TO BE RETAINED AND REMAIN UNDISTURBED BY THE WORKS UNLESS NOTED OTHERWISE.
8. FOR OTHER NOTES REFER TO DRAWINGS 0002 AND 0003.



**D5 FOR CONSTRUCTION**



REV	DATE	DESCRIPTION	BY	CHK	APP	
0	20.12.2018	ISSUED FOR CONSTRUCTION		SGB	TB	GPB

REVISIONS

CLIENT



PROJECT

FORESHORE STABILISATION  
CAPTAIN COOK RESERVE  
GREEN POINT

TITLE

TITLE SHEET,  
LOCALITY PLAN AND  
DRAWING LIST



DRAWN	COORD. SYSTEM	DATUM	DATE
SGB	MGA	AHD	11.10.2018
SCALE	REF:	PA1889-RHD-00-DR-C-0001	
AT A1 AS SHOWN			

DRAWING No.	REVISION
PA1889-RHD-00-DR-C-0000	0



**GENERAL**

THESE DRAWINGS SHALL BE READ IN CONJUNCTION WITH ALL OTHER DRAWINGS AND SPECIFICATIONS AND WITH SUCH OTHER WRITTEN INSTRUCTIONS AS MAY BE ISSUED DURING THE COURSE OF THE CONTRACT. ANY DISCREPANCY SHALL BE REFERRED TO THE SUPERINTENDENT BEFORE PROCEEDING WITH THE WORK.

ALL MATERIALS AND WORKMANSHIP SHALL BE IN ACCORDANCE WITH THE RELEVANT AND CURRENT SAA CODES AND WITH THE BY-LAWS AND ORDINANCES OF THE RELEVANT BUILDING AUTHORITIES EXCEPT WHERE VARIED BY THESE DRAWINGS AND SPECIFICATIONS.

ALL CRITICAL ARRANGEMENTS AND DIMENSIONS SHOWN SHALL BE VERIFIED BY THE CONTRACTOR ON SITE BEFORE WORK COMMENCES. DRAWINGS SHALL NOT BE SCALED FOR DIMENSIONS.

BEFORE UNDERTAKING ANY WORK, ESTABLISH THE LOCATIONS OF ALL EXISTING SERVICES AFFECTED BY THE WORKS. IF NECESSARY, CARRY OUT A DIAL-BEFORE-YOU-DIG SEARCH. ADVISE THE SUPERINTENDENT IF THERE ARE ANY UNKNOWN SERVICES THAT CAN POTENTIALLY BE AFFECTED BY THE WORKS.

END AND TRANSITION DETAILS FOR DIFFERENT TREATMENT AREAS ARE TO BE CONFIRMED BY THE CONTRACTOR DURING CONSTRUCTION.

DURING CONSTRUCTION THE STRUCTURE SHALL BE MAINTAINED IN A STABLE CONDITION AND NO PART SHALL BE OVERSTRESSED. TEMPORARY BRACING AND BATTERS SHALL BE PROVIDED BY THE CONTRACTOR TO KEEP THE WORKS AND EXCAVATIONS STABLE AT ALL TIMES.

THE CONTRACTOR SHALL PROVIDE TEST CERTIFICATES FROM A N.A.T.A. APPROVED TESTING LABORATORY CERTIFYING THAT THE MATERIALS USED COMPLY WITH THE RELEVANT SPECIFICATIONS.

UNLESS NOTED OTHERWISE ALL DIMENSIONS ARE IN MILLIMETRES AND ALL LEVELS ARE IN METRES.

UNLESS NOTED OTHERWISE ALL LEVELS ARE IN METRES RELATIVE TO AUSTRALIAN HEIGHT DATUM (AHD).

**KEY DESIGN OBJECTIVES**

- PROTECT, REHABILITATE AND IMPROVE THE FORESHORE
- IMPROVE RECREATIONAL AMENITY
- RECOGNISE AND ACCOMMODATE NATURAL PROCESSES AND CLIMATE CHANGE
- ENSURE ECOLOGICALLY SUSTAINABLE DEVELOPMENT AND USE OF RESOURCES.

NOMINAL DESIGN LIFE FOR THE FORESHORE TREATMENTS 20 YEARS

**QUALITY ASSURANCE AND OCCUPATIONAL HEALTH AND SAFETY**

THE CONTRACTOR SHALL IMPLEMENT AND MAINTAIN A QUALITY ASSURANCE SYSTEM SUCH THAT RECORDS ARE KEPT OF ALL ASPECTS AND STAGES OF THE WORK.

THE RECORDS FOR EACH CONSTRUCTION TASK SHALL BE STAGED AND ITEMISED TO THE SATISFACTION OF THE SUPERINTENDENT. THE PROFORMAS SHALL BE SUBMITTED TO THE SUPERINTENDENT FOR APPROVAL AND WORK SHALL NOT COMMENCE UNTIL SUCH APPROVAL HAS BEEN GIVEN.

DURING CONSTRUCTION, THE CONTRACTOR SHALL MAINTAIN ACCURATE AND UP TO DATE RECORDS AND SHALL MAKE SUCH RECORDS AVAILABLE TO THE SUPERINTENDENT IF REQUESTED. FAILURE TO MAINTAIN RECORDS AS SPECIFIED WILL RESULT IN THE CONTRACTOR RE-INSPECTING COMPLETED WORKS AT ITS OWN COST IF INSTRUCTED TO DO SO BY THE SUPERINTENDENT.

AT THE COMPLETION OF EACH STAGE OF THE WORKS THE CONTRACTOR SHALL CERTIFY THAT THOSE WORKS HAVE BEEN UNDERTAKEN AND COMPLETED IN ACCORDANCE WITH THE DRAWINGS, SPECIFICATION AND INSTRUCTIONS ISSUED DURING THE COURSE OF THE CONTRACT.

ALL WORKMANSHIP AND CONSTRUCTION METHODS SHALL BE UNDERTAKEN IN ACCORDANCE WITH CURRENT NSW AND AUSTRALIAN WHS LEGISLATION. TOOL BOX TALKS A SHALL BE HELD EACH DAY PRIOR TO COMMENCING WORKS AND SAFE WORK METHOD STATEMENTS (SWMS)

SHALL BE PREPARED FOR ALL WORK ITEMS AND REVIEWED PRIOR TO UNDERTAKING EACH WORK ITEM.

THE CONTRACTOR SHALL OBTAIN AND KEEP ON SITE ALL RELEVANT MATERIAL SAFETY DATA SHEETS (MSDS) FOR ANY MATERIALS THAT ARE USED IN THE WORKS. ALL TRANSPORTATION, STORAGE AND USE OF THESE MATERIALS SHALL BE IN ACCORDANCE WITH MSDS.

**SITE INFORMATION**

TIDAL PLANE	LEVEL (M AHD)
HIGH HIGH WATER SPRINGS	0.628
MEAN HIGH WATER SPRINGS	0.391
MEAN HIGH WATER	0.338
MEAN TIDE LEVEL	0.081
MEAN LOW WATER	-0.176
MEAN LOW WATER SPRINGS	-0.229
INDIAN SPRINGS LOW WATER	-0.398

PREDICTED PEAK WATER LEVELS FOR GOSFORD  
10-YEAR ARI 1.5 M AHD  
20-YEAR AR 1.6 M AHD

PREDICTED SIGNIFICANT WAVE HEIGHTS FOR GREEN POINT  
5YR ARI ~0.40M  
100YR ARI ~0.50M

**COMMENCEMENT**

SITE ESTABLISHMENT SHALL CONSIST OF THE CONTRACTOR SETTING UP TEMPORARY SERVICES AND FURNISHING ON SITE ALL PLANT, EQUIPMENT AND PERSONNEL NECESSARY FOR COMPLETION OF THE WORKS.

THE SUPERINTENDENT SHALL UNDERTAKE A DILAPIDATION SURVEY OF ALL ITEMS WHICH MAY BE AFFECTED BY THE WORKS AND THE CONTRACTOR SHALL NOT COMMENCE WORK ON THE SITE UNTIL THIS HAS BEEN UNDERTAKEN. THE DILAPIDATION SURVEY SHALL INCLUDE A DETAILED PHOTOGRAPHIC AND/OR VIDEO RECORD OF THE PRE-CONSTRUCTION CONDITION OF THE SITE.

**WORKS ENVIRONMENTAL MANAGEMENT PLAN (EMP)**

THE CONTRACTOR SHALL ENSURE COMPLIANCE WITH ALL RELEVANT LEGISLATION, GUIDELINES, PERMITS, LICENSES AND INDUSTRY CODES OF PRACTICE RELATING TO ENVIRONMENTAL PROTECTION.

THE CONTRACTOR SHALL ENSURE THAT ALL RUBBISH OR SURPLUS MATERIAL IS PROGRESSIVELY REMOVED AND DISPOSED OFF SITE IN AN ENVIRONMENTALLY ACCEPTABLE MANNER.

THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE DESIGN, IMPLEMENTATION AND MONITORING OF ALL TEMPORARY ENVIRONMENTAL MEASURES DURING CONSTRUCTION AND THE RELEVANT DEFECTS LIABILITY PERIOD.

THE CONTRACTOR SHALL BE RESPONSIBLE FOR REPORTING AND CORRECTING WORKS EMP NON-CONFORMANCES DURING CONSTRUCTION AND THE RELEVANT DEFECTS LIABILITY PERIOD, AND CORRECTING WORKS EMP MATTERS RAISED BY THE SUPERINTENDENT ON CORRECTIVE ACTION REQUESTS.

**SURVEY**

ALL LEVELS ARE FROM SURVEY PROVIDED BY STEPHEN THORNE AND ASSOCIATES PTY LTD, DATED 29/04/14. ROYAL HASKONINGDHV TAKE NO

RESPONSIBILITY FOR THE ACCURACY OF THE SURVEY AND SERVICES SHOWN. THE CONTRACTOR SHALL CONFIRM THE SURVEY PRIOR TO COMMENCEMENT OF WORKS.

ON COMPLETION OF THE WORKS A COMPLIANCE SURVEY SHALL BE UNDERTAKEN BY THE CONTRACTOR. THIS SHALL COMPRISE SURVEYED CROSS-SECTIONS OF THE SITE TO BE UNDERTAKEN AT 10M INTERVALS ALONG THE FORESHORE WORKS. THIS INFORMATION SHALL BE USED TO PREPARE WORK AS EXECUTED DRAWINGS OF THE WORKS.

SURVEY SHALL BE CARRIED OUT BY A SUITABLY EXPERIENCED AND QUALIFIED REGISTERED SURVEYOR. THE SUPERINTENDENT SHALL BE PROVIDED WITH PDF AND DWG COPIES OF THE SURVEY AND WORK AS EXECUTED DRAWINGS. THE CONTRACTOR WILL BE RESPONSIBLE FOR ANY FURTHER SURVEY REQUIRED DUE TO WORK BEING INCOMPLETE OR NOT COMPLYING WITH THE DRAWINGS AND SPECIFICATIONS.

**FORESHORE TREATMENT EXTENTS**

THE EXTENTS WOULD BE CONFIRMED ONSITE BY THE SUPERINTENDENT AND APPROXIMATELY BE AS FOLLOWS:

FORESHORE TREATMENT	SET OUT CHAINAGE (M)	
	START	END
ROCK TREATMENT	4	27
	32	38
	39	44
	45	134
	165	199
	209	229
BEACH TREATMENT	150	165
	200	224
	242	253
TIMBER WALL	150	165
	245	253
SALTMARSH BERM	229	245
DINGHY SKID	152	155
	247	250
ROCK PROMONTORY	253	260

**EXCAVATION**

EXCAVATION SHALL BE CARRIED OUT AT THE LOCATIONS SHOWN AND THE LEVELS, WIDTHS AND SIDESLOPES INDICATED ON THE DRAWINGS.

SLOPES OF EXCAVATION BATTERS ARE TO BE DETERMINED BY THE CONTRACTOR.

UNLESS CONFIRMED FOR DEMOLITION, EXISTING SERVICES AND STRUCTURES SHALL BE PRESERVED BY THE CONTRACTOR DURING EXCAVATION ACTIVITIES.

AN INDICATION OF THE MATERIAL TO BE REMOVED DURING EXCAVATION IS PROVIDED IN THE GEOTECHNICAL INVESTIGATIONS THAT HAVE BEEN COMPLETED AT THE SITE. TYPICALLY, THE MATERIAL COMPRISES FINE TO MEDIUM GRAINED SAND WITH A FINES CONTENT OF LESS THAN 10% OVERLAIN BY GENERAL FILL MATERIAL PLACED TO ESTABLISH THE FORESHORE RESERVE.

AT ALL TIMES DURING EXCAVATION THE CONTRACTOR SHALL PROVIDE AND MAINTAIN, TO THE SATISFACTION OF THE SUPERINTENDENT AND RELEVANT AUTHORITIES, A FLOATING BOOM WITH A SUSPENDED SILT CURTAIN TO CONTAIN ANY TURBIDITY GENERATED BY THE WORKS.

ALL EXCAVATED MATERIAL SHALL BE REUSED ONSITE AS DIRECTED BY THE SUPERINTENDENT. OVERSIZED ROCKS, BLOCKS AND DEMOLISHED MASONRY SHALL BE BROKEN UP AS DIRECTED BY THE SUPERINTENDENT TO MEET SIZE REQUIREMENTS FOR REUSE WITHIN THE VARIOUS TREATMENT AREAS.

**D5 FOR CONSTRUCTION**

0	20.12.18	ISSUED FOR CONSTRUCTION	SGB	TB	GPB
REV	DATE	DESCRIPTION	BY	CHK	APP

REVISIONS

CLIENT



PROJECT  
FORESHORE STABILISATION  
CAPTAIN COOK RESERVE  
GREEN POINT

TITLE  
NOTES SHEET 1



DRAWN	COORD. SYSTEM	DATUM	DATE
SGB	MGA	AHD	11.10.2018
SCALE	REF:	PA1889-RHD-00-DR-C-NOTES	
AT A1	AS SHOWN		

DRAWING No.	REVISION
PA1889-RHD-00-DR-C-0001	0



### FILLING

FILL USED FOR CREATION OF NEW BEACH AREAS SHALL BE IMPORTED MEDIUM GRAINED SAND WITH LESS THAN 3% FINES. THIS MATERIAL SHALL BE CLASSIFIED AS VIRGIN EXCAVATED NATURAL MATERIAL (VENM).

FILL USED FOR CREATION OF BEDDING MATERIAL FOR THE DINGY SKID SHALL BE IMPORTED WELL-GRADED, MEDIUM TO COARSE GRAINED SAND WITH LESS THAN 8% FINES. THIS MATERIAL SHALL BE CLASSIFIED AS VIRGIN EXCAVATED NATURAL MATERIAL (VENM).

BACKFILL PLACED BEHIND TIMBER WALL STRUCTURES SHALL BE FREE DRAINING, FREE FROM ORGANIC MATERIALS, OTHER CONTAMINANTS AND DELETERIOUS SUBSTANCES AND HAVE A MAXIMUM PARTICLE SIZE NOT EXCEEDING 40mm

PRIOR TO DELIVERY OF FILL MATERIAL TO SITE, THE CONTRACTOR SHALL PROVIDE WRITTEN EVIDENCE TO THE SUPERINTENDENT DEMONSTRATING THE COMPLIANCE OF PROPOSED FILL MATERIALS WITH THE SPECIFICATION.

FILL MATERIAL SHALL BE PLACED IN LAYERS OF LOOSE THICKNESS NOT EXCEEDING 100mm.

WHERE FILL IS PLACED FOR LANDSCAPING PURPOSES, EACH LAYER SHALL BE COMPACTED TO 90% STANDARD MAXIMUM DRY DENSITY WITHIN 2% OF THE STANDARD OPTIMUM MOISTURE CONTENT.

WHERE BACKFILL IS PLACED ADJACENT TO STRUCTURES, EACH LAYER SHALL BE COMPACTED TO AN AVERAGE DENSITY EQUIVALENT TO 98% (AND NO TEST RESULT BELOW 95%) STANDARD MAXIMUM DRY DENSITY WITHIN 2% OF THE STANDARD OPTIMUM MOISTURE CONTENT.

THE CONTRACTOR SHALL ARRANGE FOR TESTING TO BE CONDUCTED BY A N.A.T.A. APPROVED TESTING LABORATORY TO DETERMINE THE STANDARD OPTIMUM MOISTURE CONTENT AND STANDARD MAXIMUM DRY DENSITY OF FILL MATERIALS.

INSITU DENSITY TESTING ON BACKFILL MATERIAL SHALL BE CARRIED OUT BY THE CONTRACTOR AT A FREQUENCY OF ONE TEST PER LAYER PER 500sqm OR THREE TESTS PER VISIT BY THE SUPERINTENDENT, WHICHEVER REQUIRES THE MOST TESTS, TO CONFIRM COMPLIANCE WITH THE COMPACTION SPECIFICATION.

THE CONSTRUCTION TOLERANCES FOR EARTHWORKS SHALL BE AS FOLLOWS:

- +/-100mm OF THE HORIZONTAL POSITION SHOWN ON THE DRAWINGS.
- +/-50mm OF THE LEVEL/LAYER THICKNESS SHOWN ON THE DRAWINGS.

### ROCK SUPPLY

ROCK USED IN ROCK TREATMENT AREAS SHALL CONSIST OF SANDSTONE SOURCED FROM A QUARRY THAT HAS PREVIOUSLY SUPPLIED ROCK FOR APPLICATION IN MARINE ENVIRONMENTS, AND THAT HAS DEMONSTRATED DURABILITY IN THIS ENVIRONMENT.

FISSILE SEDIMENTARY AND METAMORPHIC ROCK SUCH AS SHALE, MUDSTONES, CLAYSTONES, BEDDED SANDSTONE OR SLATES ARE NOT SUITABLE FOR USE IN ROCK TREATMENT AREAS.

ROCKS SHALL BE UNWEATHERED WITHOUT UNFAVOURABLE DELINEATIONS WITHIN THE MICROFABRIC.

INDIVIDUAL ROCKS SHALL BE HARD, DURABLE AND CLEAN AND FREE FROM CRACKS, CLEAVAGE PLANES, SEAMS, CHEMICAL ALTERATION OR WEATHERING AND OTHER DEFECTS WHICH WOULD RESULT IN THE BREAKDOWN OF THE ROCK IN A MARINE ENVIRONMENT.

ROCK SHALL BE ROUGH AND ANGULAR.

ROCKS SHALL EXHIBIT NO SIGNS OF STRESS RELIEF.

ROCK SHALL AS A MINIMUM SATISFY THE FOLLOWING CRITERIA:

PROPERTY	TEST METHOD	UNIT	CRITERIA
STRENGTH	IS(50) POINT LOAD WET, RMS NSW METHOD T223	MPa	>1.5
	WET/DRY STRENGTH RATIO, RMS NSW METHOD T215	%	<30
DENSITY	DRY UNIT WEIGHT	T/m <sup>3</sup>	2.25
WATER ABSORPTION		%	<1.5
DURABILITY	SODIUM SULFATE SOUNDNESS	%	<9
MAX/MIN DIMENSION	-	-	<2.5

### ROCK PLACEMENT

THE THICKNESS OF ARMOUR ROCK AND ROCK BEDDING SHOWN ON THE DRAWINGS SHALL EACH BE ACHIEVED BY PLACEMENT OF AT LEAST TWO LAYERS OF ARMOUR ROCK AND ROCK BEDDING.

THE ARMOUR ROCK AND ROCK BEDDING SHALL BE PLACED SUCH THAT THE SPECIFIED REQUIREMENTS FOR MASS (50% OR MEDIAN), DIAMETER (MINIMUM AND MAXIMUM), FINISHED SIDE SLOPES, CREST AND TOE LEVELS, LAYER THICKNESSES AND DENSITY REQUIREMENTS ARE SATISFIED.

ROCK SHALL NOT BE ROLLED OR DROPPED INTO POSITION, IT SHALL BE PLACED IN A MANNER THAT SATISFIES THE FOLLOWING:

- MINIMISES ITS BREAKDOWN ON HANDLING AND PRODUCTION OF FINES.
- MINIMISES THE SEGREGATION OF VARIOUS GRADES OF ROCK
- ROCKS ARE WEDGED AND LOCKED TOGETHER SUCH THAT THEY ARE NOT FREE TO MOVE. THIS SHALL BE DONE WITHOUT DISTURBING ADJACENT ROCKS.
- THERE SHALL BE NO FREE ROCK ON THE FINISHED SURFACE OF THE ROCK TREATMENT.

THE CONSTRUCTION TOLERANCES FOR PLACEMENT OF ROCK SHALL BE AS FOLLOWS:

- +/-200mm OF THE HORIZONTAL POSITION SHOWN ON THE DRAWINGS.
- +100mm/-0mm OF THE LAYER THICKNESS SHOWN ON THE DRAWINGS

### GEOTEXTILE FILTER

GEOTEXTILE FILTER FABRIC USED SHALL BE ELCOMAX 600R OR AN APPROVED EQUIVALENT.

GEOTEXTILE SHALL BE LAID ON A CONTINUOUS BED FREE OF VOIDS AND FREE OF SHARP OBJECTS TO PREVENT TEARING.

GEOTEXTILE ELEMENTS MAY BE JOINED BY EITHER OVERLAPPING OR SEWING. OVERLAP WIDTHS SHALL BE NO LESS THAN 0.5m. FOR SEWING ASSEMBLY, 0.1m OVERLAP IS SUFFICIENT USING A NON-BIODEGRADABLE THREAD.

GEOTEXTILE PLACED IN WATER WILL REQUIRE BALLAST TO SECURE IT IN POSITION.

THE GEOTEXTILE SHALL MEET THE INSPECTION AND ACCEPTANCE CRITERIA SET OUT BY THE MANUFACTURER.

### GEOTEXTILE CONTAINERS

GEOTEXTILE CONTAINERS REQUIRED TO CONSTRUCT THE SCOUR PROTECTION ALONG THE SIDES OF THE DINGHY SKIDS ARE TEXCEL 1200RP ELCOROCK STAPLE FIBRE 0.3 M<sup>3</sup> CONTAINERS OR APPROVED

EQUIVALENT. THE CONTAINERS MEASURE 1300 X 800 X 250 MM WHEN FILLED AND THEY ARE COATED WITH A VANDAL DETERRENT COATING.

THE GEOTEXTILE CONTAINERS SHALL BE FILLED AND INSTALLED IN ACCORDANCE WITH THE DRAWINGS, SPECIFICATION AND MANUFACTURER/SUPPLIER'S RECOMMENDATIONS AS ACCEPTED BY THE SUPERINTENDENT.

THE FOLLOWING STANDARDS SHALL BE COMPLIED WITH FOR THE GEOTEXTILE CONTAINER TO THE EXTENT THAT THEY ARE RELEVANT AND NOT OVERRIDDEN BY THE SPECIFICATION: AS 3706 GEOTEXTILES- METHODS OF TEST, AND AS 2001.2.3.2-2001 METHOD OF TEST FOR TEXTILES- PHYSICAL TESTS- DETERMINATION OF MAXIMUM FORCE USING THE GRAB METHOD

THE GEOTEXTILE MATERIAL COMPRISING THE GEOTEXTILE CONTAINERS SHALL COMPLY WITH THE FOLLOWING KEY TEST CRITERIA OR AS OTHERWISE APPROVED BY THE SUPERINTENDENT. SINGLE PRE-FABRICATION OR POST- TESTS WILL BE ACCEPTABLE.

DESCRIPTION	UNIT	TEST CRITERIA	TEST METHOD
THICKNESS @ 2KPA	MM	≥ 9.4	AS3706.1
CBR BURST ELONGATION <sup>1</sup>	N %	≥ 11,400 ≥ 50	AS3706.4
DROP CONE PUNCTURE RESISTANCE (H <sub>60</sub> )	MM	≥ 12,500	AS3706.5
SEAM STRENGTH <sup>2</sup>	KN/M	≥ 31	AS 3706.6
TENSILE STRENGTH	MACHINE	≥ 40	AS3706.2
	ACROSS	≥ 80	
PORE SIZE DRY SIEVE EOS	µM	< 80	AS3706.7
UV STABILITY AFTER 500 HOURS	KN/M	≥ 32	AS3706.11

#### TABLE NOTES

<sup>1</sup> ELONGATION IS THE % CBR ELONGATION AT PUNCTURE CORRESPONDING TO MAXIMUM BURST STRENGTH.

<sup>2</sup> NOTE SEAM STRENGTH INCLUDED AS A GEOTEXTILE MATERIAL SPECIFICATION ITEM. REFER ALSO CLAUSE GEOTEXTILE CONTAINERS AND TESTING REQUIREMENTS - SEWING YARN).

THE SEWING YARN TO CLOSE THE GEOTEXTILE CONTAINERS USED IN THE WORKS SHALL BE POLYESTER WITH A BREAKING STRAIN EQUAL TO OR GREATER THAN 18KG WITH UV STABILITY AFTER 150 HOURS GREATER THAN OR EQUAL TO 10KG IN ACCORDANCE WITH AS3706.11-2000.


SAMPLING AND TESTING SHALL BE UNDERTAKEN BY AN INDEPENDENT NATA REGISTERED TESTING ORGANISATION APPROVED IN WRITING BY THE SUPERINTENDENT. THE CONTRACTOR SHALL ISSUE THE FOLLOWING FOR APPROVAL:

- FOR INFORMATION, BASELINE QUALITY CONTROL SUBMISSIONS FOR EACH BATCH OF PRODUCTION;
- FOR APPROVAL, RESULTS OF LABORATORY TESTING IN COMPLIANCE WITH THE REQUIREMENTS OF THE SPECIFICATION;
- FOR INFORMATION, LETTER OF CERTIFICATION.

BASELINE QUALITY CONTROL SUBMISSIONS SHALL COMPRISE A PHYSICAL PROPERTIES SHEET AND THE GEOTEXTILE MANUFACTURER QUALITY CONTROL DOCUMENTATION FOR THE PARTICULAR LOTS OF GEOTEXTILE TO BE USED IN THE FABRICATION OF THE GEOTEXTILE CONTAINERS DELIVERED.

THE CONTRACTOR SHALL SUBMIT TO THE SUPERINTENDENT FOR INFORMATION A LETTER OF CERTIFICATION, MAKING SPECIFIC REFERENCE TO THE BASELINE QUALITY CONTROL SUBMISSIONS AND THE APPROVED RESULTS OF LABORATORY TESTING, STATING THAT THE GEOTEXTILE MATERIAL AND YARN COMPRISING THE GEOTEXTILE CONTAINERS IS IN CONFORMANCE WITH THE INDEX AND PERFORMANCE PROPERTIES AS REQUIRED BY THE SPECIFICATION.

**D5 FOR CONSTRUCTION**

0	20.12.18	ISSUED FOR CONSTRUCTION	SGB	TB	GPB
REV	DATE	DESCRIPTION	BY	CHK	APP
REVISIONS					
CLIENT					
					
PROJECT					
<b>FORESHORE STABILISATION CAPTAIN COOK RESERVE GREEN POINT</b>					
TITLE					
<b>NOTES SHEET 2</b>					
					
DRAWN	COORD. SYSTEM	DATUM	DATE		
SGB	MGA	AHD	11.10.2018		
SCALE	REF:	DRAWING No.			
AS SHOWN	PA1889-RHD-00-DR-C-0001_0004	PA1889-RHD-00-DR-C-0002			
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GEOTEXTILE MATERIAL USED TO MANUFACTURE THE GEOTEXTILE CONTAINERS SHALL BE MANUFACTURED UNDER A QUALITY MANAGEMENT SYSTEM THAT IS THIRD PARTY CERTIFIED TO ISO 9001:2000 STANDARDS. GEOTEXTILE FILAMENTS SHALL BE ROT-PROOF, CHEMICALLY STABLE AND HAVE LOW WATER ABSORBENCY. FILAMENTS SHALL RESIST DELAMINATION AND MAINTAIN THEIR RELATIVE DIMENSIONAL STABILITY IN THE GEOTEXTILE. COATINGS OR PROTECTION LAYERS SHALL NOT COMPROMISE PERFORMANCE OF THE BASE MATERIAL. GEOTEXTILES SHALL HAVE STAPLE FILAMENTS, BONDED BY THE NEEDLE PUNCHING PROCESS. CONTINUOUS FILAMENT NEEDLE PUNCHED GEOTEXTILES SHALL NOT BE PERMITTED. GEOTEXTILES SHALL BE FREE OF ANY DEFECTS WHICH MAY HAVE AN ADVERSE EFFECT ON THE PHYSICAL AND MECHANICAL PROPERTIES OF THE GEOTEXTILE.

THE FABRICATING FACILITY SHALL OPERATE UNDER A MANAGEMENT SYSTEM THAT IS THIRD PARTY CERTIFIED TO ISO 9001:2000 STANDARDS. THE GEOTEXTILE CONTAINERS SHALL BE FABRICATED SUCH AS TO ENSURE EFFICIENT AND DURABLE CONTAINERS.

ALL GEOTEXTILE CONTAINER PALLETS SHALL BE WRAPPED IN OPAQUE UV AND MOISTURE RESISTANT PLASTIC SHEETING TO AVOID ANY DAMAGE PRIOR TO INSTALLATION.

THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE STORAGE OF THE GEOTEXTILE CONTAINERS ON SITE. PROVIDE A STORAGE SPACE SUCH THAT ON-SITE HANDLING IS MINIMISED AND UV DEGRADATION IS PREVENTED. THE METHOD OF STORAGE SHALL BE IN ACCORDANCE WITH ANY OTHER RECOMMENDATIONS SET BY THE MANUFACTURER/SUPPLIER.

WITH EACH BATCH OF GEOTEXTILE CONTAINERS DELIVERED TO THE SITE, THE CONTRACTOR SHALL PROVIDE A CERTIFICATE OF COMPLIANCE THAT THE GEOTEXTILE COMPLIES WITH ALL THE REQUIREMENTS OF THIS SPECIFICATION.

CONTROL TESTING SHALL BE CARRIED OUT BY THE CONTRACTOR FOR EACH BATCH OF GEOTEXTILE IN ACCORDANCE WITH THE CONTRACTORS QUALITY SYSTEM IN ACCORDANCE WITH THE PROVISIONS OF THE SPECIFICATION.

FILL FOR THE GEOTEXTILE CONTAINERS SHALL COMPRISE SAND FROM AN APPROVED SOURCE. METHODS USED TO FILL THE GEOTEXTILE CONTAINERS CAN BE EITHER DRY FILLING OR HYDRAULIC. CONTAINERS SHALL BE SUITABLY FILLED SUCH THAT THE GEOTEXTILE IS TIGHT WHEN CLOSED, AND HAS MINIMAL OPPORTUNITY TO FLAP WHEN INUNDATED DURING HIGH WATER LEVEL AND WAVE CONDITIONS. THE GEOTEXTILE CONTAINERS SHALL BE FILLED STRICTLY IN ACCORDANCE WITH INSTRUCTIONS PROVIDED BY THE MANUFACTURER/SUPPLIER.

CLOSE THE GEOTEXTILE CONTAINERS AFTER FILLING WITH SAND. CLOSURE SHALL COMPRISE SEWING UNLESS APPROVED OTHERWISE. ALL CLOSURES SHALL BE MADE IN A MANNER SUFFICIENT TO PREVENT MOVEMENT OF THE FILLING TRUNK BY WAVE ACTION. SEWN CLOSURE SEAMS SHALL BE EITHER FACTORY OR SITE CLASS. FACTORY CLASS SEAMS SHALL MEET WITH HIGH QUALITY ASSURANCE STANDARDS WHILE SITE CLASS SEAMS MUST INCLUDE SAFETY FEATURES.

FACTORY CLASS STITCHING SHALL BE DOUBLE SINGLE-CHAIN POLYESTER. SITE CLASS SEAMS ARE USED DURING CONSTRUCTION TO ACHIEVE CLOSURE OF THE FILLED CONTAINERS. PRIOR TO COMMENCEMENT OF CONTAINER FILLING, THE CONTRACTOR SHALL SUBMIT DETAILS AND GAIN APPROVAL FOR SITE CLASS SEAMS TO BE USED.

THE CONTAINERS SHALL BE PLACED IN SUCH A WAY AS TO AVOID ANY RISK OF PUNCTURE OR DAMAGE TO THE EDGE SEAMS. ENSURE MANOEUVRING AND HANDLING DURING PLACEMENT TO REDUCE THE STRAINS PUT ON THE GEOTEXTILE AND SEAMS. ANY SHARP-EDGED OBJECTS INCLUDING ROCKS SHALL BE REMOVED FROM THE BED PRIOR TO PLACING THE BED LAYER OF THE GEOTEXTILE CONTAINERS. THE CONTAINERS SHALL BE PLACED IN SUCH A WAY AS TO MINIMISE EXPOSURE OF SITE CLASS SEAMS.

THE CONTRACTOR SHALL PROVIDE THE COUNCIL WITH A DETAILED METHODOLOGY, PREPARED BY THE MANUFACTURER/SUPPLIER, FOR THE REPAIR OF GEOTEXTILE CONTAINERS WHICH MAY BE DAMAGED DURING

THE LIFE OF THE REVETMENT. THE CONTRACTOR SHALL PROVIDE THE COUNCIL WITH THREE (3) STANDARD PATCHES.

### TIMBER SUPPLY

WHERE POSSIBLE, THE NEW TIMBER RETAINING WALL (LOGS AND WALING) BEHIND BEACH TREATMENT AREAS SHALL BE CONSTRUCTED FROM TIMBER RECYCLED FROM EXISTING TIMBER WALLS AT THE SITE.

NEW SAWN TIMBER SHALL BE TREATED, HARDWOOD IN-GROUND DURABILITY CLASS I OR II GRADE F17 UNLESS NOTED OTHERWISE.

PRESERVATIVE TREATMENT FOR TIMBER SHALL IN ACCORDANCE WITH AS1604 FOR HAZARD CLASS H6. THE PRESERVATIVES USED SHALL BE COPPER CHROME ARSENIC (CCA) AND PIGMENT EMULSIFIED CREOSOTE (PEC). THE CONTRACTOR SHALL PROVIDE DETAILS OF THE PRESERVATION COMPANY TO THE SUPERINTENDENT AND A CERTIFICATE OF COMPLIANCE WITH THE RETENTION RATES AND PENETRATION RATES IN AS1604. THE CERTIFICATE SHALL ALSO STATE THE SPECIES OF TIMBER AND PRESERVATIVES USED.

MAXIMUM TIMBER DIMENSIONAL TOLERANCE ON THE FINISHED WIDTH AND THICKNESS TO BE:

WIDTH:	+6mm	-3mm
THICKNESS:	+1.5mm	-1.5mm

### TIMBER CONSTRUCTION

ALL TIMBER CONSTRUCTION SHALL BE IN ACCORDANCE WITH AS1720.

150mm DIAMETER POSTS USED TO SUPPORT THE TIMBER RETAINING WALL ARE TO BE INSTALLED BY EXCAVATION OF A 300mm DIAMETER HOLE TO A DEPTH OF AT LEAST 1m BELOW THE NEW BEACH SURFACE LEVEL AND GROUTING OF POSTS WITHIN EACH HOLE. IF SOFT MATERIAL IS ENCOUNTERED DURING EXCAVATION, THE SUPERINTENDENT SHALL BE NOTIFIED AND ENGINEER ADVICE SOUGHT BEFORE PROCEEDING.

ALL BOLTS IN TIMBER CONSTRUCTION TO BE GALVANISED GRADE 4.6/S, WITH MINIMUM 20mm DIAMETER UNLESS NOTED OTHERWISE. BOLT HOLES TO BE DRILLED EXACT SIZE. WASHERS UNDER HEADS AND NUTS TO BE AT LEAST 2.5 TIMES BOLT DIAMETER UNLESS OTHERWISE SPECIFIED.

RECESSES TO THE TOPS OF HORIZONTAL MEMBERS EXPOSED TO THE ENVIRONMENT (SUCH AS FROM BOLTS, SPIKES ETC.) SHALL HAVE DEPRESSIONS FILLED WITH GREY PORION EXTERIOR FILLER OR APPROVED EQUIVALENT AFTER COMPLETION OF THE AFFECTED PART OF THE WORKS.

CUTS, RECESSES, LAPS AND END GRAIN SHALL BE COATED LIBERALLY WITH TWA IN-GROUND PASTE IN ACCORDANCE WITH THE DIRECTIONS FOR USE.

ALL TIMBER JOINTS AND CONNECTORS ARE TO BE 100mm MINIMUM AWAY FROM LOOSE KNOTS, SEVERE SLOPING GRAIN, GUM VEINS OR OTHER MINOR DEFECTS.

THE FACE OF ROUNDED TIMBER MEMBERS SHALL BE SAW CUT TO PROVIDE A FLAT SURFACE FOR TIMBER CONNECTIONS.

### METAL FIXINGS

ALL BOLTS, WASHERS, NUTS, NAILS, BRACKETS AND CHAIN SHALL BE HOT DIP GALVANISED IN ACCORDANCE WITH AS4680.

EXPOSED BOLTS AND NUTS SHALL BE PROTECTED AFTER THE BOLT HAS BEEN FINALLY TIGHTENED AS FOLLOWS. THE NUTS AND BOLT-ENDS PROTRUDING BEYOND THE NUTS, SHALL BE PAINTED WITH TWO COATS OF AN ALUMINISED PROTECTIVE MASTIC COATING.

### DEMOLITION

ALL EXISTING STRUCTURES ABUTTING UNDER OR PROTRUDING THROUGH THE WORKS SHALL BE DEMOLISHED UNLESS NOTED OTHERWISE ON THE DRAWINGS. CONFIRM EXTENT OF DEMOLITION ON SITE WITH THE SUPERINTENDENT BEFORE PROCEEDING WITH THE WORK.

THE CONTRACTOR SHALL CARRY OUT DEMOLITION WORK IN ACCORDANCE WITH AS2601 MAKING DUE ALLOWANCE FOR THE DETERIORATED CONDITION OF THE STRUCTURES.

THE CONTRACTOR SHALL PROTECT PROPERTY AND SERVICES WHICH ARE TO REMAIN ON OR ADJACENT TO THE SITE DURING DEMOLITION ACTIVITIES.

ALL DEMOLITION MATERIALS SHALL BE LAWFULLY DISPOSED OF OR REUSED IN ACCORDANCE WITH THE DRAWINGS AND SPECIFICATIONS.

### SALTMARSH VEGETATION

THE CONTRACTOR SHALL ENSURE THAT THE SEEDLINGS FOR THE VEGETATION SPECIES ARE SOURCED FROM A NURSERY THAT HAS EXPERIENCE IN SALTMARSH SUPPLY. SALTMARSH SPECIES THAT ARE APPROVED FOR USE COMPRISE SARCOCORNIA QUINQUEFLORA (SAMPHIRE) AND SUAEDA AUSTRALIS (SEABLITE).

PLANT AND GROWTH MEDIUM SAMPLES SHALL BE PROVIDED TO THE SUPERINTENDENT PRIOR TO ACCEPTANCE OF STOCK FROM THE SOURCE NURSERY FOR USE IN THE WORKS. ONE SAMPLE FOR EACH PLANT SPECIES SHALL BE PROVIDED IN THE CONDITION IN WHICH IT IS PROPOSED TO BE SUPPLIED TO SITE. A 5kg SAMPLE OF GROWTH MEDIUM SHALL ALSO BE PROVIDED.

ONCE THE SALTMARSH PLANT STOCK IS INSPECTED FOR ANY DEFECTIVE STOCK (AND REFUSED IF REQUIRED), THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE DELIVERY, STORAGE AND MAINTENANCE OF THE SALTMARSH PLANT STOCK PRIOR TO PLANTING. PLANTS SHALL BE DELIVERED ON A DAY-TO-DAY BASIS AND NOT BE STORED AT THE SITE FOR LONGER THAN 24 HOURS.

THE SALTMARSH GROWTH MEDIUM SHALL CONSIST OF A MINIMUM 250mm LAYER OF SOIL MATERIAL CAPABLE OF SUPPORTING HEALTHY MARINE VEGETATION. THIS SHALL COMPRISE SOIL THAT CONTAINS AN ADEQUATE PROPORTION OF SILT AND ORGANIC MATERIAL WITH GOOD MOISTURE RETENTION AND IS FREE FROM THE FOLLOWING:

- STONES OVER 25mm DIAMETER.
- CLAY LUMPS.
- TREE ROOTS.
- WEEDS, PARTICULARLY HYDROCOTYLE BONARIENSIS AND JUNCTUS ACUTUS (SPINY RUSH).
- STICKS, DEMOLITION DEBRIS AND OTHER RUBBISH.
- MATERIAL TOXIC TO PLANTS.



THE GROWTH MEDIUM SHALL BE EVALUATED FOR SUITABILITY BY A QUALIFIED SOIL SCIENTIST AND ACCEPTED BY A PRACTITIONER EXPERIENCED IN SALTMARSH CONSTRUCTION. GROWTH MEDIUM MAY BE SOURCED FROM EXCAVATED NON ACID SULFATE SOIL MATERIAL FROM THE SITE SUBJECT TO ITS EVALUATION, AND AMELIORATION OR ADDITIVES APPLIED AS NECESSARY. ALL IMPORTED GROWTH MEDIUM SHALL COMPLY WITH THE NEPC INTERIM URBAN ECOLOGICAL INVESTIGATION LEVELS.

THE BASE SOIL SHALL BE RIPPED PRIOR TO PLACEMENT OF THE GROWTH MEDIUM.

THE CONTRACTOR SHALL ENSURE THAT EROSION OF THE GROWTH MEDIUM DOES NOT OCCUR. A SINGLE LAYER OF CRUSHED SANDSTONE BETWEEN 40mm AND 70mm IN DIAMETER SHALL BE USED AS 'MULCH' TO PREVENT EROSION DURING ESTABLISHMENT OF VEGETATION.

PRIOR TO SALTMARSH PLANTING, THE SUPERINTENDENT SHALL VERIFY THAT THE LEVEL OF THE PLACED GROWTH MEDIUM MEETS THE INTENDED TIDAL INUNDATION FREQUENCY. THE SUPERINTENDENT SHALL BE NOTIFIED WHEN THE CONTRACTOR HAS COMPLETED THE PLACEMENT OF THE GROWTH MEDIUM. THE CONTRACTOR SHALL ALLOW FOR A 14 DAY PERIOD FOR THE SUPERINTENDENT TO INSPECT THE TIDAL INUNDATION OF THE PLACED GROWTH MEDIUM. THE SUPERINTENDENT MAY INSTRUCT

**D5 FOR CONSTRUCTION**

0	20.12.18	ISSUED FOR CONSTRUCTION	SGB	TB	GPB
REV	DATE	DESCRIPTION	BY	CHK	APP
REVISIONS					
CLIENT					
					
PROJECT					
FORESHORE STABILISATION CAPTAIN COOK RESERVE GREEN POINT					
TITLE					
NOTES SHEET 3					
					
DRAWN	COORD. SYSTEM	DATUM	DATE		
SGB	MGA	AHD	11.10.2018		
SCALE	REF.	DRAWING No.			
AS SHOWN	PA1889-RHD-00-DR-C-NOTES	PA1889-RHD-00- DR-C-0003			
DRAWING No.					REVISION
PA1889-RHD-00- DR-C-0003					0

THE CONTRACTOR TO INFILL OR TRIM THE PLACED GROWTH MEDIUM TO EITHER RAISE OR LOWER THE PLANTING AREA.

PLANTING SHALL BE UNDERTAKEN WITH THE PLANT SPECIES AND AT PLANTING CENTRES AS DIRECTED BY THE SUPERINTENDENT.

THE CONTRACTOR SHALL ENSURE THAT PLANTING ACTIVITIES ARE LIMITED TO COMPANIES OR INDIVIDUALS WITH EXPERIENCE IN PLANTING THE NOMINATED SPECIES.

THE CONTRACTOR SHALL INSTALL PLANTS WITH THE FOLLOWING CHARACTERISTICS:

- LARGE HEALTHY ROOT SYSTEMS.
- VIGOROUS AND WELL ESTABLISHED.
- FREE FROM DISEASE AS PESTS.
- OF GOOD FORM CONSISTENT WITH THE SPECIES OR VARIETY.
- HARDENED OFF, NOT SOFT OR FORCED

THE PLANT MATERIAL SHALL BE SUFFICIENTLY ROBUST TO STAND UP UNDER ITS OWN WEIGHT. WEAK STEMMED PLANTS SHALL BE REJECTED BY THE SUPERINTENDENT. WHERE STAKING IS REQUIRED, IT SHALL BE TO HOLD THE ROOT BALL STILL WHILE TENDED ROOTS MOVE INTO THE GROWTH MEDIUM, NOT TO SUPPORT WEAK STEMS.

SALTMARSH PLANTING SHALL BE UNDERTAKEN WHEN THE SOIL HAS DRIED OUT, AND TRAMPLING AND FORMATION OF UNEVEN LEVELS OF THE GROWTH MEDIUM SHALL BE PREVENTED.

THE CONTRACTOR SHALL ENSURE THAT PLANTS ARE SUITABLY PROTECTED TO WITHSTAND BEING BLOWN OVER, WASHED AWAY OR EATEN BY ANIMALS. THIS MAY REQUIRE STAKING AND PLACEMENT OF WIRE MESH SURROUNDS.

PLANTING SHALL NOT BE UNDERTAKEN IN UNSUITABLE WEATHER CONDITIONS, SUCH AS EXTREME HEAT AND/OR WIND, UNDER WHICH INDIVIDUAL SPECIMENS MAY SUFFER, AFFECTING ESTABLISHMENT.

FOLLOWING PLANTING, THE SALTMARSH PLANTING AREA SHALL BE IRRIGATED WITH FRESH WATER SUCH THAT THE GROWTH MEDIUM IS THOROUGHLY SATURATED. FOLLOWING INITIAL WATERING, THE PLANTING AREA SHALL BE WATERED WITH FRESH WATER EVERY 3-4 DAYS OR MORE FREQUENTLY TO ENSURE THAT THE ROOTS ARE CONTINUALLY MOIST. WATERING SHALL BE UNDERTAKEN FOR A MINIMUM OF 3 MONTHS.

THE CONTRACTOR MUST PLANT THE FULL COMPLEMENT OF SALTMARSH AS SPECIFIED AND DIRECTED BY THE SUPERINTENDENT, AND GUARANTEE AN 80% SUCCESS RATE FOR ALL SPECIES.

**FORESHORE PLANTING**

THE CONTRACTOR SHALL PLACE A MINIMUM 150mm THICK LAYER OF GROWTH MEDIUM OVER DISTURBED AREAS BEHIND FORESHORE TREATMENT AREAS TO MATCH THE EXISTING SURFACE AND FACILITATE THE ESTABLISHMENT OF GRASS COVER AND PLANTING OF ENDEMIC GRASSES/SEDGES. THE GROWTH MEDIUM SHALL HAVE THE SAME SPECIFICATIONS AS THE GROWTH MEDIUM USED FOR SALTMARSH ESTABLISHMENT.

THE CONTRACTOR SHALL ESTABLISH GRASS COVER AND PLANT SPECIES AT PLANTING CENTRES AS DIRECTED BY THE SUPERINTENDENT. AREAS OF GRASS ESTABLISHMENT AND PLANTINGS SHALL BE MAINTAINED BY THE CONTRACTOR OVER MINIMUM PERIOD OF 3 MONTHS AT A WATERING FREQUENCY SPECIFIED BY THE SUPERINTENDENT.

**COMPLETION**

EXCEPT TO THE EXTENT THAT THE SITE HAS BEEN REPAIRED AND UPGRADED IN ACCORDANCE WITH THE WORKS, THE CONTRACTOR SHALL REINSTATE TO ITS PRECONSTRUCTION CONDITION ALL AREAS DISTURBED AND ANY STRUCTURES DAMAGED DURING THE WORKS.

**D5 FOR CONSTRUCTION**

0	20.12.18	ISSUED FOR CONSTRUCTION	SGB	TB	GPB
REV	DATE	DESCRIPTION	BY	CHK	APP

REVISIONS

CLIENT



PROJECT

FORESHORE STABILISATION  
CAPTAIN COOK RESERVE  
GREEN POINT

TITLE

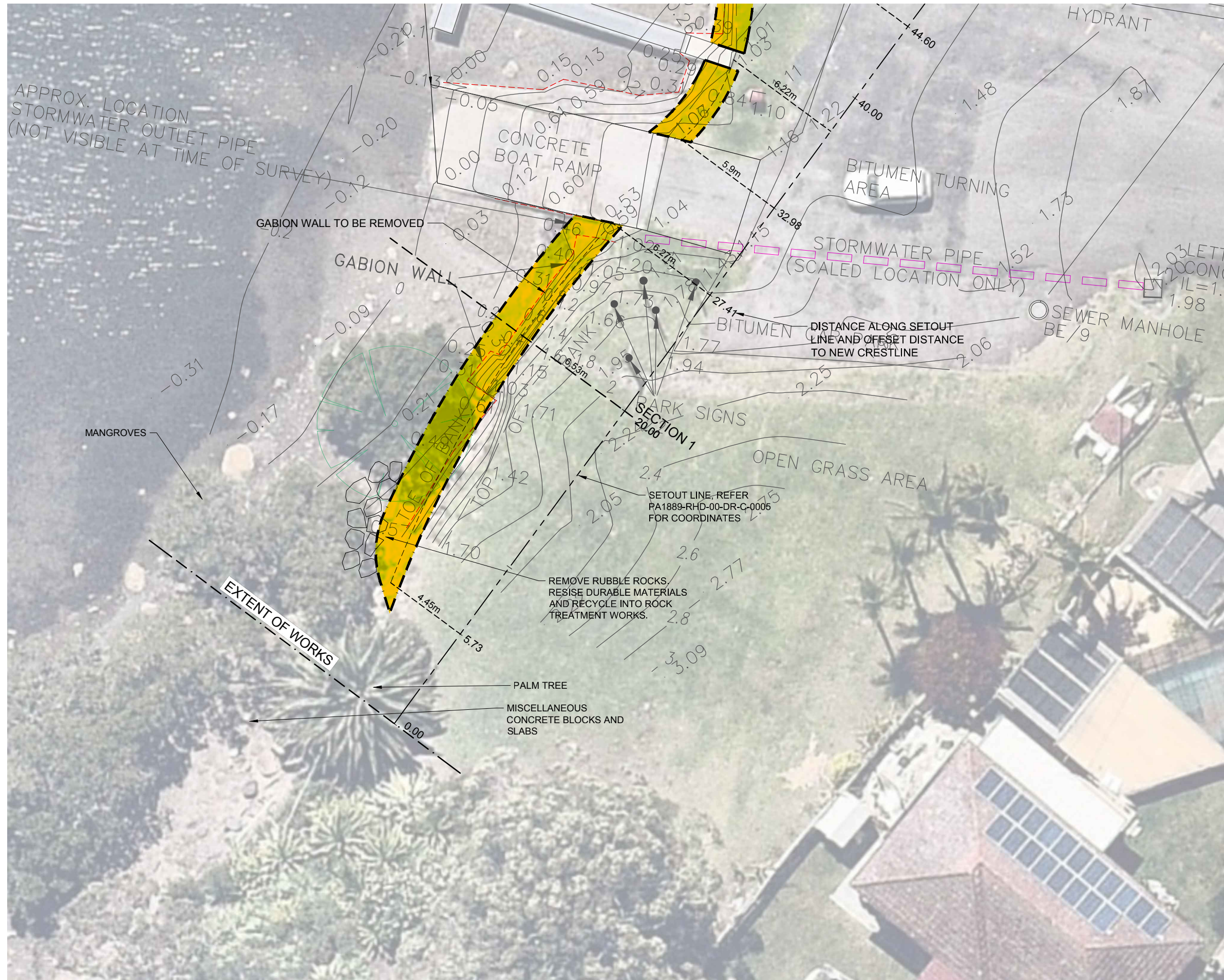
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DRAWN	COORD. SYSTEM	DATUM	DATE
SGB	MGA	AHD	11.10.2018
SCALE	REF.	DRAWING No.	
AS SHOWN	PA1889-RHD-00-DR-C-NOTES	PA1889-RHD-00-DR-C-0004	

DRAWING No.	REVISION
PA1889-RHD-00-DR-C-0004	0





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**LEGEND:**

- ROCK TREATMENT
- BEACH TREATMENT
- SALT MARSH BERM TREATMENT



**D5 FOR CONSTRUCTION**

REV	DATE	DESCRIPTION	BY	CHK	APP
0	20.12.18	ISSUED FOR CONSTRUCTION	SGB	TB	GPB

REVISIONS

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PROJECT

**FORESHORE STABILISATION  
CAPTAIN COOK RESERVE  
GREEN POINT**

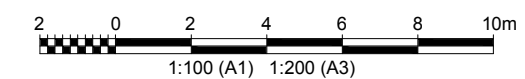
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PLAN  
SHEET 1**

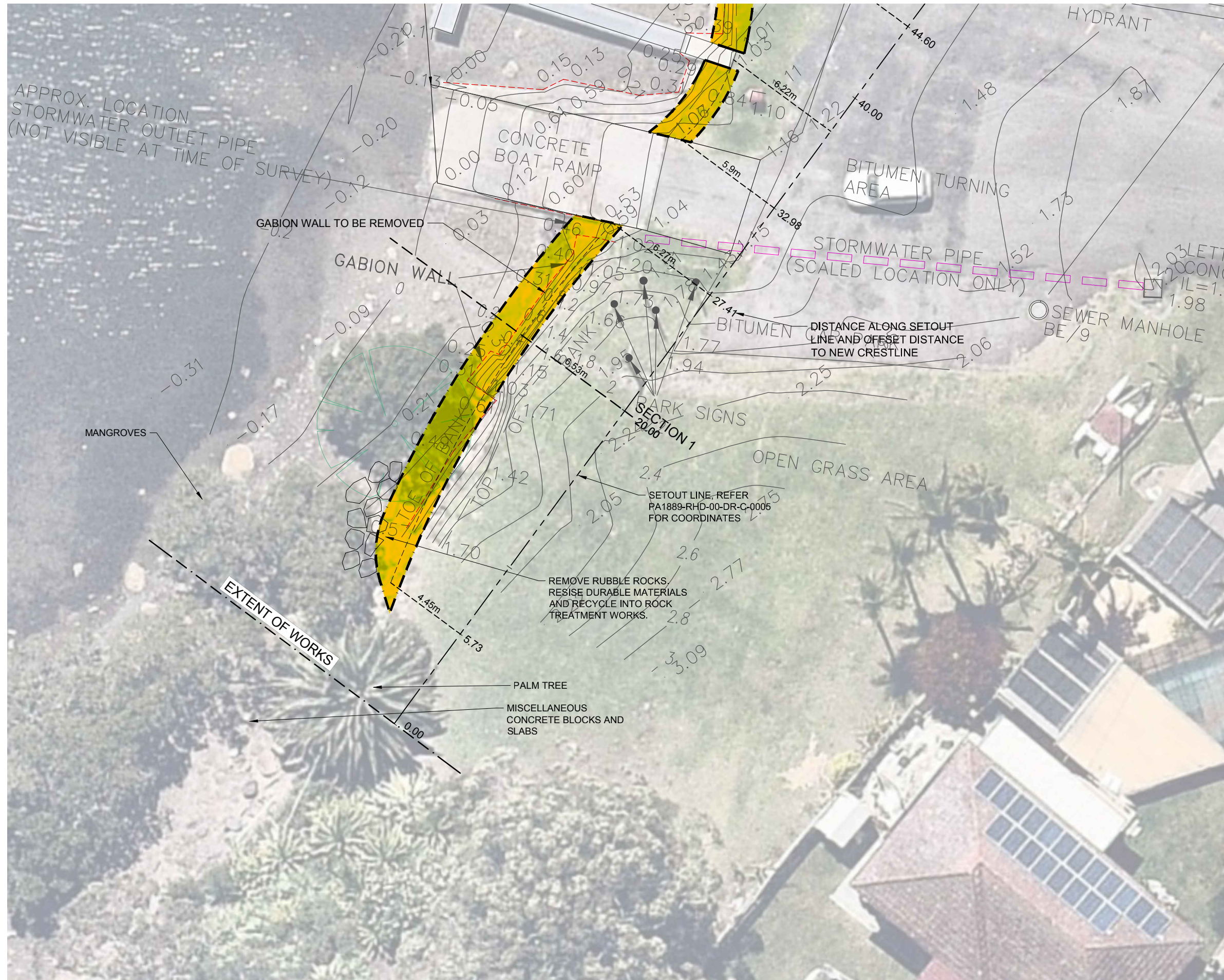
Level 14, 55 Berry Street  
North Sydney NSW 2060  
Australia  
Tel +61 2 88545000  
Fax +61 2 99290960  
Email: project.admin.australia@rhdhv.com  
Website: www.royalhaskoningdhv.com

DRAWN SGB	COORD. SYSTEM MGA	DATUM AHD	DATE 11.10.2018
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DRAWING No.	REVISION
PA1889-RHD-00-DR-C-0006	0







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**LEGEND:**

- ROCK TREATMENT
- BEACH TREATMENT
- SALTMARSH BERM TREATMENT



**D5 FOR CONSTRUCTION**

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REVISIONS

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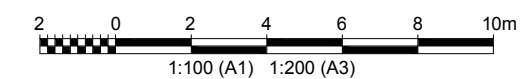
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CAPTAIN COOK RESERVE  
GREEN POINT**

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PLAN  
SHEET 1**

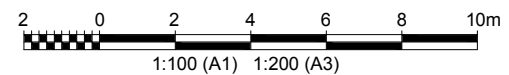
Level 14, 55 Berry Street  
North Sydney NSW 2060  
Australia  
Tel +61 2 88545000  
Fax +61 2 99290960  
Email: project.admin.australia@rhdhv.com  
Website: www.royalhaskoningdhv.com

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**LEGEND:**

- ROCK TREATMENT
- BEACH TREATMENT
- SALT MARSH BERM TREATMENT



**D5 FOR CONSTRUCTION**




0	20.12.18	ISSUED FOR CONSTRUCTION	SGB	TB	GPB
REV	DATE	DESCRIPTION	BY	CHK	APP
REVISIONS					
CLIENT					
PROJECT					
FORESHORE STABILISATION CAPTAIN COOK RESERVE GREEN POINT					
TITLE					
GENERAL ARRANGEMENT PLAN SHEET 2					
DRAWN					
DRAWN					
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AT A1 AS SHOWN	MGA	AHD	11.10.2018		
DRAWING No. PA1889-RHD-00-DR-C-0007					
REVISION A					



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**LEGEND:**

-  ROCK TREATMENT
-  BEACH TREATMENT
-  SALTMARSH BERM TREATMENT



**D5 FOR CONSTRUCTION**

REV	DATE	DESCRIPTION	BY	CHK	APP
0	20.12.18	ISSUED FOR CONSTRUCTION	SGB	TB	GPB

**REVISIONS**

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PROJECT  
**FORESHORE STABILISATION  
CAPTAIN COOK RESERVE  
GREEN POINT**

TITLE  
**GENERAL ARRANGEMENT  
PLAN  
SHEET 3**

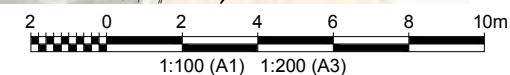
Level 14, 55 Berry Street  
North Sydney NSW 2060  
Australia  
Tel +61 2 98545000  
Fax +61 2 99290960  
Email: project.admin.australia@rhdhv.com  
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DRAWN	COORD. SYSTEM	DATUM	DATE
SGB	MGA	AHD	11.10.2018

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PA1889-RHD-00-DR-C-0008	0



FOR PLAN CONTINUATION REFER DR-C-0007







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**LEGEND:**

- ROCK TREATMENT
- BEACH TREATMENT
- SALTMARSH BERM TREATMENT



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REVISIONS



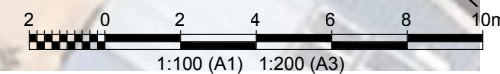
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FORESHORE STABILISATION  
CAPTAIN COOK RESERVE  
GREEN POINT

**TITLE**  
GENERAL ARRANGEMENT  
PLAN  
SHEET 4

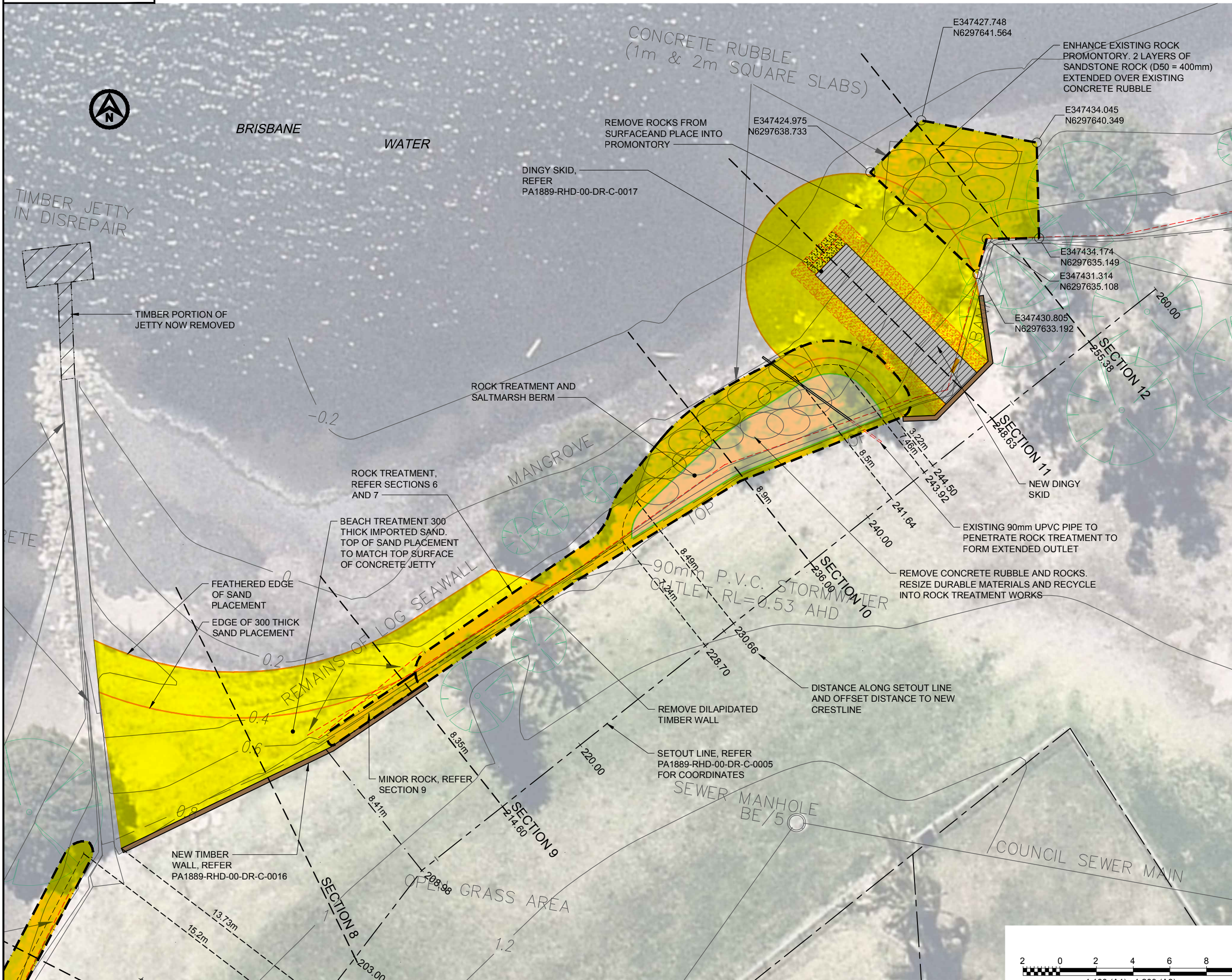


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DRAWING No.	REVISION
PA1889-RHD-00-DR-C-0009	0







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**LEGEND:**

- ROCK TREATMENT
- BEACH TREATMENT
- SALTMARSH BERM TREATMENT



NOT FOR CONSTRUCTION

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REV DATE DESCRIPTION		



**PROJECT**  
FORESHORE STABILISATION  
CAPTAIN COOK RESERVE  
GREEN POINT

**TITLE**  
GENERAL ARRANGEMENT  
PLAN  
SHEET 5

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North Sydney NSW 2060  
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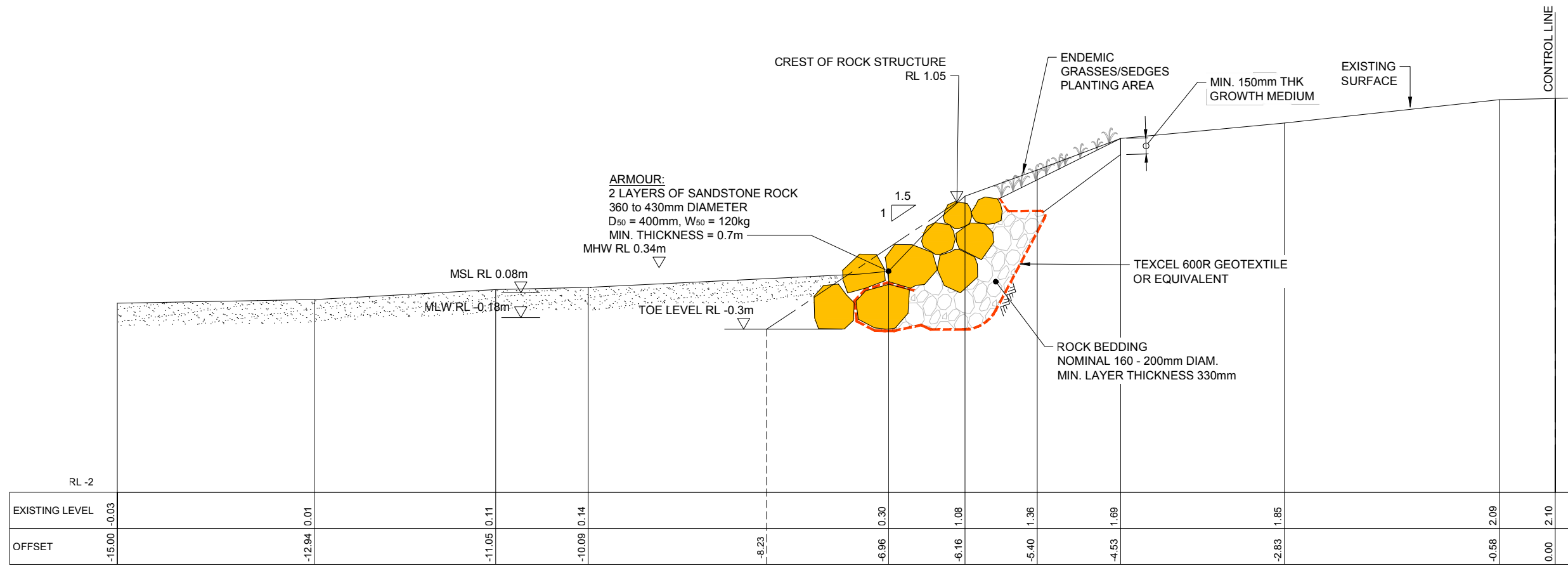


FOR PLAN CONTINUATION REFER DR-C-009



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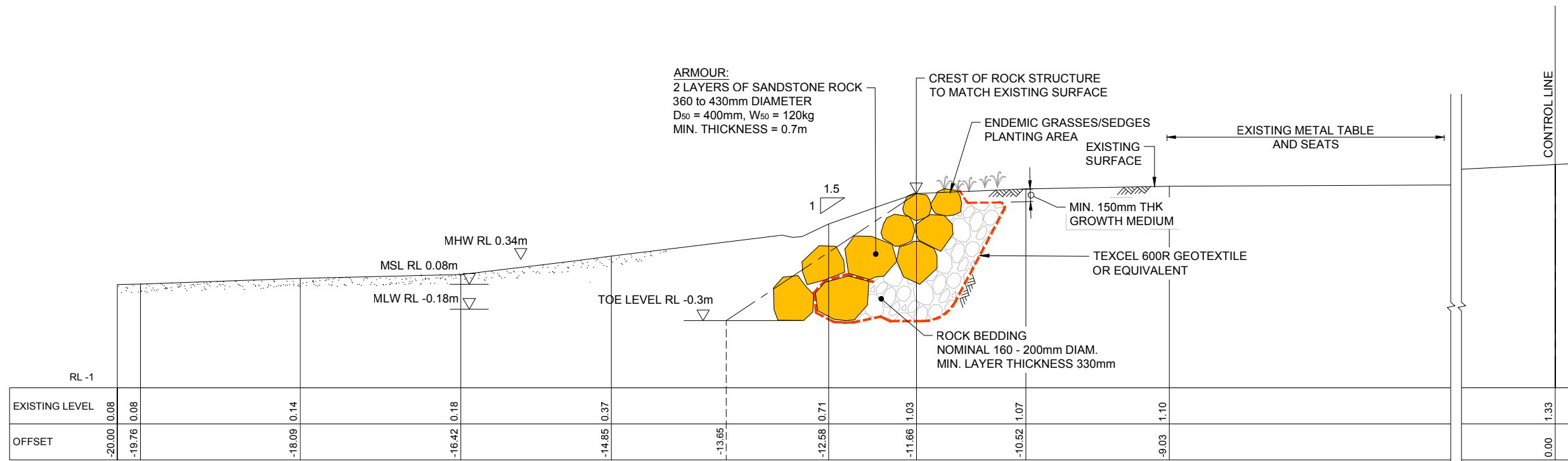
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ROCK TREATMENT

SCALE 1:25

SECTION 1



ROCK TREATMENT

SCALE 1:25

SECTION 2

**D5 FOR CONSTRUCTION**

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REV	DATE	DESCRIPTION	BY	CHK	APP

REVISIONS

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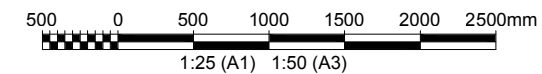
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FORESHORE STABILISATION  
CAPTAIN COOK RESERVE  
GREEN POINT

TITLE  
SECTIONS AND DETAILS  
SHEET 1



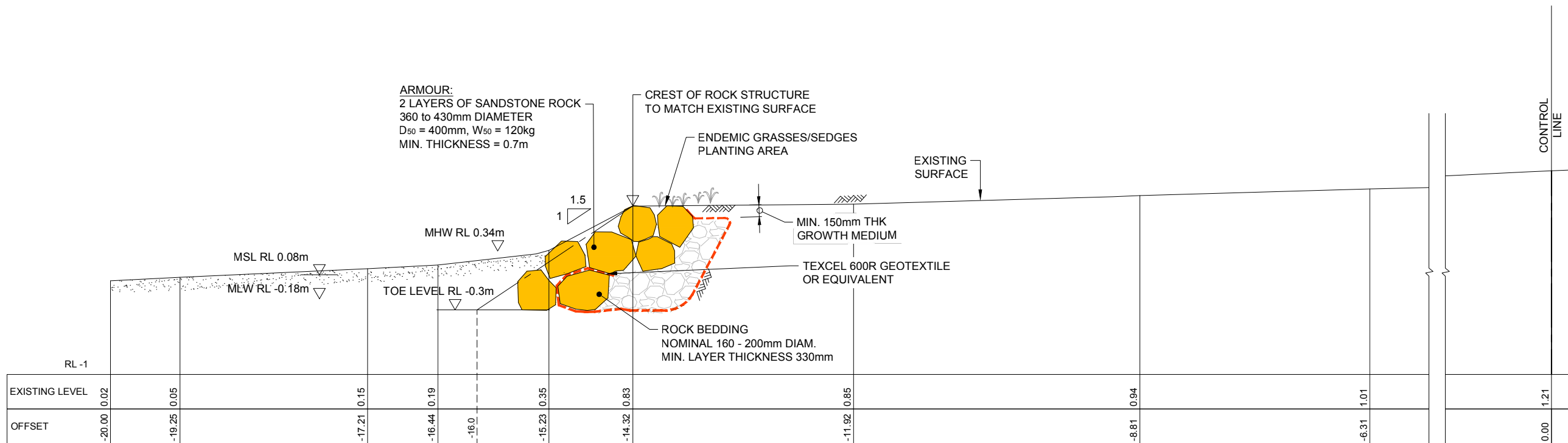
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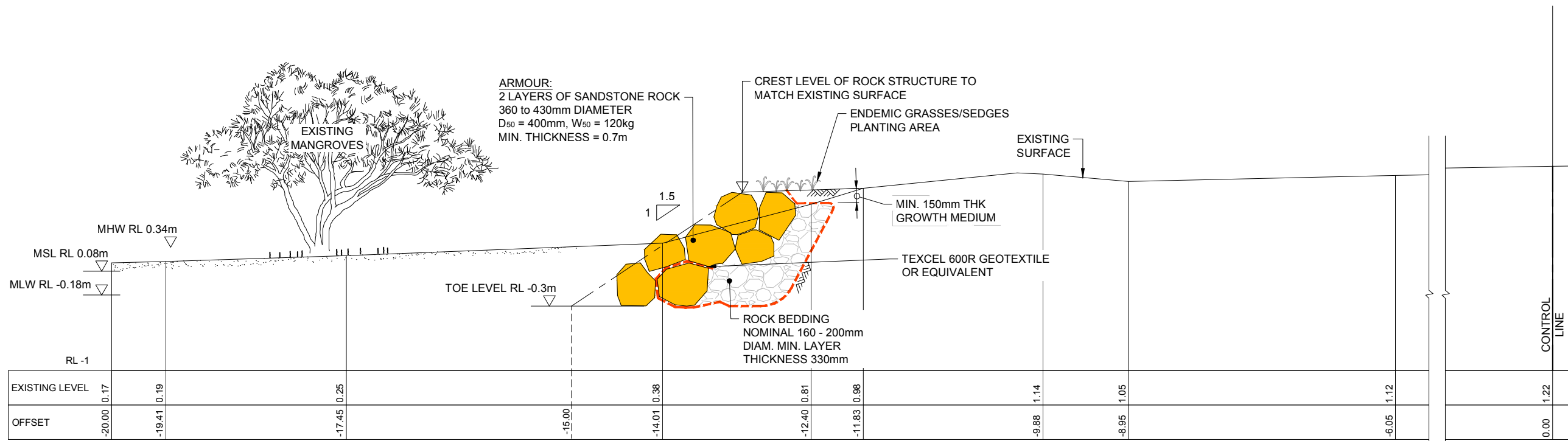
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**SECTION 3**

**ROCK TREATMENT**  
SCALE 1:25



**SECTION 4**

**ROCK TREATMENT**  
SCALE 1:25

**D5 FOR CONSTRUCTION**

REV	DATE	DESCRIPTION	BY	CHK	APP
0	20.12.18	ISSUED FOR CONSTRUCTION	SGB	TB	GPB

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PROJECT

FORESHORE STABILISATION  
CAPTAIN COOK RESERVE  
GREEN POINT

TITLE

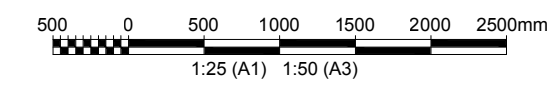
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SHEET 2



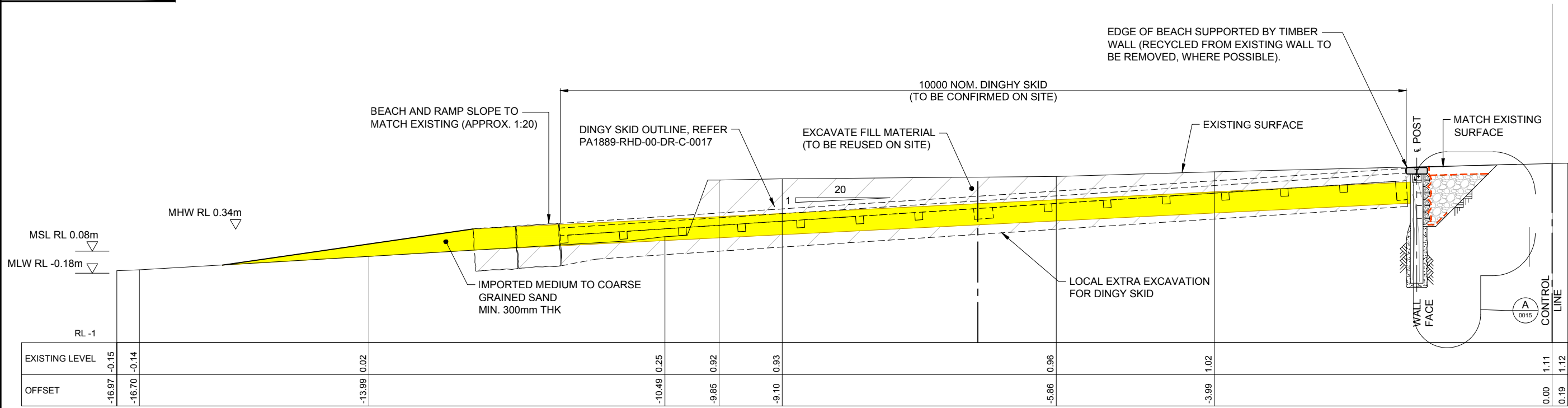
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PA1889-RHD-00-DR-C-0012	0



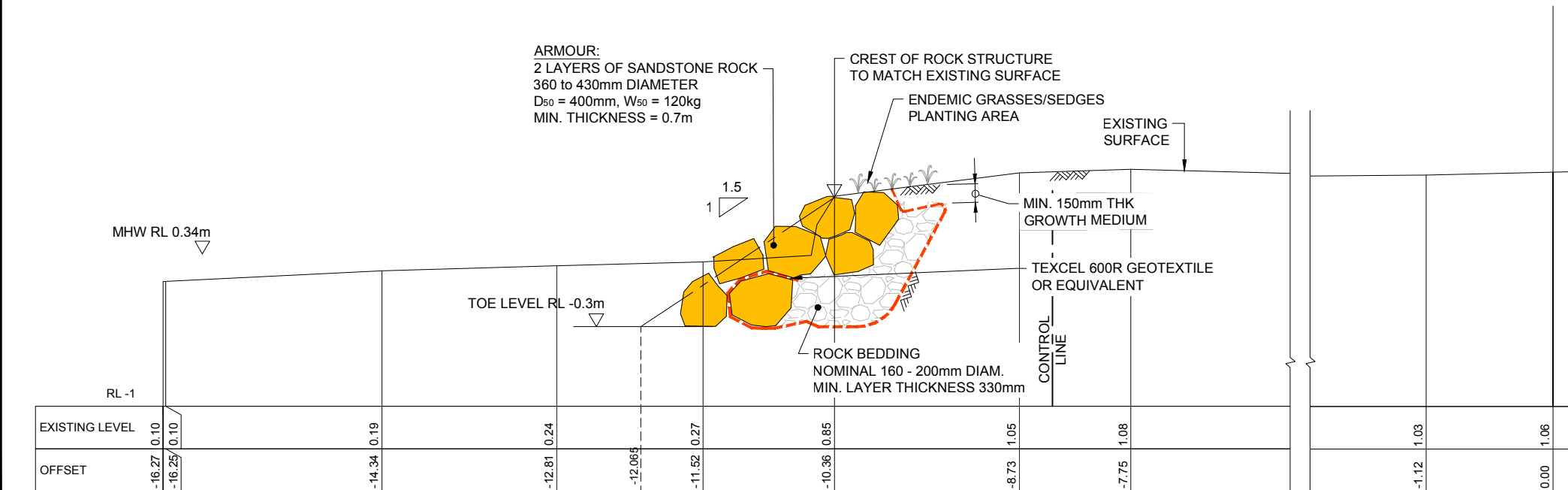




**BEACH TREATMENT**

SCALE 1:25

**SECTION 5**



**ROCK TREATMENT**

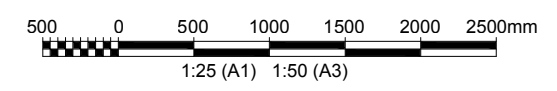
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**SECTION 6**

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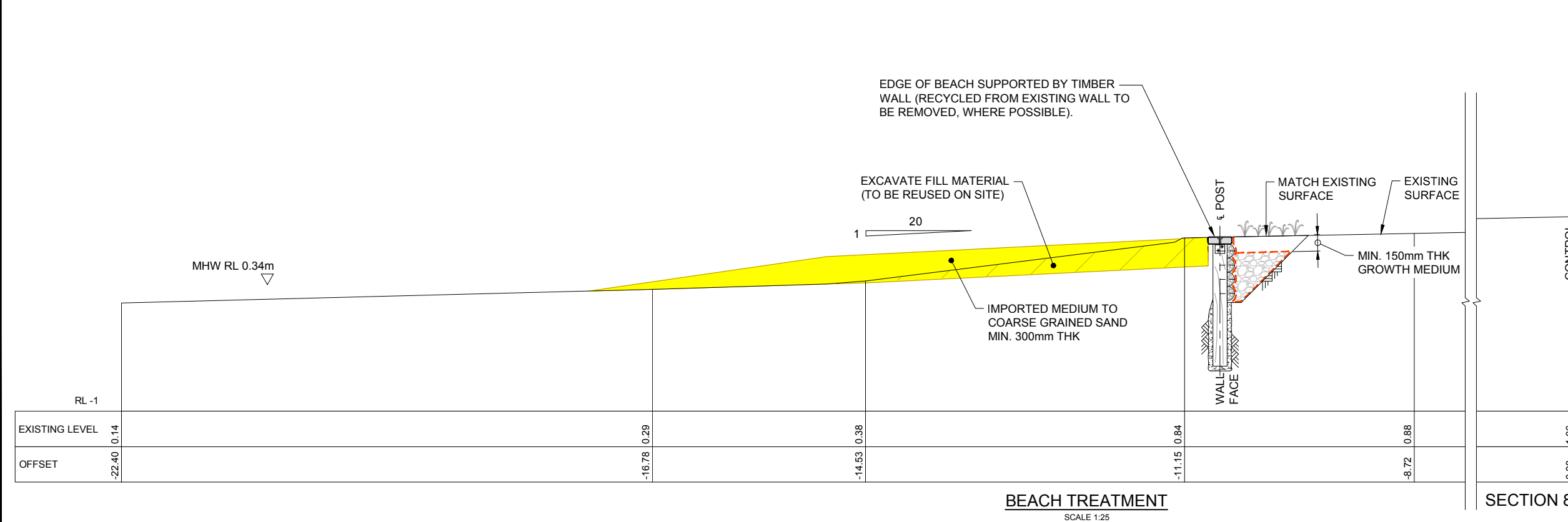
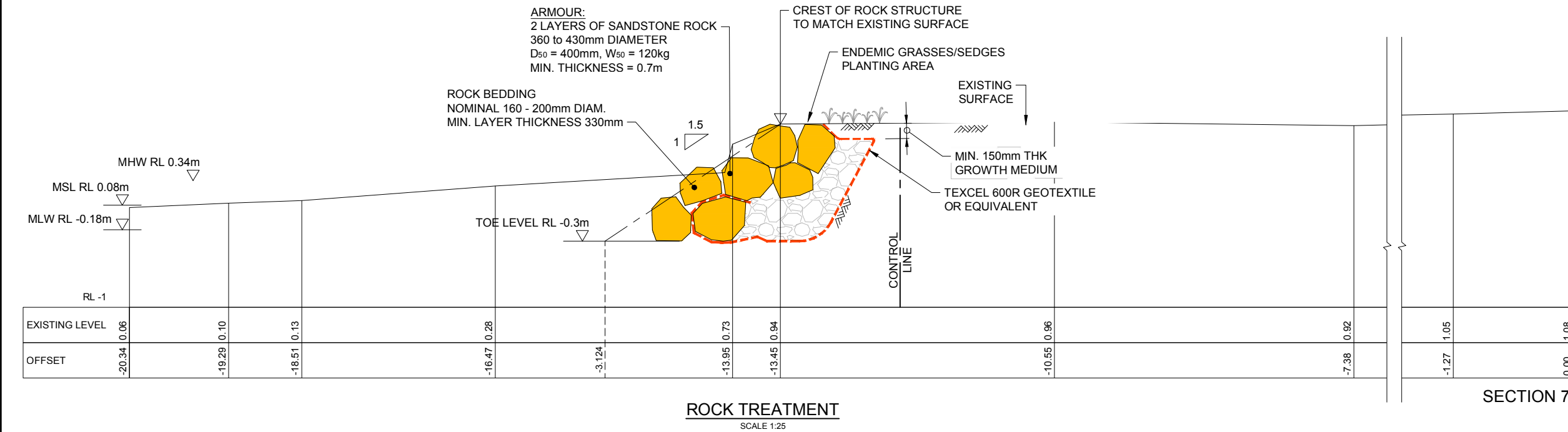
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REV	DATE	DESCRIPTION	BY	CHK	APP
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CLIENT					
PROJECT					
FORESHORE STABILISATION CAPTAIN COOK RESERVE GREEN POINT					
TITLE					
SECTIONS AND DETAILS SHEET 3					
Drawn by: [Blank]					
Scale: AS SHOWN					
Drawing No. PA1889-RHD-00-DR-C-0013					
Revision: 0					

**GENERAL NOTES:**

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**D5 FOR CONSTRUCTION**

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REV	DATE	DESCRIPTION	BY	CHK	APP

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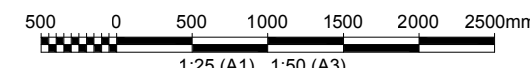
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**FORESHORE STABILISATION  
CAPTAIN COOK RESERVE  
GREEN POINT**

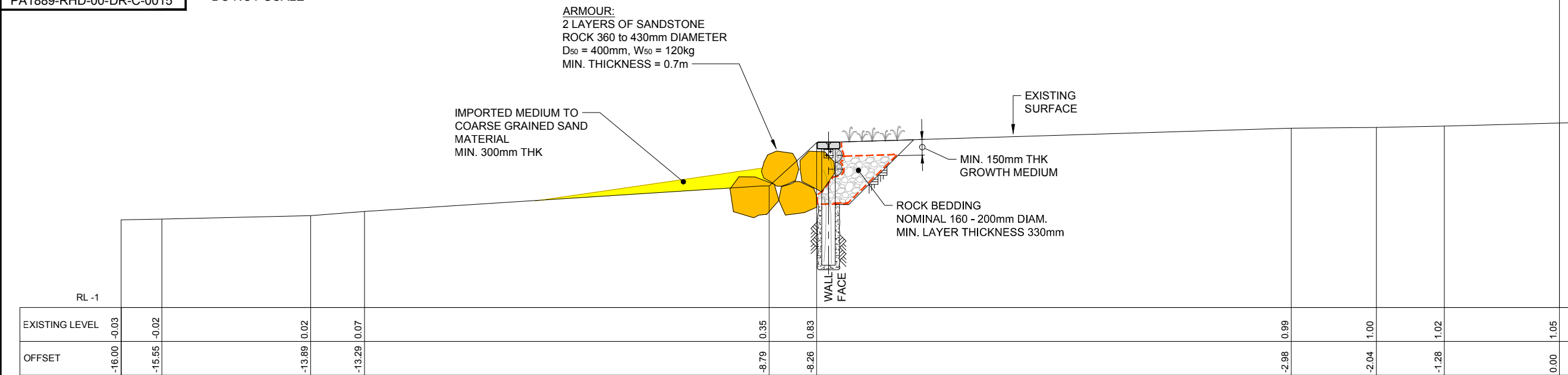
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**SECTIONS AND DETAILS  
SHEET 4**



DRAWN	SCB	COORD. SYSTEM	MGA	DATUM	AHD	DATE	11.10.2018
SCALE	AT A1	AS SHOWN	REF.	PA1889-RHD-00-DR-C-SECTIONS			

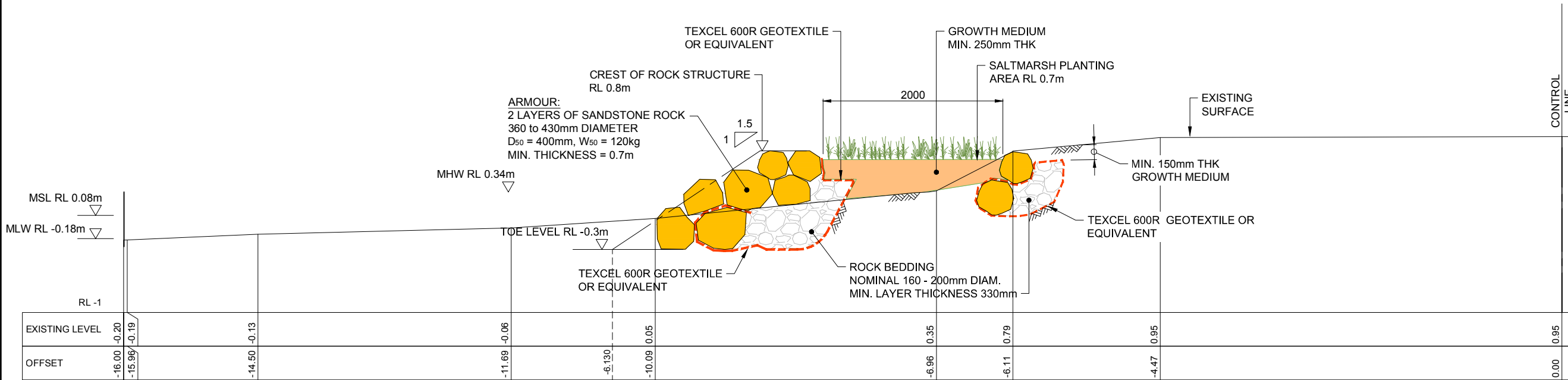
DRAWING No.	PA1889-RHD-00-DR-C-0014	REVISION	0
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**MINOR ROCK TREATMENT**  
SCALE 1:25

SECTION 9



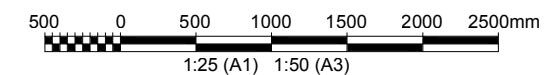
**ROCK TREATMENT AND SALTMARSH BERM**  
SCALE 1:25

SECTION 10

**GENERAL NOTES:**

1. THESE DRAWINGS ARE TO BE READ IN CONJUNCTION WITH ALL OTHER REFERENCE DRAWINGS WHICH SHOW OTHER ASPECTS OF WORK TO BE INCORPORATED.
2. ALL DIMENSIONS ARE IN MILLIMETRES AND ALL LEVELS ARE IN METRES (UNLESS NOTED OTHERWISE).
3. ALL LEVELS REDUCED TO AUSTRALIAN HEIGHT DATUM (AHD).
4. ALL LEVELS ARE FROM SURVEY PROVIDED BY STEPHEN THORNE AND ASSOCIATES PTY LTD, DATED 29/04/2014. ROYAL HASKONINGDHV TAKE NO RESPONSIBILITY FOR THE ACCURACY OF THE SURVEY AND SERVICES SHOWN.
5. CONTRACTOR TO CONFIRM SURVEY PRIOR TO COMMENCEMENT OF WORKS.
6. SERVICES SHOWN ARE INDICATIVE ONLY. LOCATIONS TO BE CONFIRMED ON SITE PRIOR TO CONSTRUCTION.
7. FOR OTHER NOTES REFER TO DRAWINGS 0002 AND 0003.

**D5 FOR CONSTRUCTION**



0	20.12.18	ISSUED FOR CONSTRUCTION	SGB	TB	GPB
REV	DATE	DESCRIPTION	BY	CHK	APP

REVISIONS					
CLIENT					



PROJECT  
**FORESHORE STABILISATION  
CAPTAIN COOK RESERVE  
GREEN POINT**

TITLE  
**SECTIONS AND DETAILS  
SHEET 5**

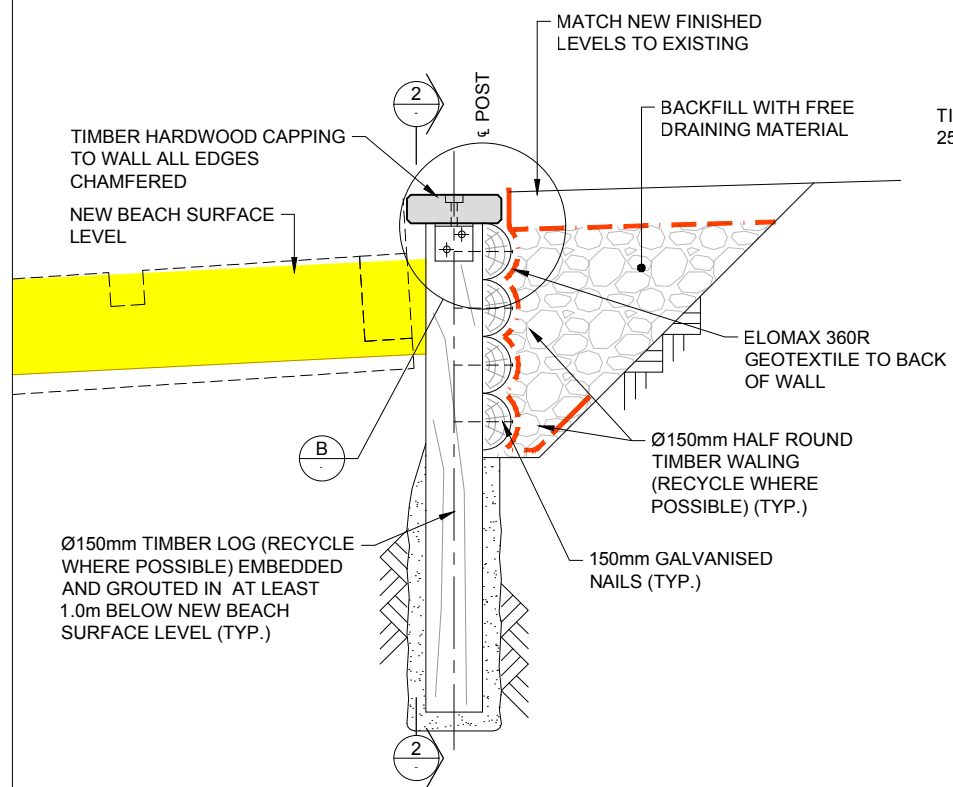


DRAWN	SCB	COORD. SYSTEM	MGA	DATUM	AHD	DATE	11.10.2018
SCALE	AT A1	AS SHOWN	REF.	PA1889-RHD-00-DR-C-SECTIONS			

DRAWING No.	PA1889-RHD-00-DR-C-0015	REVISION	0
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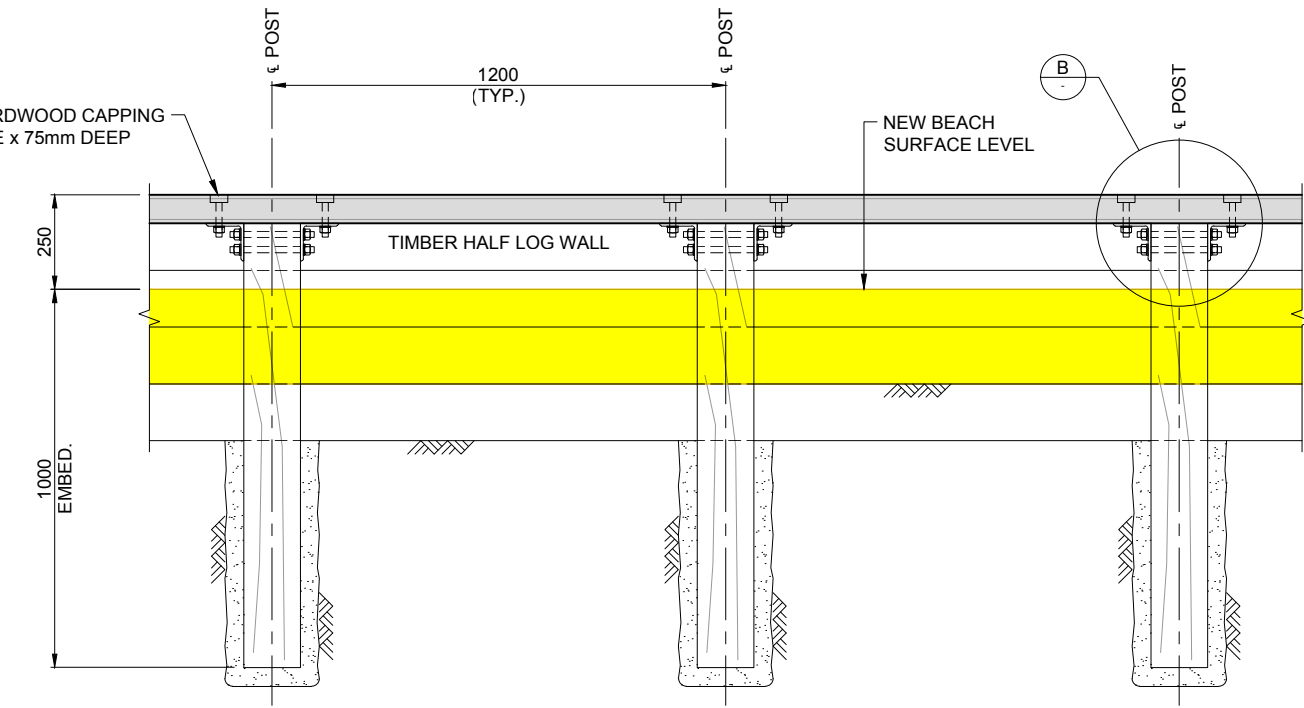
**GENERAL NOTES:**

1. THESE DRAWINGS ARE TO BE READ IN CONJUNCTION WITH ALL OTHER REFERENCE DRAWINGS WHICH SHOW OTHER ASPECTS OF WORK TO BE INCORPORATED.
2. ALL DIMENSIONS ARE IN MILLIMETRES AND ALL LEVELS ARE IN METRES (UNLESS NOTED OTHERWISE).
3. ALL LEVELS REDUCED TO AUSTRALIAN HEIGHT DATUM (AHD).
4. ALL LEVELS ARE FROM SURVEY PROVIDED BY STEPHEN THORNE AND ASSOCIATES PTY LTD, DATED 29/04/2014. ROYAL HASKONINGDHV TAKE NO RESPONSIBILITY FOR THE ACCURACY OF THE SURVEY AND SERVICES SHOWN.
5. CONTRACTOR TO CONFIRM SURVEY PRIOR TO COMMENCEMENT OF WORKS.
6. SERVICES SHOWN ARE INDICATIVE ONLY. LOCATIONS TO BE CONFIRMED ON SITE PRIOR TO CONSTRUCTION.
7. MATURE VEGETATION TO BE RETAINED AND REMAIN UNDISTURBED BY THE WORKS UNLESS NOTED OTHERWISE.
8. FOR OTHER NOTES REFER TO DRAWINGS 0002 AND 0003.



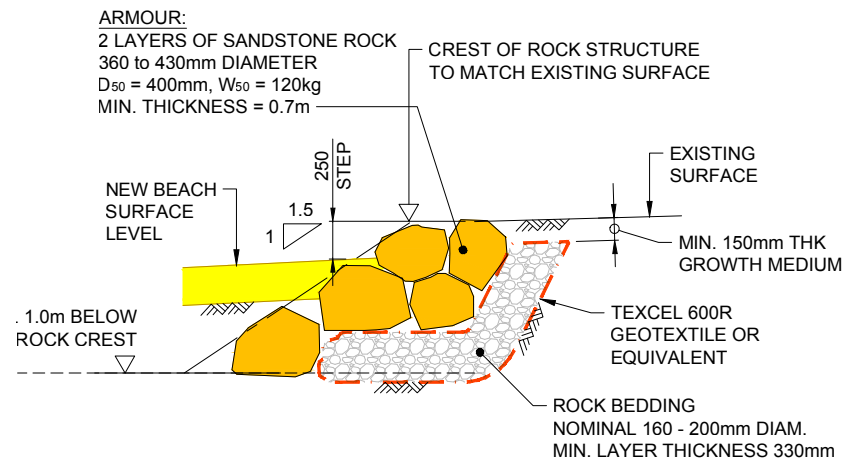
TYPICAL TIMBER WALL SECTION

DETAIL 1:10 (A1) A 0011 A 0012 A 0013



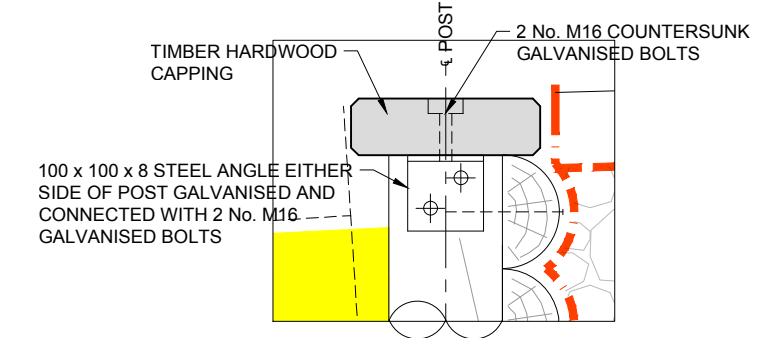
TYPICAL TIMBER WALL ELEVATION

SECTION 2 1:10 (A1)

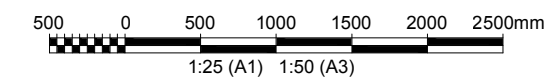
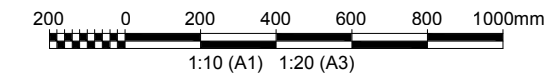
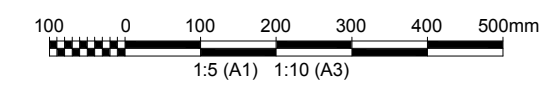


ROCK WALL OPTION AT NEW BEACH

SCALE 1:25



DETAIL B 1:5 (A1)



**D5 FOR CONSTRUCTION**

REV	DATE	DESCRIPTION	BY	CHK	APP
0	20.12.18	ISSUED FOR CONSTRUCTION	SGB	TB	GPB

REVISIONS



PROJECT  
FORESHORE STABILISATION  
CAPTAIN COOK RESERVE  
GREEN POINT

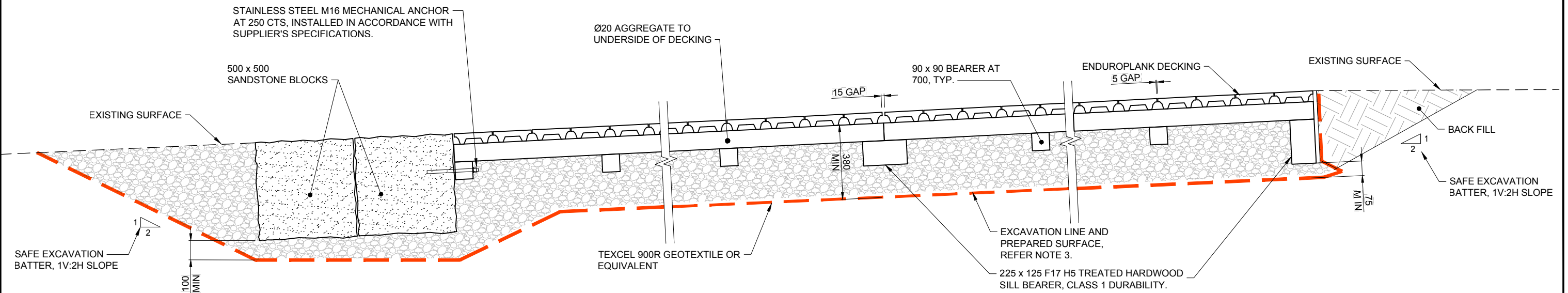
TITLE  
SECTIONS AND DETAILS  
SHEET 6



DRAWN	COORD. SYSTEM	DATUM	DATE
SGB	MGA	AHD	11.10.2018
SCALE	REF.	DRAWING No.	
AT A1 AS SHOWN	PA1889-RHD-00-DR-C-SECTIONS	REVISION	

DRAWING No. PA1889-RHD-00-DR-C-0016 REVISION 0



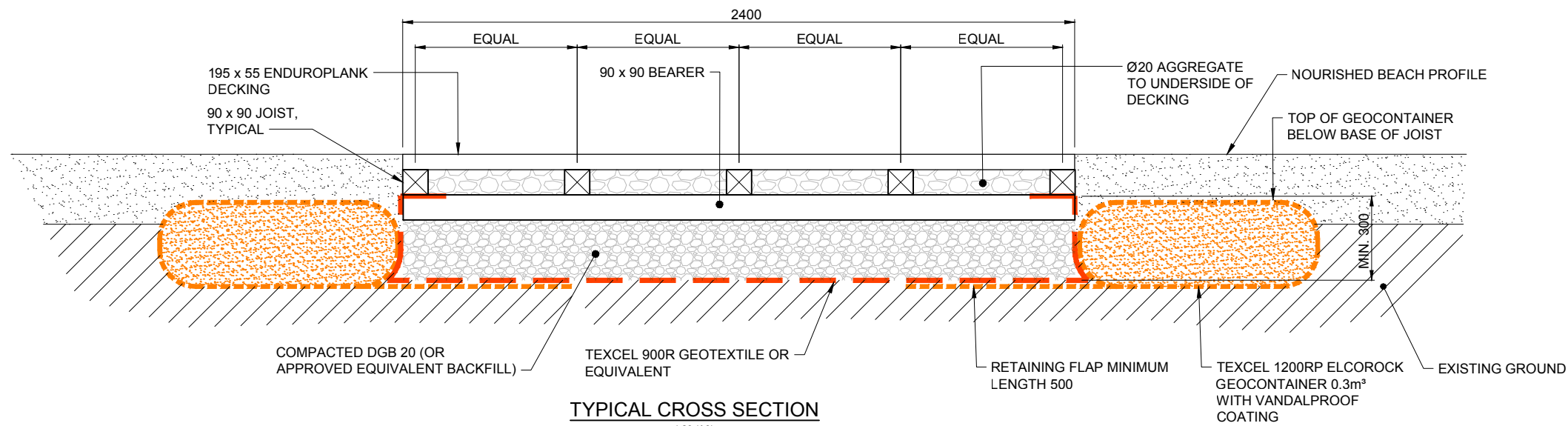


**DINGHY SKID - DETAILS**

1:20 (A3)

**NOTES - GENERAL**

1. ALL WORKS TO BE CARRIED OUT IN ACCORDANCE WITH RHDHV SPECIFICATIONS U.N.O.
2. ALL DEBRIS REMOVED FROM SITE ON COMPLETION OF WORKS AND ANY DAMAGE SHALL BE REMEDIATED.
3. ALL DIMENSIONS SHOW IN MILLIMETRES U.N.O.
4. LOCALLY TRANSITION ROCK TREATMENT TO MATCH WITH DINGHY SKID.
5. BASE MATERIAL TO BE PROOF ROLLED. MIN. BEARING CAPACITY OF PREPARED SURFACE TO BE 20kPa



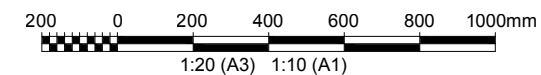
**TYPICAL CROSS SECTION**

1:20 (A3)

**NOTES - RAMP**

1. ALL DINGHY STRUCTURE COMPONENTS ARE REPLAS (OR APPROVED EQUIVALENT) PROFILES AND SHALL BE INSTALLED AND FIXED AS PER MANUFACTURER'S SPECIFICATIONS.
2. REPLAS PRODUCTS ARE NOT STRUCTURAL. ENSURE DGB20 OR SIMILAR IS COMPACTED FIRMLY AROUND BEARERS / SILL BEARERS TO PROVIDE ADEQUATE SUPPORT. DGB20 TO BE WRAPPED IN GEOFABRIC.
3. ALL FIXINGS SHALL BE GRADE 316 STAINLESS STEEL GAUGE 14 BUGLE HEAD SCREWS 100 LONG FOR DECKING AND 150 LONG FOR JOISTS. DECKING SHALL BE FIXED WITH 2 x SCREWS ALONG THE CENTRE OF JOIST AND 1 x SCREW ON THE 4 x REMAINING JOISTS. PRE-DRILL ALL HOLES FOR PLACEMENT OF SCREWS.
4. ALL COMPONENT LENGTHS ARE 2400 U.N.O.

**D5 FOR CONSTRUCTION**



0	20.12.18	ISSUED FOR CONSTRUCTION	SGB	TB	GPB
REV	DATE	DESCRIPTION	BY	CHK	APP

REVISIONS

CLIENT



PROJECT  
FORESHORE STABILISATION  
CAPTAIN COOK RESERVE  
GREEN POINT

TITLE  
SECTIONS AND DETAILS  
SHEET 7



DRAWN	COORD. SYSTEM	DATUM	DATE
SGB	MGA	AHD	15.10.2018
SCALE	REF.	DRAWING No.	
AT A1 AS SHOWN	PA1889-RHD-00-DR-C-0017	REVISION	

DRAWING No. PA1889-RHD-00-DR-C-0017 REVISION 0

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## **Appendix B**

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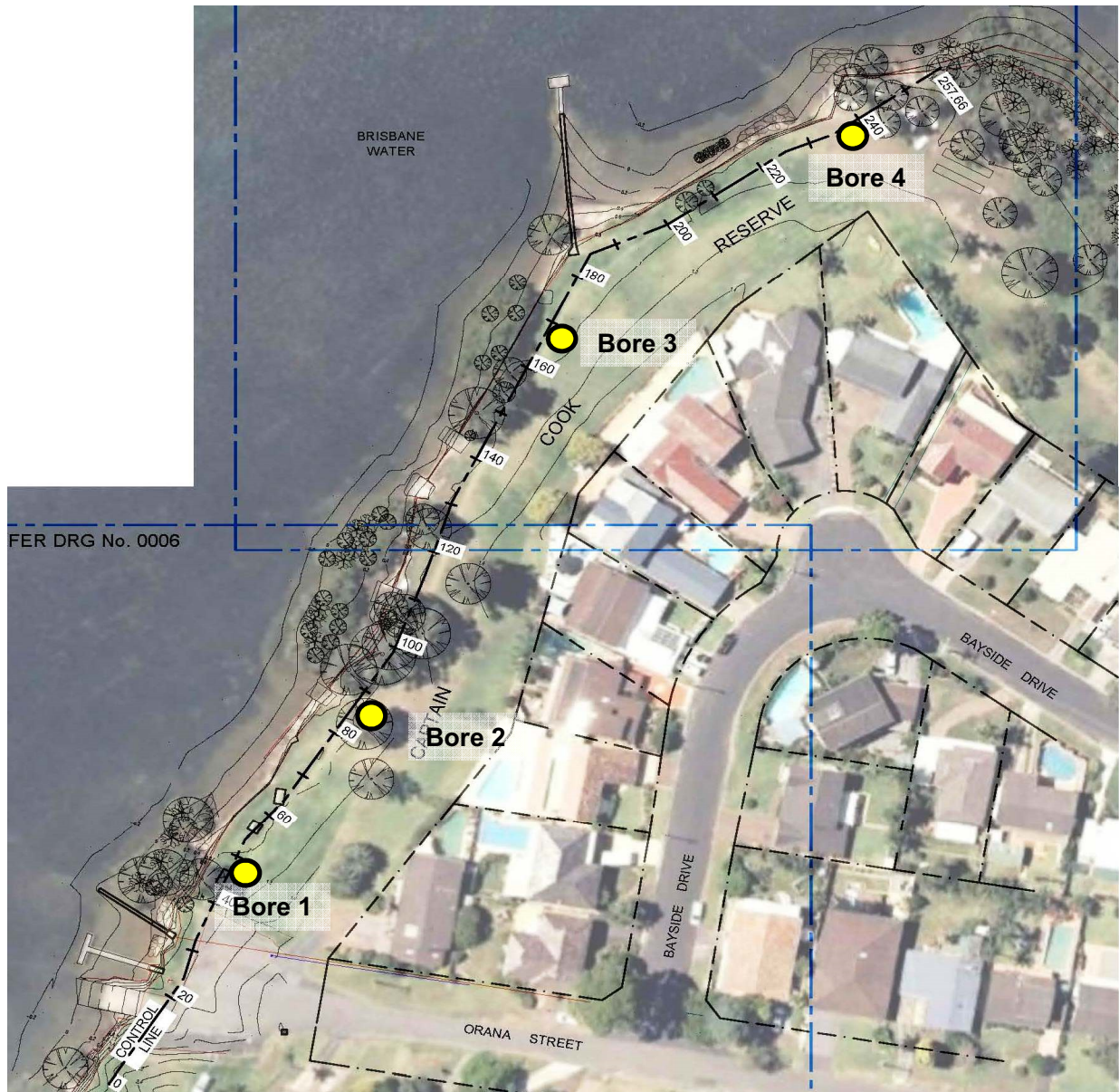
Information from Previous Assessment:

Drawing 1

Borehole Logs

Table C1

Laboratory Test Report, Chain of Custody and Sample Receipt Advice



Client supplied Drawing Number 8A0400/MA/0005, dated June 2014

 Approximate Borehole Locations



**Location of Boreholes  
Proposed Forehosre Stabilisation  
Captain Cook Reserve  
Green Point, NSW**

PROJECT:	83414.00
DWG No:	1
REV:	0
CLIENT: Coast Ecology	DATE: 26-Jun-18

# BOREHOLE LOG

**CLIENT:** Coast Ecology  
**PROJECT:** Proposed Foreshore Stabilisation  
**LOCATION:** Captain Cook Reserve, Green Point

**SURFACE LEVEL:** 1.4m AHD  
**EASTING:** 347326  
**NORTHING:** 6297483  
**DIP/AZIMUTH:** 90°/--

**BORE No:** 1  
**PROJECT No:** 83414.00  
**DATE:** 12/6/2018  
**SHEET 1 OF 1**

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Well Construction Details	
				Type	Depth	Sample	Results & Comments			
		TOPSOIL/FILLING: Generally comprising, brown silt topsoil/filling with abundant rootlets and trace sand, damp	[Pattern]	D/E	0.1					
	0.3	FILLING: Generally comprising, orange brown clay filling with some sand, M>Wp	[Pattern]	D/E	0.35			▼		
	0.4	- Groundwater observed at 0.32m								
		CLAYEY SAND: Grey and yellow brown clayey sand, wet	[Pattern]	D/E	0.5					
			[Pattern]	D/E	0.75					
	0.8	GRAVELLY CLAY: Red brown and grey brown gravelly clay. Gravels are ironstone <30mm, M<Wp	[Pattern]	D/E	1.0					
	1		[Pattern]	D/E	1.25					
		- some gravels from 1.3m								
		- clay from 1.5m		D/E	1.5					
			[Pattern]	D/E	1.75					
	2	Bore discontinued at 2.0m .Limit of investigation		D/E	2.0					

**RIG:** Toyota 4WD      **DRILLER:** M Harrison      **LOGGED:** M Harrison      **CASING:**  
**TYPE OF BORING:** 60mm φ Dynamic Push Tube (continuous sample)  
**WATER OBSERVATIONS:** Free Groundwater Observed at 0.32m  
**REMARKS:** Surface level interpolated from client drawing No. 8A0400/MA/0005 Revision B, dated June 2014

SAMPLING & IN SITU TESTING LEGEND			
A	Auger sample	G	Gas sample
B	Bulk sample	P	Piston sample
BLK	Block sample	U <sub>s</sub>	Tube sample (x mm dia.)
C	Core drilling	W	Water sample
D	Disturbed sample	W	Water seep
E	Environmental sample	≡	Water level
		PID	Photo ionisation detector (ppm)
		PL(A)	Point load axial test 1s(50) (MPa)
		PL(D)	Point load diametral test 1s(50) (MPa)
		pp	Pocket penetrometer (kPa)
		S	Standard penetration test
		V	Shear vane (kPa)









# BOREHOLE LOG

**CLIENT:** Coast Ecology  
**PROJECT:** Proposed Foreshore Stabilisation  
**LOCATION:** Captain Cook Reserve, Green Point

**SURFACE LEVEL:** 1.4m AHD  
**EASTING:** 347349  
**NORTHING:** 6297509  
**DIP/AZIMUTH:** 90°/--

**BORE No:** 2  
**PROJECT No:** 83414.00  
**DATE:** 12/6/2018  
**SHEET 1 OF 1**

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Well Construction Details	
				Type	Depth	Sample	Results & Comments			
	0.15	TOPSOIL/FILLING: Generally comprising, brown silt with abundant rootlets and trace sand		D/E	0.1					
	0.32	FILLING: Generally comprising, orange brown clay filling with some sand, M<Wp		D/E	0.25					
	0.32	CLAYEY SAND: Grey and yellow brown clayey sand, wet		D/E	0.5			▼		
		- Groundwater observed at 0.5m		D/E	0.5					
		- some ironstone gravels at 0.7-0.8m		D/E	0.75					
		- abundant shell material from 0.9 - 1.0m		D/E	1.0					
	1.15	CLAY: Red brown and grey clay, M=Wp		D/E	1.25					
				D/E	1.5					
				D/E	1.75					
2	2.0	Bore discontinued at 2.0m .Limit of investigation		D	2.0					

**RIG:** Toyota 4WD      **DRILLER:** M Harrison      **LOGGED:** M Harrison      **CASING:**  
**TYPE OF BORING:** 60mm φ Dynamic Push Tube (continuous sample)  
**WATER OBSERVATIONS:** Free Groundwater Observed at 0.5m  
**REMARKS:** Surface level interpolated from client drawing No. 8A0400/MA/0005 Revision B, dated June 2014

SAMPLING & IN SITU TESTING LEGEND			
A	Auger sample	G	Gas sample
B	Bulk sample	P	Piston sample
BLK	Block sample	U <sub>s</sub>	Tube sample (x mm dia.)
C	Core drilling	W	Water sample
D	Disturbed sample	W	Water seep
E	Environmental sample	▽	Water level
		PID	Photo ionisation detector (ppm)
		PL(A)	Point load axial test Is(50) (MPa)
		PL(D)	Point load diametral test Is(50) (MPa)
		pp	Pocket penetrometer (kPa)
		S	Standard penetration test
		V	Shear vane (kPa)



# BOREHOLE LOG

**CLIENT:** Coast Ecology  
**PROJECT:** Proposed Foreshore Stabilisation  
**LOCATION:** Captain Cook Reserve, Green Point

**SURFACE LEVEL:** 1.0m AHD  
**EASTING:** 347375  
**NORTHING:** 6297582  
**DIP/AZIMUTH:** 90°/--

**BORE No:** 3  
**PROJECT No:** 83414.00  
**DATE:** 12/6/2018  
**SHEET 1 OF 1**

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Well Construction Details	
				Type	Depth	Sample	Results & Comments			
		FILLING: Generally comprising, brown silty clay filling with abundant rootlets	X	D/E	0.1					
		- Groundwater observed at 0.3m		D/E	0.25			▼		
	0.4	FILLING: Generally comprising, orange brown clay filling with some sand, M>Wp	X	D/E	0.5					
	0.65	CLAYEY SAND: Grey and yellow brown clayey sand, wet	X	D/E	0.75					
	1	- abundant shell material from 1.15 - 1.3m	X	D/E	1.0			1		
			X	D	1.3					
			X	D	1.4					
	1.5	CLAY: Red brown and grey clay with some sand	X	D	1.75					
		- no sand below 1.6m	X							
	2.0	Bore discontinued at 2.0m .Limit of investigation	X	D	2.0			2		

**RIG:** Toyota 4WD      **DRILLER:** M Harrison      **LOGGED:** M Harrison      **CASING:**  
**TYPE OF BORING:** 60mm φ Dynamic Push Tube (continuous sample)  
**WATER OBSERVATIONS:** Free Groundwater Observed at 0.3m  
**REMARKS:** Surface level interpolated from client drawing No. 8A0400/MA/0005 Revision B, dated June 2014

SAMPLING & IN SITU TESTING LEGEND			
A	Auger sample	G	Gas sample
B	Bulk sample	P	Piston sample
BLK	Block sample	U <sub>s</sub>	Tube sample (x mm dia.)
C	Core drilling	W	Water sample
D	Disturbed sample	W	Water seep
E	Environmental sample	▼	Water level
		PID	Photo ionisation detector (ppm)
		PL(A)	Point load axial test Is(50) (MPa)
		PL(D)	Point load diametral test Is(50) (MPa)
		pp	Pocket penetrometer (kPa)
		S	Standard penetration test
		V	Shear vane (kPa)



# BOREHOLE LOG

**CLIENT:** Coast Ecology  
**PROJECT:** Proposed Foreshore Stabilisation  
**LOCATION:** Captain Cook Reserve, Green Point

**SURFACE LEVEL:** 1.0m AHD  
**EASTING:** 347418  
**NORTHING:** 6297618  
**DIP/AZIMUTH:** 90°/--

**BORE No:** 4  
**PROJECT No:** 83414.00  
**DATE:** 12/6/2018  
**SHEET 1 OF 1**

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Well Construction Details	
				Type	Depth	Sample	Results & Comments			
	0.05	FILLING: Generally comprising, brown silt topsoil with abundant rootlets and trace sand  FILLING: Generally comprising, grey clay with some brick fragments, abundant rootlets  - Groundwater observed at 0.25m	[Cross-hatched pattern]	D/E	0.02					
				D/E	0.25			▼		
	0.5	CLAYEY SAND: Dark brown clayey sand, some organics, saturated  - abundant sleus at 0.85-0.95m	[Diagonal lines pattern]	D/E	0.6					
				D/E	0.85					
	1.0	SAND: Dark brown sand with some shells and decomposed wood fragments, saturated	[Dotted pattern]	D/E	1.1					
				D/E	1.3					
	1.6	Bore discontinued at 1.6m . Due to hole collapse		D/E	1.6					
	2									

**RIG:** Toyota 4WD                      **DRILLER:** M Harrison                      **LOGGED:** M Harrison                      **CASING:**  
**TYPE OF BORING:** 60mm φ Dynamic Push Tube (continuous sample)  
**WATER OBSERVATIONS:** Free Groundwater Observed at 0.25m  
**REMARKS:** Surface level interpolated from client drawing No. 8A0400/MA/0005 Revision B, dated June 2014

SAMPLING & IN SITU TESTING LEGEND			
A	Auger sample	G	Gas sample
B	Bulk sample	P	Piston sample
BLK	Block sample	U <sub>s</sub>	Tube sample (x mm dia.)
C	Core drilling	W	Water sample
D	Disturbed sample	W	Water seep
E	Environmental sample	▼	Water level
		PID	Photo ionisation detector (ppm)
		PL(A)	Point load axial test Is(50) (MPa)
		PL(D)	Point load diametral test Is(50) (MPa)
		pp	Pocket penetrometer (kPa)
		S	Standard penetration test
		V	Shear vane (kPa)



**Table C1: Results of Acid Sulfate Soil Tests**

Bore	Sample Depth <sup>a</sup> (m)	Sample Description	Soil Textural Classification	Screening Test Results <sup>c</sup>				Laboratory Results								
				pH			Strength of Reaction <sup>b</sup> Comments	pH <sub>KCL</sub>	S <sub>KCL</sub> (%S)	S <sub>CR</sub> (%S)	S <sub>NAS</sub> (%S)	Titratable Actual Acidity (TAA) [%sulfur]	Acid Neutralising Capacity (ANC) [%sulfur]	s-S <sub>NAS</sub> (%sulfur)	Sum of Existing and Potential Acidity (%S)	
				pH <sub>F</sub>	pH <sub>FOX</sub>	pH <sub>F</sub> - pH <sub>FOX</sub>										
1	0.10	Filling - Brown silt topsoil filling, abundant rootlets	Medium	5.9	3.7	<b>2.2</b>	1	-	-	-	-	-	-	-	-	-
	0.35	Filling - Orange brown clay filling	Fine	5.4	3.6	<b>1.8</b>	1	-	-	-	-	-	-	-	-	-
	0.50	<b>Alluvium - Grey and yellow brown clayey sand</b>	Medium	5.7	<b>3.4</b>	<b>2.3</b>	1	5.1	0.018	0.010	<0.005	0.010	<0.05	<0.005	0.020	
	0.75			5.9	3.8	<b>2.1</b>	1	-	-	-	-	-	-	-	-	
	1.00	Residual - Red brown and grey brown gravelly clay	Medium	5.9	5.6	0.3	1	-	-	-	-	-	-	-	-	
	1.25			5.7	5.4	0.3	1	-	-	-	-	-	-	-		
	1.50	Residual - Red brown and grey brown clay	Fine	6.0	4.8	<b>1.2</b>	1	-	-	-	-	-	-	-	-	
	1.75			6.2	5.6	0.6	1	-	-	-	-	-	-	-		
2.00	6.3			5.9	0.4	1	-	-	-	-	-	-	-			
2	0.10	Filling - Brown silt topsoil filling, abundant rootlets	Medium	6.3	<b>2.9</b>	<b>3.4</b>	1	-	-	-	-	-	-	-	-	
	0.25	Filling - Orange brown clay filling	Fine	6.7	5.2	<b>1.5</b>	1	6.8	0.029	<0.005	<0.005	<0.01	0.090	<0.005	<0.005	
	0.50	<b>Alluvium - Grey and yellow brown clayey sand</b>	Medium	6.8	5.8	<b>1.0</b>	1	-	-	-	-	-	-	-		
	0.75			7.0	6.2	0.8	1	-	-	-	-	-	-	-		
	1.00	<b>Alluvium - Grey and yellow brown clayey sand, abundant shell material</b>	Medium	7.0	6.4	0.6	1	-	-	-	-	-	-	-		
	1.25	Residual - Red brown and grey clay	Fine	7.0	6.8	0.2	1	-	-	-	-	-	-	-	-	
	1.50			6.7	6.2	0.5	1	-	-	-	-	-	-	-		
1.75	6.8			6.6	0.2	1	-	-	-	-	-	-	-			
2.00	6.9			6.7	0.2	1	-	-	-	-	-	-	-			
3	0.10	Filling - Brown silty clay filling, abundant rootlets	Fine	6.0	<b>2.9</b>	<b>3.1</b>	1	-	-	-	-	-	-	-		
	0.25	Filling - Orange brown clay filling	Fine	5.1	<b>2.8</b>	<b>2.3</b>	1	-	-	-	-	-	-	-		
	0.50	Filling - Orange brown clay filling	Fine	5.7	3.6	<b>2.1</b>	1	-	-	-	-	-	-	-		
	0.75	<b>Alluvium - Grey and yellow brown clayey sand</b>	Medium	5.9	<b>2.9</b>	<b>3.0</b>	1	-	-	-	-	-	-	-		
	1.00			5.6	<b>2.2</b>	<b>3.4</b>	1	-	-	-	-	-	-	-		
	1.30	<b>Alluvium - Grey and yellow brown clayey sand, abundant shell material</b>	Medium	6.2	<b>2.9</b>	<b>3.3</b>	1	-	-	-	-	-	-	-		
	1.40			6.4	<b>3.4</b>	<b>3.0</b>	1	6.2	0.040	0.600	<0.005	<0.01	<0.05	<0.005	<b>0.600</b>	
	1.75			6.6	6.2	0.4	1	-	-	-	-	-	-	-		
2.00	Residual - Red brown and grey clay	Fine	6.5	6.4	0.1	1	-	-	-	-	-	-	-			
4	0.02	Filling - Brown silt topsoil filling, abundant rootlets	Medium	5.7	<b>2.6</b>	<b>3.1</b>	1	-	-	-	-	-	-	-		
	0.25	Filling - Grey clay filling, some brick fragments, abundant rootlets	Fine	5.3	<b>3.1</b>	<b>2.2</b>	1	5.2	0.084	<0.005	<0.005	0.010	<0.05	<0.005	0.018	
	0.60	<b>Alluvium - Dark brown clayey sand, some organics</b>	Medium	5.0	3.8	<b>1.2</b>	1	4.9	0.057	0.020	<0.005	0.030	<0.05	<0.005	0.052	
	0.85			6.7	6.1	0.6	1	-	-	-	-	-	-	-		
	1.10	<b>Alluvium - Dark brown sand, some shell and wood fragments</b>	Coarse	6.7	<b>2.3</b>	<b>4.4</b>	4	-	-	-	-	-	-	-		
	1.30			6.6	<b>2.1</b>	<b>4.5</b>	4	-	-	-	-	-	-	-		
	1.60			6.5	<b>1.9</b>	<b>4.6</b>	4	6.5	0.043	0.570	<0.005	<0.01	<0.05	<0.005	<b>0.570</b>	
ASSMAC Indicators	Coarse Texture: 'Sands to loamy sands'														0.030	
	Medium Texture: 'Sandy loams to light clays'			<4	<3.5	>1	-	-	-	-	-	-	-	-	0.060	
	Fine Texture: 'Medium to heavy clays'														0.100	

**Legend:**

- a Depth below ground surface
- b Strength of Reaction
- c Exceedances recorded during screening tests are not considered to be acid sulfate soils unless the results are confirmed by laboratory testing i.e.. Chromium reducible sulfur results.
- 1: denotes no or slight reaction
- 2: denotes moderate reaction
- 3: denotes violent reaction
- 4: denotes "volcano" i.e.. Very rigorous effervescence, gas evolution and heat
- F after number indicates a bubbling/frothy reaction (organics)
- Bold** notates exceedance of acid sulfate soil criteria
- Bold** notates exceedance of net acidity action criteria or ASSMAC indicator

NB - Groundwater was observed in the boreholes between 0.25m and 0.5m.



## CERTIFICATE OF ANALYSIS 194550

### Client Details

<b>Client</b>	Douglas Partners Pty Ltd
<b>Attention</b>	Jessica Paulsen
<b>Address</b>	96 Hermitage Rd, West Ryde, NSW, 2114

### Sample Details

<b>Your Reference</b>	<b>83414.00, Green Point</b>
<b>Number of Samples</b>	6 soil
<b>Date samples received</b>	22/06/2018
<b>Date completed instructions received</b>	22/06/2018

### Analysis Details

Please refer to the following pages for results, methodology summary and quality control data.  
Samples were analysed as received from the client. Results relate specifically to the samples as received.  
Results are reported on a dry weight basis for solids and on an as received basis for other matrices.

### Report Details

<b>Date results requested by</b>	29/06/2018
<b>Date of Issue</b>	28/06/2018
NATA Accreditation Number 2901. This document shall not be reproduced except in full.	
Accredited for compliance with ISO/IEC 17025 - Testing. <b>Tests not covered by NATA are denoted with *</b>	

#### Results Approved By

Priya Samarawickrama, Senior Chemist

#### Authorised By

Jacinta Hurst, Laboratory Manager

Chromium Suite						
Our Reference		194550-1	194550-2	194550-3	194550-4	194550-5
Your Reference	UNITS	1	2	3	4	4
Depth		0.5	0.25	1.5	0.25	0.6
Date Sampled		12/06/2018	12/06/2018	12/06/2018	12/06/2018	12/06/2018
Type of sample		soil	soil	soil	soil	soil
Date prepared	-	25/06/2018	25/06/2018	25/06/2018	25/06/2018	25/06/2018
Date analysed	-	25/06/2018	25/06/2018	25/06/2018	25/06/2018	25/06/2018
pH <sub>kcl</sub>	pH units	5.1	6.8	6.2	5.2	4.9
s-TAA pH 6.5	%w/w S	0.01	<0.01	<0.01	0.01	0.03
TAA pH 6.5	moles H <sup>+</sup> /t	9	<5	<5	9	18
Chromium Reducible Sulfur	%w/w	0.01	<0.005	0.60	<0.005	0.02
a-Chromium Reducible Sulfur	moles H <sup>+</sup> /t	7	<3	370	<3	15
S <sub>HCl</sub>	%w/w S	<0.005	<0.005	<0.005	<0.005	<0.005
S <sub>KCl</sub>	%w/w S	0.018	0.029	0.040	0.084	0.057
S <sub>NAS</sub>	%w/w S	<0.005	<0.005	<0.005	<0.005	<0.005
ANC <sub>BT</sub>	% CaCO <sub>3</sub>	<0.05	0.28	<0.05	<0.05	<0.05
s-ANC <sub>BT</sub>	%w/w S	<0.05	0.09	<0.05	<0.05	<0.05
s-Net Acidity	%w/w S	0.020	<0.005	0.60	0.018	0.052
a-Net Acidity	moles H <sup>+</sup> /t	16	<5	370	11	33
Liming rate	kg CaCO <sub>3</sub> /t	1.2	<0.75	28	0.85	2.5
a-Net Acidity without ANCE	moles H <sup>+</sup> /t	16	<5	370	11	33
Liming rate without ANCE	kg CaCO <sub>3</sub> /t	1.2	<0.75	28	0.85	2.5
s-Net Acidity without ANCE	%w/w S	0.020	<0.005	0.60	0.018	0.052

Chromium Suite		
Our Reference		194550-6
Your Reference	UNITS	4
Depth		1.6
Date Sampled		12/06/2018
Type of sample		soil
Date prepared	-	25/06/2018
Date analysed	-	25/06/2018
pH <sub>kcl</sub>	pH units	6.5
s-TAA pH 6.5	%w/w S	<0.01
TAA pH 6.5	moles H <sup>+</sup> /t	<5
Chromium Reducible Sulfur	%w/w	0.57
a-Chromium Reducible Sulfur	moles H <sup>+</sup> /t	350
S <sub>HCl</sub>	%w/w S	<0.005
S <sub>KCl</sub>	%w/w S	0.043
S <sub>NAS</sub>	%w/w S	<0.005
ANC <sub>BT</sub>	% CaCO <sub>3</sub>	<0.05
s-ANC <sub>BT</sub>	%w/w S	<0.05
s-Net Acidity	%w/w S	0.57
a-Net Acidity	moles H <sup>+</sup> /t	350
Liming rate	kg CaCO <sub>3</sub> /t	27
a-Net Acidity without ANCE	moles H <sup>+</sup> /t	350
Liming rate without ANCE	kg CaCO <sub>3</sub> /t	27
s-Net Acidity without ANCE	%w/w S	0.57

**Client Reference: 83414.00, Green Point**

Method ID	Methodology Summary
<b>Inorg-068</b>	Chromium Reducible Sulfur - Hydrogen Sulfide is quantified by iodometric titration after distillation to determine potential acidity. Based on Acid Sulfate Soils Laboratory Methods Guidelines, Version 2.1 - June 2004.



Client Reference: 83414.00, Green Point

QUALITY CONTROL: Chromium Suite					Duplicate			Spike Recovery %		
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	[NT]
Date prepared	-			25/06/2018	1	25/06/2018	25/06/2018		25/06/2018	[NT]
Date analysed	-			25/06/2018	1	25/06/2018	25/06/2018		25/06/2018	[NT]
pH <sub>KCl</sub>	pH units		Inorg-068	[NT]	1	5.1	5.1	0	93	[NT]
s-TAA pH 6.5	%w/w S	0.01	Inorg-068	<0.01	1	0.01	0.01	0	[NT]	[NT]
TAA pH 6.5	moles H <sup>+</sup> /t	5	Inorg-068	<5	1	9	9	0	85	[NT]
Chromium Reducible Sulfur	%w/w	0.005	Inorg-068	<0.005	1	0.01	0.01	0	[NT]	[NT]
a-Chromium Reducible Sulfur	moles H <sup>+</sup> /t	3	Inorg-068	<3	1	7	7	0	97	[NT]
S <sub>HCl</sub>	%w/w S	0.005	Inorg-068	<0.005	1	<0.005	<0.005	0	[NT]	[NT]
S <sub>KCl</sub>	%w/w S	0.005	Inorg-068	<0.005	1	0.018	0.019	5	[NT]	[NT]
S <sub>NAS</sub>	%w/w S	0.005	Inorg-068	<0.005	1	<0.005	<0.005	0	[NT]	[NT]
ANC <sub>BT</sub>	% CaCO <sub>3</sub>	0.05	Inorg-068	<0.05	1	<0.05	<0.05	0	[NT]	[NT]
s-ANC <sub>BT</sub>	%w/w S	0.05	Inorg-068	<0.05	1	<0.05	<0.05	0	[NT]	[NT]
s-Net Acidity	%w/w S	0.005	Inorg-068	<0.005	1	0.020	0.020	0	[NT]	[NT]
a-Net Acidity	moles H <sup>+</sup> /t	5	Inorg-068	<5	1	16	15	6	[NT]	[NT]
Liming rate	kg CaCO <sub>3</sub> /t	0.75	Inorg-068	<0.75	1	1.2	1.2	0	[NT]	[NT]
a-Net Acidity without ANCE	moles H <sup>+</sup> /t	5	Inorg-068	<5	1	16	15	6	[NT]	[NT]
Liming rate without ANCE	kg CaCO <sub>3</sub> /t	0.75	Inorg-068	<0.75	1	1.2	1.2	0	[NT]	[NT]
s-Net Acidity without ANCE	%w/w S	0.005	Inorg-068	<0.005	1	0.020	0.020	0	[NT]	[NT]

## Result Definitions

<b>NT</b>	Not tested
<b>NA</b>	Test not required
<b>INS</b>	Insufficient sample for this test
<b>PQL</b>	Practical Quantitation Limit
<b>&lt;</b>	Less than
<b>&gt;</b>	Greater than
<b>RPD</b>	Relative Percent Difference
<b>LCS</b>	Laboratory Control Sample
<b>NS</b>	Not specified
<b>NEPM</b>	National Environmental Protection Measure
<b>NR</b>	Not Reported

## Quality Control Definitions

<b>Blank</b>	This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, can be determined by processing solvents and reagents in exactly the same manner as for samples.
<b>Duplicate</b>	This is the complete duplicate analysis of a sample from the process batch. If possible, the sample selected should be one where the analyte concentration is easily measurable.
<b>Matrix Spike</b>	A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.
<b>LCS (Laboratory Control Sample)</b>	This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.
<b>Surrogate Spike</b>	Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.

Australian Drinking Water Guidelines recommend that Thermotolerant Coliform, Faecal Enterococci, & E.Coli levels are less than 1cfu/100mL. The recommended maximums are taken from "Australian Drinking Water Guidelines", published by NHMRC & ARMC 2011.

## Laboratory Acceptance Criteria

Duplicate sample and matrix spike recoveries may not be reported on smaller jobs, however, were analysed at a frequency to meet or exceed NEPM requirements. All samples are tested in batches of 20. The duplicate sample RPD and matrix spike recoveries for the batch were within the laboratory acceptance criteria.

Filters, swabs, wipes, tubes and badges will not have duplicate data as the whole sample is generally extracted during sample extraction.

Spikes for Physical and Aggregate Tests are not applicable.

For VOCs in water samples, three vials are required for duplicate or spike analysis.

Duplicates: <5xPQL - any RPD is acceptable; >5xPQL - 0-50% RPD is acceptable.

Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals; 60-140% for organics (+/-50% surrogates) and 10-140% for labile SVOCs (including labile surrogates), ultra trace organics and speciated phenols is acceptable.

In circumstances where no duplicate and/or sample spike has been reported at 1 in 10 and/or 1 in 20 samples respectively, the sample volume submitted was insufficient in order to satisfy laboratory QA/QC protocols.

When samples are received where certain analytes are outside of recommended technical holding times (THTs), the analysis has proceeded. Where analytes are on the verge of breaching THTs, every effort will be made to analyse within the THT or as soon as practicable.

Where sampling dates are not provided, Envirolab are not in a position to comment on the validity of the analysis where recommended technical holding times may have been breached.


Measurement Uncertainty estimates are available for most tests upon request.


# CHAIN OF CUSTODY



<b>Client:</b> Douglas Partners	<b>Project Number:</b> 83414.00	<b>To:</b> Envirolab Services
<b>Contact Person:</b> Jessica Paulsen	<b>Project Name:</b> Green Point	<b>Contact Person:</b> Aileen Hie
<b>Project Mgr:</b> Jessica Paulsen	<b>PO No.:</b> 83414.00	<b>Address:</b> 12 Ashley Street Chatswood NSW 2068
<b>Address:</b> 5/3 Teanster Cl Tuggerah NSW 2259	<b>Lab Quote No.:</b> 2016-2017 List	<b>Phone:</b> 02 9910 6200
	<b>Date results required:</b> STANDARD	<b>Fax:</b> 02 9910 6201
	<i>Note: Inform lab in advance if urgent turnaround is required - surcharges apply</i>	<b>Email:</b> ahie@envirolab.com.au
<b>Phone:</b> 4351 1422 <b>Mob:</b>	<b>Report format:</b> Esdat/PDF / Excel	<b>Laboratory Report No.:</b>
<b>Email:</b> jessica.paulsen@douglaspartners.com.au	<b>Comments:</b>	<b>Lab Comments:</b>

Sample information						Tests Required										Comments	
Lab Sample ID	Field Sample ID	Depth	Date sampled	Container Type	Type of sample	Combo 8A	COMBO 3	PH	CEC	TRH/BTEX	Chromium Reducible Suite					Combo	Provide as much information about the sample as you can
1	1	0.5	12/06/2018	plastic bag	S						1						Please hold until further notice
2	2	0.25	12/06/2018	plastic bag	S						1						
3	3	1.5	12/06/2018	plastic bag	S						1						
4	4	0.25	12/06/2018	plastic bag	S						1						
5	4	0.6	12/06/2018	plastic bag	S						1						
6	4	1.6	12/06/2018	plastic bag	S						1						


**Envirolab Services**  
 12 Ashley St  
 Chatswood NSW 2067  
 Ph: (02) 9910 6200  
 Job No: 194550  
 Date Received: 22/6/18  
 Time Received: 10:30  
 Received By: MH  
 Temp: Cool/Ambient 7-3  
 Cooling: Ice/Icepack  
 Security: Intact/Broken/None

<b>Relinquished by:</b> Douglas Partners	<b>Sample Receipt</b>	<b>Lab use only:</b>
<b>Courier (by whom):</b> TNT	<b>Received by (Company):</b> EU	<b>Samples Received:</b> Cool or Ambient (circle one)
<b>Condition of Sample at dispatch:</b> Cool or Ambient (circle one) <u>Frozen</u>	<b>Print Name:</b> MH	<b>Temperature Received at:</b> 7-3 (if applicable)
<b>Temperature (if Applicable):</b> Frozen, on ice	<b>Date &amp; Time:</b> 22/6/18 10:30	<b>Transported by:</b> Hand delivered / courier
<b>Print Name:</b> Jessica Paulsen	<b>Signature:</b>	
<b>Date &amp; Time:</b> 21/06/2018		
<b>Signature:</b> 		



Envirolab Services Pty Ltd

ABN 37 112 535 645

12 Ashley St Chatswood NSW 2067

ph 02 9910 6200 fax 02 9910 6201

customerservice@envirolab.com.au

www.envirolab.com.au

## SAMPLE RECEIPT ADVICE

### Client Details

<b>Client</b>	Douglas Partners Pty Ltd
<b>Attention</b>	Jessica Paulsen

### Sample Login Details

<b>Your reference</b>	83414.00, Green Point
<b>Envirolab Reference</b>	194550
<b>Date Sample Received</b>	22/06/2018
<b>Date Instructions Received</b>	22/06/2018
<b>Date Results Expected to be Reported</b>	29/06/2018

### Sample Condition

<b>Samples received in appropriate condition for analysis</b>	YES
<b>No. of Samples Provided</b>	6 soil
<b>Turnaround Time Requested</b>	Standard
<b>Temperature on Receipt (°C)</b>	7.3
<b>Cooling Method</b>	Ice
<b>Sampling Date Provided</b>	YES

### Comments

Nil

Please direct any queries to:

#### Aileen Hie

Phone: 02 9910 6200

Fax: 02 9910 6201

Email: ahie@envirolab.com.au

#### Jacinta Hurst

Phone: 02 9910 6200

Fax: 02 9910 6201

Email: jhurst@envirolab.com.au

Analysis Underway, details on the following page:



**Envirolab Services Pty Ltd**

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Sample ID	Chromium Suite
1-0.5	✓
2-0.25	✓
3-1.5	✓
4-0.25	✓
4-0.6	✓
4-1.6	✓

The '✓' indicates the testing you have requested. **THIS IS NOT A REPORT OF THE RESULTS.**

### Additional Info

Sample storage - Waters are routinely disposed of approximately 1 month and soils approximately 2 months from receipt.

Requests for longer term sample storage must be received in writing.