REPORT

Rip Road Foreshore Reserve Seawall and Rip Rap Revetment

Technical Specification

Client: Central Coast Council

Reference: PA1952MARP190823

Status: 0.1/Final

Date: 29 June 2020

Royal HaskoningDHV

Enhancing Society Together

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Royal HaskoningDHV

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1 DESCRIPTION OF WORKS

1.1 General

The Works to be carried out under this Contract shall include the supply of all materials, plant, equipment and labour for construction of the Rip Road Reserve seawall and revetment. All materials and workmanship shall be in accordance with the relevant and current Standards Australia codes and with the by-laws and ordinances of the relevant building authorities except where varied by the Drawings and Specification. The Contractor shall comply with all relevant national, state and local legislative requirements.

1.2 Scope of Work

The shoreline protection Works at Rip Road Reserve comprise a seawall, foreshore access steps, dinghy skid and a rip rap revetment.

The Works shall include but are not limited to:

- Contractor's Management Plans & Details, including Construction Programme, Method Statement, Quality Plan and relevant Inspection and Test Plans, Site Safety Management Plan and relevant Safe Work Method Statements and the Contractor's Construction Environmental Management Plan (CEMP).
- Preliminaries, including installation of site security fence and gates around the perimeter of the Works site and site offices, material storage area, survey set-out of works; erosion and sedimentation controls and pre-construction condition assessment.
- Demolition and Earthworks associated with preparation of foundations and profiles for construction of seawall and revetment.
- Stonemasonry works, including supply and placement of all material.
- Rip rap revetment including supply of materials and placement.
- Site reinstatement including landscape planting in disturbed areas.
- Survey, including setout, pre-construction, progress and compliance and 'as-constructed' surveys for the works.

1.3 Drawings

The Drawings that are included in and form part of the Contract Documents are listed below and attached in **Appendix A**.

The Drawings shall be read in conjunction with all such other drawings and specifications and with such other instructions that may be issued during the course of the Contract. Any discrepancy shall be referred to the Superintendent before proceeding with the work.

Deviations to the Drawings shall be marked on the "For Construction" Contract Drawings in red ink with changed dimensions and levels underlined in red ink.

Drawing Number	Drawing Title
PA1952-RHD-00-DR-MA-0010	Title Sheet, Drawing List and Locality Plan
PA1952-RHD-00-DR-MA-0050	Site Plan
PA1952-RHD-00-DR-MA-0075	General Arrangement
PA1952-RHD-00-DR-MA-0150	Perspective
PA1952-RHD-00-DR-MA-0200	Seawall Typical Details
PA1952-RHD-00-DR-MA-0300	Dinghy Skid and Typical Stair Details
PA1952-RHD-00-DR-MA-0400	Revetment Details
PA1952-RHD-00-DR-MA-0500	Miscellaneous Details

1.3.1 Chainage System

All chainages are given in metres (m) measured along the set-out line and cross-sections.

1.3.2 Level Datum and Linear Dimensions

All reference to Reduced Level (RL) are in metres above Australian Height Datum (AHD). AHD is approximately Mean Sea Level along the Australian seaboard.

All levels shown on the Drawings are in metres reduced to Australian Height Datum (AHD).

1.4 Proprietary Items

1.4.1 Alternative Offer

The Contractor may offer an alternative to any proprietary item. Apply in writing for review and acceptance to use the alternative. The request must be accompanied by all available technical information and shall describe how, if at all, the alternative differs from the proprietary item and how it will affect other parts of the Works and performance of the Works.

Except to the extent that the acceptance, if any, of the Principal includes a contrary provision, the acceptance is deemed to include the conditions that the:

- variation must not directly or indirectly result in any increase in the cost to the Principal of the Works;
- Contractor must indemnify the Principal against any increase in costs; and,
- variation must not directly or indirectly cause any delay to the Works and if it does, the Contractor will compensate the Principal for any loss which the delay causes.

1.5 Contract Documents

The following documents form part of the Contract

- Specification;
- Drawings for the Contract (Appendix A); and,

- Geotechnical and Acid Sulfate Soil Assessment to the extent of the limitations noted in the reports (Appendix B)
- Review of Environmental Factors (including NSW DPI Part 7 permit conditions (Fisheries Management Act) and Aboriginal Cultural Heritage Assessment conditions).

These documents will remain the property of the Principal and must be returned by the Contractor to the Principal on demand in writing. The documents must not, without the prior written approval of the Principal, be used, copied or reproduced for any purpose other than the execution of the work under the Contract.

1.5.1 Precedence

If there are any conflicts in the information given in this Specification and the Drawings, the Specification shall take precedence over the Drawings.

1.6 Site Information Supplied by the Principal

Site information and site conditions collated by the Principal is supplied to the Contractor for the Contractors convenience. The site information is not a complete assessment and shall not be relied upon by the Contractor. The Principal or Superintendent is not responsible for any interpretation, deductions and conclusions made by the Contractor from the information made available and the Contractor shall accept full responsibility for any such interpretation, deductions or conclusions.

Where the Principal has not given possession of the entire Site, the Contractor may apply for approval, which shall not be unreasonably withheld, to carry out further site investigation.

The following documents that provide site information have been supplied by the Principal to the Contractor:

- Design Report (Appendix C);
- Terrestrial Survey (Appendix D).

This information does not form part of the Contract.

These documents will remain the property of the Principal and must be returned by the Contractor to the Principal on demand in writing. The documents must not, without the prior written approval of the Principal, be used, copied or reproduced for any purpose other than the execution of the work under the Contract.

1.7 Site Investigations

The Contractor shall undertake investigations of the site in order to obtain sufficient information for construction of the Works. The extent and nature of these investigations are at the discretion of the Contractor and could comprise any of, or more than, the following:

- geotechnical investigations: e.g. in order to define temporary design parameters or to define variability and stratigraphy of the soils and bedrock at the site;
- survey of the seabed or of topography at the site: e.g. to better define levels and existing features.

Where the findings of such investigations impact on the design or construction of the Works, it will be deemed that the Contractor has included adequate allowance for the findings of such investigations.

1.8 Contractor's Documents

The Principal or Superintendent shall not be bound to check documents supplied by the Contractor for errors, omissions or compliance with the requirements of the Specification. Approval or otherwise of the Contractor's documents shall not relieve the Contractor from responsibility for the Contractor's errors or omissions or compliance with the requirements of the Specification.

2 PRE-CONSTRUCTION REQUIREMENTS

2.1 General

Pre-construction activities shall include the preparation of relevant management plans and construction documentation. The plans and documentation shall be supplied to the Superintendent for approval. At a minimum, the plans and documentation shall include:

1. Project Management Plan; and,
2. Pre-construction Condition Assessment.

The Superintendent may request additional documentation if deemed necessary. The cost of producing additional documentation and maintaining and updating the requested documentation listed above shall be included in the Contractor's tender price.

2.2 Project Management Plan

The Contractors Project Management Plan shall be an overarching plan that identifies the Contractor's organisational structure and project management structure. The Project Management Plan shall outline the Contractor's procedure to ensure compliance with all relevant local, State and Commonwealth legislation, guidelines, permits and licences and industry codes of practice. The Project Management Plan shall include the following sub-plans:

1. Construction Programme
2. Work Health and Safety Management Plan
    - Emergency Response Plan
3. Traffic Management Plan
4. Construction Environmental Management Plan
5. Construction Method Statements
    - Transport of Goods and Materials
6. Quality Control Plan
    - Inspection and Test Plan
    - Measurement and Survey Quality Plan

Additional sub-plans may be required at the Superintendent's discretion.

2.2.1 Construction Programme

The Contractor shall supply the Superintendent with a Baseline Construction Programme upon engagement. The baseline programme shall remain unchanged throughout the course of the project and it shall be used for assessing progress of the construction project.

A Revised Construction Programme shall be provided to the Superintendent fortnightly. The revised programme shall include all approved Extensions of Time and factor in any delays that are likely to be experienced by the Contractor.

2.2.2 Work Health and Safety Management Plan

The Contractor shall comply with all relevant Work Health and Safety regulations, including:

- Work Health and Safety Act 2011; and,
- Work Health and Safety Regulation 2017.

The Contractor shall also familiarise itself with work, health and safety operational procedures and policies required by Central Coast Council.

The Contractor shall prepare a site specific Work Health and Safety Management Plan including Safe Work Method Statements (SWMS) and ensure adherence to these for all construction tasks. Copies of SWMS are to be kept on-site for ready reference by workers. Tool box talks/meetings and briefing sessions are to be conducted by the Contractor to ensure full compliance with the SWMS. All construction personnel shall always be appropriately qualified and carry relevant documentation (such as a construction induction card or specific operating licences) with them.

The Contractor shall obtain and keep on-site all relevant Safety Data Sheets (SDS) for any materials that are used in the works. Materials that require an SDS shall be noted in the Work Health and Safety Management Plan. All transportation, storage and use of these materials shall be in accordance with the SDS.

In accordance with Work Health and Safety regulations, the known hazards identified by the consulting engineer are listed below. This assessment is not exhaustive and may exclude hazards that are typical of work practices. The Contractor shall undertake their own assessment of hazards.

- Exposure to the elements (heat, cold, UV radiation).
- Aquatic and/or terrestrial fauna bites/stings.
- Slips, trips and falls (e.g. unstable, wet, slippery surfaces, excavations, exposed reo bars and posts/pegs).
- Manual handling and heavy lifts.
- Risk of unsecure loads falling during handling and placement.
- Geotechnical instability and/or unstable batters. Groundwater in soils of low stability may be present in the Works area and specific safety precautions must be undertaken.
- Use, handling and storage of hazardous chemicals/dangerous goods.
- Excessive noise for long periods of time.
- Presence of hazardous airborne contaminants (e.g. gasses and vapours, silica etc.).
- Underground or overhead utilities.
- Transport of goods and materials and working adjacent to moving traffic.
- Work near or over water and risk of drowning.
- Violence and aggression from members of the public.

Emergency Response Plan

The Work Health and Safety Management Plan shall include an Emergency Response Plan. The Emergency Response Plan shall identify actions to be taken in the event of an emergency and allocate roles to site personnel. The Emergency Response Plan shall include phone numbers to call in case of an emergency, identify emergency escape routes and mustering locations and the location of the nearest health care emergency service.

2.2.3 Traffic Management Plan

The Contractor shall submit a Traffic Management Plan (TMP) to the Superintendent for approval prior to commencing work. The TMP shall adequately cover all construction activities and include a plan indicating the trucking route between the quarry or rock supply source and the Site. The TMP shall include the location of traffic management signs and traffic management controllers if deemed necessary for the Construction Methodology proposed by the Contractor.

Construction from a barge within the estuary may be required at times. Access to the site via boat and barge including the boat ramp to be used should be addressed in the TMP.

The TMP shall comply with all requirements of the NSW Roads and Maritime Services, DPI Fisheries, Central Coast Council and any other relevant authorities.

2.2.4 Construction Environmental Management Plan

The Contractor shall prepare and submit a Construction Environmental Management Plan (CEMP) to the requirements of all relevant legislation, requirements of all authorities granting approvals and licences and accepted best practice management procedures. The CEMP shall include requirements identified in the Review of Environmental Factors (REF) prepared for the project.

The Contractor shall engage a suitably qualified and certified Environmental Officer. The Contractor's Environmental Officer will be responsible for the preparation, direction and implementation of all environmental protection aspects of the Works and undertake Environmental Audits. The Environmental Officer shall be identified in the CEMP.

As a minimum, the CEMP shall cover the following environmental aspects:

- noise and vibration;
- air quality;
- water quality;
- stormwater management;
- erosion and sedimentation control;
- protection of foreshore vegetation and terrestrial flora;
- marine ecology;
- heritage;
- waste management and energy use;
- management of Acid Sulfate Soils; and,
- pedestrian access, traffic management and parking.

2.2.5 Construction Method Statements

The Contractor shall prepare method statements for each component of work. The method statement shall outline:

- extent of work;
- sequence for the completion of the construction activities;
- design profiles for the seawall; and,
- constraints offered at the Site.

The Construction method statement shall include a register of plant and equipment required for the component of work. The register shall include plant identification number and critical specifications such as payload, lifting capacity, boom reach etc. The register shall be updated as necessary with critical plant specifications provided to the Superintendent prior to utilising the equipment on the project.

2.2.6 Quality Control Plan

The Contractor shall prepare a Quality Control Plan, which shall identify the procedure that the Contractor will implement to ensure the Works are constructed in accordance with the Drawings and Specification. The Quality Control Plan shall include the following sub-plans:

- Inspection and Test Plans
- Measurement and Survey Quality Plan

Inspection and Test Plans

Where applicable, the Contractor shall prepare Inspection and Test Plans (ITPs) for distinct work activities. The ITPs must include:

- description of the Work activity;
- test method and tolerance applicable to the Work activity;
- frequency of the inspection and/or test;
- identification of parties responsible for the inspection and/or test; and,
- identification of Witness Points and Hold Points during the inspection and test period.

The Work activity must be divided into discrete lots for the purpose of inspection and testing. The lots must be measurable and trackable. A Lot register must be provided with each ITP.

Measurement and Survey Quality Plan

The Measurement and Survey Quality Plan shall identify the Contractor's methodology for ensuring materials are measured correctly and/or the works are surveyed correctly. The equipment and Contractor's method for measurement and survey must be in accordance with the National Measurement Act 1960, and the Specifications and accuracy must be suitable for the intended purpose. The Plan shall include identification of:

1. the unit of measure of all materials used throughout the course of the Works;
2. measurement equipment and/or survey equipment utilised on the Works and the requirement for calibration and maintenance of this equipment; and,
3. level of accuracy of the methodology and equipment.

As a minimum, calibration and maintenance shall comply with the requirements of the instruments' technical specification, measurement regulations and standard measurement practices. The plan shall include details of the Quality Assurance process including accuracy and validation of results.

The Measurement and Survey Quality Plan shall include a register of calibration certificates for the measurement and/or survey equipment used throughout the course of the project. The register shall be updated frequently. The details for inclusion in the register shall be provided to the Superintendent prior to utilising the equipment on the Works.

At the request of the Superintendent, the Contractor shall be capable of physically proving that the measurement and/or survey equipment is operating correctly, and the required accuracy is achieved.

2.3 Implementation of Project Management Plan

All Works shall be carried out strictly in accordance with the Contractor's Project Management Plan.

The Principal is responsible for:

- Ensuring that the Contractor's PMP meets the requirements of the Contract Documents.
- Auditing the Contractor's implementation of the PMP and for issuing corrective action requests to the Contractor as appropriate.

Corrective Action Requests (CAR) will specify the Works PMP non-conformance and require the person/organisation responsible to state the corrective action being taken and its time of completion and, in addition, will require a statement of preventive actions to ensure that similar non-conformances do not occur.

The Contractor shall be responsible for:

- Preparation of a Contractor's PMP;
- Communicating the PMP requirements to employees and subcontractors;
- Reporting and correcting PMP non-conformances during construction and the defects liability period;
- Internal auditing of the PMP to ensure compliance with the PMP and compliance with legislation, guidelines, permits and licences; and,
- Maintenance, management and periodic review of the PMP including updating all registers as required.

The Contractor shall prepare monthly Project Reports addressing the requirements detailed in the Project Management Plan. The reports shall be provided to the Superintendent and information in the report shall be conveyed at progress meetings.

2.4 Pre and Post Construction Condition Assessment

The Contractor shall be required to undertake pre-construction condition assessment comprising:

1. A dilapidation survey of all structural components which may be affected by the Works including but not limited to all buildings, roads and footpaths.
2. A comprehensive photographic record and/or video record, including commentary, covering all other areas that may be affected by the Works. This shall include all vegetated areas, gravel carparks and the like. The photographic record shall be completed by the Contractor in the company of the Superintendent.

The Contractor shall compile the dilapidation survey and photographic record into a bound report and provide two hard copies along with digital files to the Superintendent.

The dilapidation survey and photographic record shall be replicated prior to Practical Completion. The purpose of this survey is to confirm the "Pre" and "Post" construction condition of the site and ensure the site has been appropriately reinstated. Refer Clause REINSTATEMENT, SITE DISESTABLISHMENT AND CLEANUP.

2.5 Time for Commencement of Work

The PMP must be submitted and approved by the Superintendent at least seven (7) days prior to the commencement of construction works.

The Superintendent may consider adjustments to the PMP during the course of the Contract and may direct the use of alternative personnel, equipment, etc. Approval and/or adjustment of these documents shall not relieve the Contractor of the Contractor's responsibility for the safety and execution of all Works.

2.6 Site Induction Meeting

As part of site establishment, the Contractor shall convene and chair a Site Induction Meeting to be attended by:

- all personnel employed by the Contractor for carrying out the Works;
- the Superintendent; and
- representatives of the Principal; or,
- relevant authorities invited by the Principal.

The Site Induction Meeting shall familiarise the attendees with the site requirements and ensure that all workers (including sub-contractors) are aware of the Project Management Plan. Workers should be made aware of environmental requirements and health and safety requirements. Following the Site Induction Meeting, the attendees shall sign the Project Management Plan (and relevant sub-plans) registers noting their understanding of the documentation provided.

The Contractor shall arrange additional Site Induction Meetings as deemed necessary to induct new personal employed by the Contractor or additional Council staff.

Excluding the costs to cover attendance by the Superintendent and representatives of the Principal or relevant authorities, the full cost of the Site Induction Meetings shall be included in the Contractor's tender price.

3 SITE ESTABLISHMENT

3.1 General

Establishment shall consist of the furnishing by the Contractor at the site of all plant, equipment and personnel necessary for completion of the Works. The site establishment shall include the setting up of temporary services.

3.2 Contractor's Working Area

The areas of the Site that can be made available to the Contractor for storage and construction purposes shall be agreed with the Superintendent.

The Contractor shall be wholly responsible for the provision of offices and sheds within the Contractor's Working Area. Offices and sheds required by the Contractor shall only be erected, and equipment shall only be located, in site compound areas. The Contractor's plant, labour and materials shall be allowed on the site only to the extent necessary for the construction of the Works.

The Contractor's preferred location for site sheds and compound areas shall be subject to approval by the Superintendent.

3.2.1 Site Access Locations

The site is accessible from the end of Rip Road, Blackwall.

Construction from a barge within the estuary may be required at times. Access to the site via boat and barge will be subject to NSW DPI conditions.

3.2.2 Site Access

The Contractor shall provide safe and adequate access to the sites at all times for pedestrians and vehicles. Access points shall be maintained in a serviceable state during the contract.

The Contractor shall take all precautions to ensure that public roads, thoroughfares, accessways and haulage routes are not obstructed or damaged as a result of the construction Works or transport of equipment and materials. In the event of any damage, the Contractor shall take all necessary and immediate steps to repair the damage at no cost to the Principal.

3.2.3 Haul Roads

The Contractor shall construct, upgrade and maintain as required for the duration of the Contract, any haul roads or construction accessways required between public or paved roadways and the Works area.

The Contractor shall obtain approval from the Superintendent for any proposed haul roads within the Site prior to construction. Vehicles shall be required to stay on the haul roads.

Where dust generation or soil erosion is of concern, the haul roads shall be:

- covered with a minimum 50 mm thick layer of clean 10 mm screenings; and,
- watered as required.

Where the Contractor uses existing paved roads adjacent to the Site, the Contractor shall be responsible for the repair of any damage caused to those roads during construction of the Works.

3.2.4 Public Restrictions

The Contractor shall confine the Contractor's storage, accommodation and other facilities and manage pedestrian access within, through and around the Contractor's Working Area in accordance with Work Health and Safety (WHS) regulations. As a minimum, man-proof temporary security fencing shall be erected and maintained around the Works Compounds.

At the end of each work day, make the Site safe and take all necessary safety measures before leaving the Site.

3.2.5 Signboards

The Contractor shall supply, and erect safety signboard(s) as required by Work Health and Safety. The minimum size of the signboards shall be 800 mm x 600 mm. The proposed wording for the signboards and their location shall be supplied to the Superintendent for approval. The signboards shall be erected prior to Commencement of Work.

3.3 Services

3.3.1 Temporary Services

The Contractor shall arrange for the connection of temporary service lines for water, power, telephone and any other service that is deemed necessary by the Contractor. All such arrangements shall be in accordance with the requirements of the relevant authority.

The Contractor shall meet the cost of accessing and providing these services to the work site as appropriate, their use and their removal at completion.

3.3.2 Protection of Existing Services

The Contractor shall take every precaution to avoid damaging existing services. The Contractor shall make the Contractor's own assessment of the location of any existing services.

In the event that the Contractor causes damage to services (such as sewer, water supply, electricity supply and telecommunications), the Contractor shall immediately notify the Superintendent and the relevant service providers. Any services damaged during the Contract shall be reinstated by the Contractor at the Contractor's own expense. Refer Clause REINSTATEMENT, SITE DISESTABLISHMENT AND CLEANUP – REINSTATEMENT.

3.4 Surface Drainage

The Contractor shall undertake all necessary works to ensure surface water is properly managed across the Site and does not interfere or damage the works in progress.

3.5 Site to be Kept Tidy

The Contractor shall ensure that all rubbish collected, and all waste generated on the Site during the Contract is regularly disposed offsite in an environmentally acceptable manner to the approval of the relevant authorities.

3.6 Heavy Machinery

Advice from the Superintendent shall be sought prior to using any heavy machinery or construction plant on the site or surrounding roads/ carpark. The Contractor shall comply with instructions issued by the Superintendent.

Heavy machinery shall be deemed plant which imparts a point load greater than 2 tonnes or a pressure 15 kPa.

3.7 Work Hours

The work shall be conducted between the hours specified below, unless otherwise agreed in writing by the Superintendent:

- 7:00 am to 6:00 pm, Monday to Fridays
- 8:00 am to 1:00 pm, Saturday

No work shall take place on Sundays or Public Holidays unless approved.

3.8 Temporary Works

The Contractor shall provide any temporary works as are necessary to carry out the Contract. Temporary works shall include construction of haul roads across the site and establishment of stockpile areas.

The cost of providing temporary works shall be deemed to be included in the Contractor's tender price for the Works.

The Contractor shall obtain approval prior to commencing temporary works.

4 PROTECTION FROM HIGH WATER LEVELS, WAVE ACTION AND STORMWATER

The Contractor shall be responsible for protecting and/or managing the Works to account for high water levels, wave action and stormwater.

The Contractor shall construct the Works in a manner which limits the extent of the Works exposed to possible damage from high water levels, wave action and stormwater.

The Contractor shall repair, at the Contractor's cost, all works damaged by tide, waves and weather.

4.1 High Water Levels

The Contractor shall inform itself of the predicted tide levels to be encountered during the Works. The Contractor should be aware that actual water levels can exceed predicted tide levels.

The Contractor shall be deemed to have made its own assessment of high water levels which may be encountered during construction of the Works. The Contractor shall adopt work methods and implement temporary works to manage the effects of high-water levels and make allowance for these conditions in the Tender.

4.2 Wave Action

The Contractor shall inform itself of the wave conditions which may be encountered at the Site, including the effects of wave action on elevated water levels, and adopt work methods and implement temporary works accordingly.

In planning and implementing any system to protect the Works from wave action, the Contractor shall ensure that it does not adversely affect areas adjacent to the Works.

The Contractor shall be deemed to have made its own assessment of wave action likely to be encountered during construction of the Works and made allowance for these conditions in the Tender.

4.3 Stormwater Management

The Contractor shall be responsible for temporary diversion of any stormwater flows from the existing stormwater system and the management of overland flows due to any surcharging of stormwater pits or for any other reason.

The Contractor shall be deemed to have made its own assessment of the need for temporary diversion of stormwater and of the overland flows likely to be encountered during construction of the works and made allowance for these conditions in the Tender.

5 SURVEY

5.1 General

Survey shall be obtained for the main activities, including those associated with setting out of the works, earthworks and construction of the various elements. The Contractor shall obtain the following Surveys:

- Pre-construction survey, prior to commencement of construction activities;
- Compliance surveys; and,
- As-constructed survey prior to practical completion and following construction of all elements of the Works.

5.2 Survey Personnel

The pre-construction survey shall be carried out by a Registered Land Surveyor with at least 3 years' experience in land surveying and set-out of civil construction projects.

All compliance and as-constructed survey work shall be carried out by, or under the supervision of an Engineering Surveyor with at least 3 years' experience in surveying and sign-off of construction projects for the terrestrial component. Survey at the toe of the structure shall be undertaken at low tide and extended as far seaward as practical with conventional terrestrial survey equipment.

The Surveyors shall be responsible for the collection and processing of the survey data and the provision of all survey equipment required to complete this task.

It is the responsibility of the Surveyors to source and compile any information or data required to complete the survey from third parties. The Surveyors shall validate all information from the third parties.

5.3 Survey Control

Survey control data used or derived from this contract must be supplied to ensure independent Quality Assurance (QA) of the survey operations, and for possible inclusion in the State's survey control infrastructure. It is therefore essential that all primary ground stations are permanently marked in accordance with the appropriate State system.

The primary ground control and check point surveys must be referenced to the local datum specified above comprising State survey control marks with "established" GDA94 coordinates and/or "accurate AHD" heights as defined in the relevant State Surveying regulation.

Survey to establish new primary control shall include an expression of uncertainty as described in the ICSM Standard for the Australian Survey Control Network Special Publication 1 (SP1) Version 2.1.

5.4 Horizontal Positioning

The horizontal datum shall be the Geocentric Datum of Australia 1994 (GDA94). The map projection and positioning shall be related to the Map Grid of Australia (MGA) Zone 56 coordinate system.

5.5 Vertical Datum

All soundings and level information shall be reduced to Australian Height Datum (AHD) as determined by the published heights of local survey control marks within or adjacent to the project extent.

AUSGeoid09 (or the most recent ICSM-approved Geoid model) shall be used to derive orthometric heights (AHD) from ellipsoidal data (GDA94 reference frame). All deliverables shall be referenced to AHD.

5.6 Survey Detail

5.6.1 Pre-Construction Survey

The pre-construction survey shall cover the Works area, Contractor's compound, stockpile locations, location of proposed haul roads and any other part of the site that may be impacted by the Contractor's construction activities. The pre-construction survey shall at a minimum capture the following details:

- existing seawall crest and toe levels;
- location of existing services (e.g. sewer and power) and amenities (steps) in the vicinity of the Works area; and,
- extent of existing vegetation along the crest of the embankment.

The pre-construction survey shall include the establishment and setout of the survey control shown on the Drawings. The survey control setout shall be clearly marked on-site and shall be maintained throughout the course of the Works.

The pre-construction survey shall be submitted to the Superintendent at least fourteen (14) days prior to commencement of construction activities.

5.6.2 Compliance Survey

The Contractor shall be responsible for the completion of compliance surveys to demonstrate to the Superintendent that the Works have been constructed in accordance with the Drawings.

Compliance surveys shall include the finished surface of the excavation batter, stormwater drains, grouted sandstone and any other elements that would be buried at completion of the works. The compliance survey shall be approved prior to placement of sandstone blocks and/or placement of backfill or drainage material.

The Compliance Survey shall include the finished profile of the structure, for the purpose of interim payment as required.

5.6.3 As-Constructed Survey

A final as-constructed survey shall be completed. This survey shall be a stand-alone survey and shall not utilise any data collected from the pre-construction or compliance surveys. The survey shall cover the same extent as the pre-construction survey.

The as-constructed survey shall include full coverage of the seawall and rip rap revetment and include survey of the toe, crest and the elevation of each course of sandstone on the access stairs. The survey shall be sufficient to prepare accurate sections at 5 m chainages.

The survey method for the as-constructed survey of the rip rap revetment shall be 'highest point survey' whereby the highest point of individual rocks in the outer layer of armour is surveyed.

5.7 Structure Non-Conformance

In the event that the surveyed work does not meet the requirements of the Specification, the Superintendent may instruct the Contractor to reconstruct that component of the Works and resubmit the survey for approval. The Time for Practical Completion shall not be affected by such rectification activities, and the cost of all works associated with the rectification including re-survey shall be borne by the Contractor.

5.8 Processing of Survey Data

The Surveyor shall develop a three-dimensional (3D) model for the surveyed area that adequately captures the survey area. The 3D model shall include:

- Pre-construction survey (to be based on available survey data);
- Design of Seawall and rip rap revetment (to be based on design model/drawings); and,
- As-Built survey.

Survey information shall be provided in digital form in DWG and DXF format on USB storage devices or a cloud-based server such that it can be utilised in AutoCAD. The 3D model shall be provided in soft copy and the cross sections shall be presented clearly and concisely such that they can be printed at appropriate scales on A3 sized paper.

Contours shall be shown at 0.5 m intervals reduced to Australian Height Datum and positioned to the MGA coordinate system. Spot levels shall also be provided in ASCII format.

The minimum metadata to be included with the survey information is:

- Class of survey
- Horizontal datum and its definition
- Horizontal tolerance
- Vertical datum and the definition
- Vertical tolerance
- Date of survey (field work completion)
- Name and signature of the surveyor responsible for the survey
- Scale of survey
- Terrestrial Survey system utilised
- Reference to any third party data including reduced levels for any survey marks established on the Site
- MGA grid crosses and labels
- Reference to Quality Control Plan
- North Arrow

All charts, calibration records, daily activity sheets, drawings and estimates of quantities prepared from the survey data shall be agreed and signed by the Superintendent and the Contractor. All raw survey data shall be provided to the Superintendent upon request. The data shall be presented in a format approved by the Superintendent.

5.8.1 Data Availability

At the request of the Superintendent, the Contractor shall supply, free of charge, any digital depth/height/coordinate and other survey information and associated documentation held by the

Contractor for the purpose of verification or computation by the Superintendent. Information shall be supplied within five (5) working days of the request and shall be in a digital format as requested by the Superintendent.

5.9 Survey by Principal

For purposes of verification the Superintendent may from time to time undertake compliance check surveys at any location or any cross-section. Any non-compliance detected by such surveys shall be remedied by the Contractor at no cost to the Principal.

5.10 Practical Completion

A certificate of Practical Completion shall not be issued until all ‘Compliance and As-Constructed’ drawings and survey data are completed and submitted to the Superintendent to the Superintendent’s satisfaction.

6 DEMOLITION AND EARTHWORKS

6.1 General

Demolition (if required) and earthworks for construction of the rock works shall only be undertaken to the extent required to allow construction of the Works. The extent of demolition and earthworks work shall include that determined from the Drawings.

6.2 Demolition and Excavation

6.2.1 Standards for Demolition and Excavation

The Contractor shall comply with the following Standards, Guidelines and Code of Practice for demolition work to the extent that they are relevant and not overridden by the Specification:

- AS 2601 The Demolition of Structures
- AS 3798-2007 Guidelines on Earthworks for Commercial and Residential Development
- Safe Work Australia Excavation Work Code of Practice (July 2014)

6.2.2 Demolition and Excavation Generally

The Contractor shall advise the Superintendent when demolition and excavation works are to commence.

Demolition and excavation shall be undertaken in a careful manner, with a minimum of disturbance and with every possible precaution taken to prevent damage to property and injury to personnel.

All demolished structures shall be subject to approval by the Superintendent. The Contractor shall provide at least one (1) weekday's notice for such inspections. Any services which require relocation as part of the work shall be relocated in accordance with the requirements of the Superintendent and any relevant authorities and codes.

No reinforcement or other elements likely to cause injury shall protrude from the demolished structures. All demolished materials that will not be reused in the Works shall be removed from the Site.
The use of explosives in demolition and excavation works shall not be permitted.

All excavated and demolished material shall be classified in accordance with NSW EPA Waste Classification Guidelines - Part 1: Classification of Waste (2014).

The burning off demolished materials on the Site is prohibited.

No crushing of demolished or excavated material shall take place on the Site.

The Contractor shall restrict dust caused by demolition works to a practicable minimum.

6.2.3 Existing Pipes, Sewers and Other Services

During the execution of works, the Contractor shall take every precaution to secure existing gas, water, drainage pipes, sewers, electric conduits, telecommunication and other existing services or works. Placement and compaction of backfill materials around structures, culverts, pipelines and the like shall be undertaken simultaneously on both sides to avoid differential loading.

A redundant concrete stormwater pipe outlet is thought to be buried within the Site. The redundant outlet shall be demolished as required, unless otherwise instructed by the Superintendent.

6.2.4 Demolition and Excavation Works Design

The Contractor is to be and shall remain solely responsible for the demolition and excavation methods, procedures and practices. The method of demolition and excavation shall be as stated in the Contractor's Method Statement.

6.2.5 Stockpiles of Demolished and Excavated Material

Stockpiles of demolished and excavated material shall be placed clear of all excavations. Slopes supported by retaining walls shall not be loaded unless an assessment of the slope and wall stability has been made which includes an allowance for additional loads due to the stockpiling.

6.2.6 Reuse of Material

The Contractor's Method Statement shall identify demolished and excavated materials to be reused on the Site. Any material to be reused on the Site shall satisfy the requirements of the Specifications. The Superintendent shall approve demolished and excavated material identified for reuse.

The Contractor shall be responsible for the offsite disposal of demolition and excavated material that is not suitable for reuse.

6.2.7 Disposal

All demolition and excavation material not reused onsite, and all other debris, shall be completely removed from the site. Excess demolished materials and debris shall be the property of the Contractor. Excess demolished materials and debris shall be disposed of offsite at a licensed recycling or waste disposal facility. The Contractor shall keep a record of all disposal receipts on site ready to be witnessed if requested by the Superintendent. The burning off of demolished materials onsite is prohibited.

6.2.8 Asbestos

In the event that asbestos of fibre cement fragments are found during demolition works, the Contractor shall notify the Superintendent immediately. Removal of asbestos shall be undertaken in accordance with *Work Health Safety Regulations* (2011) and the code of practice issued by Safe Work Australia for safe removal of asbestos.

6.2.9 Acid Sulfate Soil

All natural excavated material, sourced from below the water table, shall be tested for potential contamination and ASS, classified, stored, transported, and disposed of at an appropriate waste facility in accordance with the NSW EPA Waste Classification Guidelines - Part 4: Acid Sulfate Soils (2014).

6.3 Fill, Drainage Material and Topsoil

6.3.1 Fill Material

All fill material shall consist of good quality granular fill, free of organic matter and having a maximum particle size of 40 mm and a fines content (i.e. content with grain size less than 75 microns) not exceeding 2% by weight. The fill shall be classified as Excavated Natural Material (ENM) and comply with

requirements of Resource Recovery Order under Part 9, Clause 93 of the Protection of the Environment Operations (Waste) Regulation 2014 issued by the NSW Environmental Protection Authority (EPA).

No crushing of demolished or excavated material shall take place on the Site.

6.3.2 Drainage Material (Blue Metal Gravel Filter)

Drainage material shall consist of good quality granular blue metal gravel with a nominal size of 20 mm. The drainage material shall be free of organic matter and having a maximum particle size of 50 mm and a fines content (i.e. content with grain size less than 75 microns) not exceeding 2% by weight.

No crushing of demolished or excavated material shall take place on the Site.

6.3.3 Topsoil

Topsoil shall comprise a blend of sand, natural soil and organic materials and be suitable for the culture of all plant material and in particular exotic and native grasses. It shall:

- be classified as Excavated Natural Material (ENM) and comply with requirements of Resource Recovery Order under Part 9, Clause 93 of the Protection of the Environment Operations (Waste) Regulation 2014 issued by the NSW Environmental Protection Authority (EPA);
- be of a friable porous nature;
- contain no stumps, roots, clay lumps or stones larger than 30 mm in size;
- have an organic content of at least 5% by mass as determined by the method specified in AS 1289 D1.1 Part D;
- have a soluble salt content not exceeding 0.06% by mass;
- be suitable for phosphorus sensitive plants; and,
- be free of weed and weed refuse material.

6.3.4 Testing and Acceptance

The Contractor shall test fill, drainage, base course and topsoil material prior to importing and/or reuse of excavated material on-site. At a minimum, the following suite of tests shall be completed:

- organic matter (AS 1289.4.1.1);
- Particle Size Distribution (PSD) (AS 1289.3.6.1); and,
- Test for contaminants in accordance with Resource Recovery Order under Part 9, Clause 93 of the Protection of the Environment Operations (Waste) Regulation 2014.

Tests shall be undertaken prior to importing of the fill material to site. The Contractor should allow for one (1) organic matter test and one (1) PSD per 100 tonnes of material placed at the site, to be undertaken throughout the course of the Works.

All samples shall be randomly collected from varying depths to ensure the samples are representative of the material to be delivered to the site.

Tests shall be undertaken by or under the supervision of a qualified Geotechnical Engineer and Engineering Technician in accordance with the relevant Australian Standards, and National Association of Testing Authorities (NATA) Australia requirements. The Superintendent shall be notified when samples are to be collected and provisions shall be made for the Superintendent to attend the sampling at the Superintendent's expense.

6.3.5 Delivery

Each truckload of fill, drainage, base course and topsoil material shall consist of one type/source of material.

No material shall be delivered to the Site without written authorisation from the Superintendent following their consideration of documentation on the source and properties.

The Contractor shall maintain a daily log of imported material delivered to the Site. The log shall record the registration of each supply truck, its date and time of arrival on the Site, the material supply docket number issued by the quarry pertaining to the delivery and a signature by a representative of the Contractor to verify the information.

During the course of construction Works, the Contractor shall provide to the Superintendent each week a copy of the completed daily material supply log and the original supply dockets pertaining to work undertaken in the previous week. The supply dockets shall include a record of loaded truck mass.

Before unloading each truckload of material, the Contractor shall allow the Superintendent to inspect the load. The Superintendent may reject a load if it is the Superintendent's opinion that the material does not comply with the requirements of this specification. The Superintendent may request that a sample of material be tested to verify that it meets the requirements of the Specification. The costs of such testing shall be deemed to be included in the Tendered price. Any load rejected shall be removed immediately from the Site at the Contractor's expense.

Where tests show that the specified requirements have not been met, the material shall not be delivered to the Site and an alternate source shall be identified.

6.3.6 Stockpiles

Stockpiles of material shall be placed clear of all excavations. Slopes supported by retaining walls shall not be loaded unless an assessment of the slope and wall stability has been made which includes an allowance for additional loads due to the stockpiling.

Stockpiling of material on the Site shall be limited to the minimum extent practicable for continuity of the Works.

6.3.7 Placement of Fill and Drainage Material

All filling shall be placed in 100 mm (loose) thick layers, unless another depth is shown on the Drawings. Fill shall be compacted by watering and rolling to achieve a dry density ratio of between 95% and 102% of Standard Maximum Dry Density (SMDD) and within 2% of their Standard Optimum Moisture Content (SOMC) at Standard Compaction as determined by AS1289.5.1.1 (standard) and AS 1289.5.4.1.

All earthwork areas shall be graded to falls, with slopes of 1 in 100 minimum.

6.3.8 Placement of Topsoil

Provision shall be made for the placement of topsoil where shown on any Drawings to a minimum depth 150 mm, unless another depth is shown on the Drawings.

6.3.9 Testing and Acceptance of Compaction

The Contractor shall test the compaction achieved during all subgrade preparation and filling to ensure that the compaction requirements are achieved. Tests shall be undertaken on prepared foundations, subgrades and placed fill material at the frequencies outlined in AS3798. At least Level 2 testing of earthworks should be carried out in accordance with AS3798. Any areas of insufficient compaction will require reworking.

in the number and at the locations and times determined by the Superintendent.

The Contractor should allow for one (1) compaction test per 50 cubic metres loose of placed and compacted material to be undertaken through the course of the Works.

All compaction tests shall be undertaken by or under the supervision of a qualified Geotechnical Engineer and Engineering Technician in accordance with the relevant Australian Standards, and National Association of Testing Authorities (NATA) Australia requirements.

Where tests show that the specified compaction requirements have not been met, the Superintendent shall require the Contractor, at the Contractor's expense, to:

i. undertake further compaction of the material which failed to meet the required compaction; or
ii. remove the material which failed to meet the required compaction, replace it with other approved material and compact the replacement material to the requirements of the Specification.

Following the completion of (i) or (ii) above, further compaction testing shall be undertaken at the Contractor's expense to determine whether the additional compaction, or compacted replacement materials, meets the compaction requirements. The number of additional tests undertaken by the Contractor shall be determined by the Superintendent.

6.4 Preparation of Subgrade

The minimum allowable bearing capacity shall be 10 mm max settlement at 100 kPa load.

If areas of poor subgrade are exposed then a bridging layer comprising a 0.3 m thick layer of coarse gravel and cobbles (of 75mm to 300mm nominal size) should then be placed on the exposed base and pushed into the very soft clay/very loose sands with the bucket of a large tracked excavator, of at least 20 tonne size.

This material must be angular, of high strength such as crushed igneous rock, concrete or high strength sandstone, and must be well graded, subsequent layers should be added and pushed in until no further penetration occurs.

6.5 Hold Points

The Contractor shall hold the works for inspection by the Superintendent as specified herein and including following hold points:

- Prepared subgrade prior to placement of concrete foundation or rip rap
- Engineered fill prior to placement of topsoil.

7 Concrete Work

7.1 Scope of Work

The Contractor shall supply and deliver all plant, materials and labour for the construction of concrete work as shown on the Drawings and specified herein.

Concrete work includes the seawall capping, ramps, and pavement.

All concrete used in the works shall be sourced from a ready mixed concrete supplier from an approved plant only. The Contractor shall submit this concrete specification to the concrete supplier. Details of the mix designs for each specified class of concrete shall be provided by the Contractor for the Superintendent's review and approval not less than one (1) week prior to commencement of concreting operations.

At the completion of concreting, sufficient documentary evidence shall be provided to Council to demonstrate that the concrete used in the Works conforms to the approved mix design and all other requirements of the concrete specification.

7.2 Standards

Current issues of the following Standards shall be complied with for the concrete work to the extent that they are relevant and not overridden by the Specification:

Concrete Manufacture and Mix

AS 1012	Methods of testing concrete (all parts);
AS 1141	Methods for sampling and testing aggregates (all parts);
AS 1379	The Specification and Manufacture of Concrete;
AS 1478.1	Chemical admixtures for concrete, mortar and grout (all parts);
AS 1554.3	Structural steel welding Part 3: Welding of reinforcing steels;
AS 2350	Methods of testing Portland and blended cements;
AS 2758	Aggregates and rock for engineering purposes – Definitions and classification;
AS 2758.1	Part 1: Concrete aggregates;
AS 3582	Supplementary cementitious material for use with Portland cement (all parts);
AS 3727	Pavements Residential
AS 3799	Liquid membrane-forming curing compounds for concrete;
AS 3972	General purpose and blended cements;
AS 4671	Steel reinforcing materials;
AS 4680	Hot-dip galvanized (zinc) coatings on fabricated ferrous articles.

Concrete Structures and Construction

AS 3600	Concrete Structures;
AS 3610	Formwork for concrete;
AS 4058	Precast Concrete Pipes
AS 4997	Guidelines for the Design of Maritime Structures;
BS 6349	British Standard – Maritime structures (all parts)

7.3 Concrete Class and Binder Design

The concrete shall comply with Structural Concrete specifications as set out in Section 6 of AS 4997-2005, and shall have properties meeting the following acceptance criteria:

- Maximum water/cement ratio of 0.40.

Due to concerns with cracking, refer to Clause CONCRETE WORK, CURING for curing specifications.

7.4 Concrete Colour and Texture

The concrete shall be of a consistent colour and texture. The colour of the concrete used in the Works shall be that naturally derived from the specified General Purpose Portland cement binder, unless otherwise instructed by the Superintendent.

7.5 Aggregates

The durability class of aggregates shall be Class C in compliance with AS 2758.1.

Coarse aggregate shall be clean, hard, durable particles consisting of crushed igneous rock or river gravel with a nominal maximum size of 20 mm.

Fine aggregate shall be dense, naturally occurring sand or rock, crushed, uncrushed or a blend of both. No more than 25% of the fine aggregate shall be manufactured sand. Sand shall generally be clean silica sand proportioned with up to a maximum of one quarter by weight of manufactured sand.

Limit fines resulting from blended crushed and uncrushed material finer than 75 micrometres to 5% maximum of weight of fine aggregates, to AS 1141.12.

Fine & coarse aggregate shall comply with AS 2758.1 - severe exposure condition. The sampling and testing of such shall comply with AS 1141. Prior to supplying concrete, furnish test certificates based on samples from the most recent production or from stockpiles for the project, for the properties tabulated below for coarse and fine aggregates respectively:

Coarse Aggregate	Test Method	Clause No. AS 2758.1	Required Property
Particle size and analysis	AS 1141.11	8.1.2	20mm max.
Particle Density	AS 1141.6.1	7.1	Normal weight aggregate
Water Absorption	AS 1141.6.1	7.3	2%
Particle Shape	AS 1141.14	8.3	Standard 10% of 3:1
Los Angeles Abrasion Value and/or Sodium sulphate soundness	AS 1141.23 & AS 1141.24	9.3.3	35% max and 6% loss
Alkali Aggregate Reactivity	SAA HB 79	10.1 & 10.2	Non-reactive
Weak/Friable Particles	AS 1141.32	11	0.5%

Fine Aggregate	Test Method	Clause No. AS 2758.1	Required Property
Particle size and analysis	AS 1141.11	8.1.3	
Bulk Density	AS 1141.4	7.2	
Water Absorption	AS 1141.5	7.3	
Organic Impurities	AS 1141.34	14.1	Standard
Sodium Sulphate Soundness	AS 1141.24	9.3.3	6%
Light Particles	AS 1141.31	12	1%
Sugar	AS 1141.35	14.2	0.0%
Potential Reactivity	SAA HB 79	10.1 & 10.2	Nil

7.6 Addition of Water and Mixing

Mixing water shall be fresh, clear, potable water or clean recycled water clear of all deleterious impurities. Water shall only be added to the mixer immediately prior to the addition of concrete raw materials.

Water must not be added to the as-delivered mix.

7.7 Transportation of Concrete

The concrete shall be transported in such a manner that there shall be no segregation of its constituents. If any segregation of the concrete materials has taken place during transport, the concrete shall be again turned over and mixed just before it is finally placed in position. No water shall be added to the concrete between the time of mixing and placing.

Whilst being transported from the mixer to the site of placing, all concrete shall be properly protected from contamination by dust or sand and from excessive moisture gain or loss from rainfall or high temperature, and all equipment used shall be purpose-made for the correct transportation of concrete.

7.8 Use of Galvanised Reinforcement

Conventional reinforcement to be N grade deformed bars to AS4671. All reinforcement and tie wire shall be hot dip galvanised in accordance with AS4680 (i.e. minimum coating of 600gm/m^2 of zinc, etc.) unless noted otherwise on the Drawings.

7.9 Reinforcement Cover

External cover to reinforcement shall be 70mm unless otherwise noted on the drawings.

The construction tolerance on cover is: +10mm/-5mm.

7.10 Bar Development Length and Cogs

Development lengths and cog lengths for galvanised reinforcement shall be in accordance with AS3600 for full stress development, as tabulated below:

Bar Diameter φ (mm)	Tension anchorage Lap Length Minimum (mm)	90^0 Cog Length Minimum (mm)	Minimum Internal Bar Bending Radius (mm)
12	≥400	≥150	≥60
16	≥500	≥200	≥80
20	≥650	≥350	≥160
24	≥800	≥400	≥192

7.11 Preparation for Placing

Concrete footings and pavement are to be founded on firm natural cut ground or compacted fill. Any soft areas are to be removed and replaced with compacted fill to meet a minimum of 100kPa allowable bearing pressure. The sub base should be thoroughly moistened with fresh, clear, potable water or clean recycled water clear of all deleterious impurities prior to placing concrete.

All waterproof membrane used in the concreting work shall be at least 200 micron thick.

Support reinforcement on approved bar chairs placed at a maximum of 1000mm centres, to maintain position and cover as shown.

In preparation for the placing of concrete, all construction debris and extraneous matter shall be removed from the interior of forms. Standing water on areas to receive concrete shall be removed before concrete is placed. All exposed reinforcement and other embedded items shall be thoroughly cleaned of all deleterious matter including concrete splash from previous concreting operations. Every precaution shall be taken to ensure that contamination due to windborne dust or other organic or chemical products from adjacent operations does not occur.

Placing of concrete shall not be commenced until the Contractor has inspected and passed the formwork or other areas to receive concrete and any reinforcement, cast in fixings etc., against which the concrete is to be placed.

Where concrete is to be cast against an existing concrete face, that face shall have been prepared to expose the aggregate and all loose particles removed. This surface shall be wetted prior to receiving concrete. This preparation shall be subject to inspection by the Contractor as part of the formwork checking procedure.

An opportunity shall be provided to the Superintendent to inspect or witness the inspection of the formwork prior to each placement of concrete.

7.12 Placement and Compaction

Concrete placement shall comply with AS 3600, Section 17.

Concrete shall be placed in the shortest possible time after mixing is completed and before it has taken an initial set. It shall be placed as close as possible to its final position to avoid segregation of materials and displacement of reinforcement.

Concreting of any section or unit of the work shall be planned to be carried out in one continuous operation with no interruption of the concreting.

No concrete shall be placed during periods of heavy rain or high winds. Concrete shall not be placed on days for which the maximum daily temperature, as forecast by the Bureau of Meteorology on the day preceding the concrete placement, equals or exceeds 27ºC.

Concrete shall be compacted by intense vibration with mechanical vibrators.

The finished concrete shall be a dense homogeneous mass, completely filling any formwork, thoroughly embedding the reinforcement and free of stone pockets, surface crazing, excessive dusting or honeycombing and shall not be inferior to the standard specified.

7.13 Set Acceleration and Design Shrinkage

The use of high early strength accelerator for concrete and mortar shall be permitted subject to the product not compromising final concrete strength. Sika Rapid 1 or approved equivalent may be added to the concrete in dosages as advised in the manufacturer's printed directions of use. No other liquid accelerator admixture shall be used without the written approval of Council.

7.14 Curing

The concrete shall be water-cured for at least 7 days under ambient conditions. Curing shall commence immediately after finishing horizontal surfaces. If forms are stripped within 7 days, then supplementary water curing shall take place to 7 days.

Alternative curing methods (e.g. use of curing compounds) may be proposed by the Contractor, however the methodology to be approved by the Superintendent.

If temperatures are forecast to exceed 25^{o}C, protect the concrete from drying through the use of wet hessian or other means which facilitate curing.

7.15 Joints

Joints shall be prepared in accordance with AS 3600.

7.16 Finish

The concrete surfaces shall be constructed to the tolerances stated in AS3600 Section 17.

7.17 Performance Testing of Concrete

In accordance with the requirements of AS 1379, a project assessment of concrete shall be made. The Contractor shall arrange for an approved registered NATA Testing Laboratory to carry out concrete testing in accordance with the requirements of AS 3600 and AS 1379. The cost of all such tests shall be borne by the Contractor. Test reports shall be supplied to the Superintendent within two (2) working days of testing.

Concrete shall be slump tested at site before and after the addition of superplasticiser. Slump testing shall be carried out in accordance with AS 1012.3. Concrete from each ready mix truck delivery of concrete to the site shall be tested. The slump shall be deemed to be acceptable if it is within the permissible tolerance in AS 1379.

Concrete shall be sampled, tested and assessed for compliance with the specified compressive strength to AS 1379. Sampling shall be carried out to AS 1012.8 and 1012.9 using rubber capping when testing 100 mm cylinders. Prepare a minimum of two cylinder specimens for each sample. Each sample shall

represent the particular mix supplied since the previous sample. The following minimum sampling and testing frequency applies in addition to those in AS 1379 clauses 6.3.3 and 6.5.2:

No of batches per day	No of samples
1	1
2 to 5	2
6 to 10	3
11 to 20	4

Concrete shall be assessed for compliance with the requirements of this Specification, including the referenced Standards (such as AS3600 and AS1379), and the Drawings.

7.18 Rejection

Concrete shall be rejected if it fails to comply with the provisions of this Specification. Rejected concrete shall be removed and replaced at the Contractor's own expense with new concrete so that it does comply with the provisions of this Specification.

8 Steelwork

8.1 General

The Contractor shall provide steelwork to the requirements specified herein. This specification outlines minimum requirements for supply, fabrication and installation of steelwork. Where more stringent requirements are outlined on Drawings or other standards or guidelines being used for the project, the Contractor shall liaise with the Superintendent for clarification.

8.2 Standards

Unless otherwise specified herein all steelwork shall comply with the current editions of the following Australian Standards, Codes and Specifications as appropriate.

STEEL

AS 1163 Cold-formed structural steel hollow sections
AS 1657 Fixed platforms, walkways, stairways and ladders - Design, construction and installation
AS 1664 Aluminium structures (All parts)
AS 3678 Structural steel – Hot-rolled plates, floorplates and slabs
AS 3679 Structural Steel – Hot-rolled bars and sections and welded I-sections (All parts)
ASTM A240/240M Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications

STEEL BOLTS, NUTS AND WASHERS

AS 1111 ISO metric hexagon bolts and screws (All parts)
AS 1112 ISO metric hexagon nuts (All parts)
AS 1237 Plain washers for metric bolts, screws and nuts for general purposes (All parts)
AS 1252 High strength steel bolts with associated nuts and washers for structural engineering

WORKMANSHIP

AS 1171 Methods for Magnetic Particle Testing of Ferromagnetic Products and Components
AS 1391 Methods for Tensile Testing of Metals
AS 1554 Structural steel welding set (All parts)
AS 1710 Non-Destructive Testing of Carbon and Low Alloy Steel Plate - Test Methods and Quality Classification
AS 1796 SAA Welder Certification Code
AS 1815 Metallic Materials - Rockwell Hardness Test
AS 1816 Metallic Materials - Brinell Hardness Test
AS 2177 Radiography of Welded Butt Joints in Metals
AS 2207 Methods for the Ultrasonic Testing of Fusion Welded Joints in Steels
AS 2214 SAA Structural Steel Welding Supervisor's Certification Code
AS 4100 Steel structures

SURFACE PREPARATION

AS 1627 Metal finishing - Preparation and pretreatment of surfaces (All parts)

STAINLESS STEEL

AS/NZS4673 Cold-formed stainless steel structures

8.3 Miscellaneous Steelwork

8.3.1 General

Miscellaneous steelwork includes all brackets and bolts for the dinghy skid.

Structural steel grades shall be as shown on the Drawings. Where steel grade is not shown on Drawings, steel members shall be minimum Grade 316, stainless steel.

Steel members shall have material composition in accordance with the minimum requirements outlined in AS/NZS 4673. The Contractor shall, at the request of the Superintendent, provide Manufacture's mill certificates for stainless steel showing the material composition of stainless steel members.

8.3.2 Fixings

"Fixings" shall be deemed to include bolts, nuts, washers, nails and the like for the securing of members. All permanent steel fixings shall be grade 316 stainless steel, unless noted otherwise.

Bolt holes for bolts up to M24 must be 2 mm larger in diameter than the nominal bolt diameter and for bolts larger than M24, 3 mm larger in diameter than the nominal bolt diameter unless noted otherwise on the Drawings.

Where lengths of bolts, threaded rods and coach screws are given on the Drawings, it shall remain the responsibility of the Contractor to ensure that the lengths are adequate, due regard being given to all dimensional tolerance.

The length of each bolt shall be such that the threaded portion will project through the nut by at least one and one half complete threads.

8.3.3 Stainless Steel

Stainless steel shall conform to ASTM A240/240M. All structural stainless steel above the splash zone shall be minimum grade 316 or 2205 Duplex. Where stainless steel is to be welded the grade shall be 316L or Duplex.

All stainless steel components shall have finished surface roughness (Ra) of no more than 0.5 µm.

All stainless steel shall be passivated in accordance with Clause 8.4.2.

In any circumstance where stainless steel members or fixings are in contact with a dissimilar metal, the two dissimilar metals shall be electrically isolated from each other. Electrical isolation can be achieved by the use of non-conductive sleeves, washers, tape or coatings. Methods of electrical isolation not specified on Drawings must be approved by the Superintendent prior to installation.

8.4 Corrosion Protection

8.4.1 General

The contractor shall supply plant, labour, materials for supply and installation of all steel components with appropriate corrosion protection system requirements as outlined herein. Where a corrosion protection system has not been specified on Drawings, the Contractor shall seek confirmation of the appropriate system from the Superintendent.

Under no circumstances shall plain steel or untreated stainless steel be installed in the atmospheric environment.

8.4.2 Passivation of Stainless Steel Components

The Contractor shall provide all labour, tools, plant materials and everything necessary for the passivation of stainless steel items or welded areas on stainless steel.

Cleaning and passivation shall be carried out before installation to ensure that the protective chromium oxide film is fully effective.

Bolts, nuts and washers and other small items should be cleaned and passivated by an overnight soak in 15% dilute nitric acid followed by a thorough washing in fresh water.

Welded areas on fabricated stainless steel items shall be passivated by treating with "SANDVIK" Pickling Paste or approved equivalent used strictly in accordance with the manufacturer's printed directions.

Items too large to be treated using the 15% nitric acid soaking method outlined above should be treated using "SANDVIK" Pickling Paste or approved equivalent used strictly in accordance with the manufacturer's printed directions.

Passivation should take place outdoors or in a well ventilated room because of the risk of gas emission.

Persons working with nitric acid or pickling paste should be equipped with rubber gloves, rubber boots, rubber apron and a guard protecting the face.

8.5 Welding

8.5.1 General

All electrodes, welding techniques, procedures and personnel shall comply with the requirements of AS/NZS 4854, AS/NZS 4855, AS/NZS 4856 or AS/NZS 4857 and AS 1554 as appropriate.

All welding shall be in accordance with AS 1554 Part 1.

All welds shall be continuous type SP in accordance with AS 1554.

All stainless steel welds must be Category 1B, Grade II as defined in AS/NZS 1554.6, unless noted otherwise.

8.5.2 Worksmanship

The finished surface profile of all welding must be smooth and free from sharp edges, undercutting, defects, or any other discontinuities that would be detrimental to the performance of the structure or to the protective treatment. All slag and traces of weld splatter must be removed from the weld zone and weld surfaces must be replaced, repaired and ground as directed by the Superintendent.

A weld once started shall be completed without any interruption or delay. Structural protection shall be provided against adverse weather conditions and draughts during welding operations.

Particular care is to be taken to avoid distortion of welded sections and the cracking of welds where the geometry of the joint as well as the metal thickness may affect the cooling rate and tend to produce distortion.

Where any field welding is to be carried out care shall be taken to accurately align and handle the sections prior to and during welding.

All plates, gussets, steel members, etc, must have sharp edges and corners rounded and ground smooth to a radius of 2 mm. This is to ensure that the effectiveness of the corrosion protection coating is not reduced at edges, and is not required where such edges are subsequently to be welded.

The welding zone of all steelwork must be free of paint, rust, grease or any other deleterious matter prior to welding taking place.

All butt welds must be complete penetration continuous butt welds, Category SP (Structural Purpose) as defined in AS/NZS 1554.1, unless noted otherwise on the Drawings.

Butt welds designated on the Drawings as "Incomplete Penetration Butt Welds" must be qualified incomplete penetration butt welds to AS/NZS 1554.1, and must have full depth preparation unless noted otherwise on the Drawings.

All weld on splices must be prequalified SP full penetration butt welds.

If a weld is not shown on the Drawings, the weld must be a continuous SP 8 mm leg size fillet weld all round the mating surfaces. Fillet welds smaller than 8 mm will not be permitted, unless otherwise shown on the Drawings or approved by the Superintendent.

All unqualified tack welds must be completely removed prior to welding. Where qualified tack welds are to be incorporated into a final weld made by a different process to that used for the tack weld, consumables of equivalent strength must be used for both processes and the tack welders to be qualified to the satisfaction of the Superintendent.

Any welds which are defective or unsound shall be removed, replaced or otherwise corrected in accordance with Clause 5.8 of AS 1554 Part 1.

Arc craters must be filled unless being incorporated into the next weld.

8.5.3 Electrodes

Welding electrodes must conform to the welding process being used. The nominal tensile strength of the weld metal must be greater than or equal to the tensile strength of the steel parts being joined.

E48XX or W50X electrodes must be used to weld up to Grade 350 steelwork.

E55XX electrodes must be used for welding Grade 450 steelwork.

Hydrogen controlled electrodes are mandatory for all welding. All welding consumables employed for the works must be supplied with batch certificates.

Electrodes or filler wire that has been wet must not be used, whether re-dried or not.

Welding flux that has become damp or has had part of the flux covering broken away or damaged must not be dried or reused. Flux fused in the welding process must not be ground or reused. Flux must be dry and free of contamination from dirt, mill scale, rust or other foreign material.

Electrode wire must be clean and free from rust, oil, grease and any other deleterious substances.

Electrode wire and flux must be stored in their original containers or other properly identified containers in a dry and weatherproof location.

Tack welds must be made with the same type of electrode that is used for depositing the root pass.

8.5.4 Testing

Testing shall be undertaken in accordance with the requirements outlined in AS 1554. Weld testing must be carried out using radiographic, ultrasonic or other means.

The first test on each weld will be carried out at the Contractor’s expense. Any further testing required as a result of the discovery of a defective weld shall be carried out at the Contractor's expense.

Radiographic testing of welds shall comply with AS 2177 Part 1, "Radiography of Welded Butt Joints in Metal - Methods of Test". Ultrasonic testing of welds shall comply with AS 2207, "Methods for the Ultrasonic Testing of Fusion Welded Joints in Steels".

8.5.5 Personnel

All welders must be qualified to AS 2980, AS/NZS 1554 or AS 1796. The Superintendent may at short notice request to inspect the welding certificate for any welder and/or to witness the welding of a test piece by the welder. If a welder's certificate is not available, the Superintendent may require a welding test to be performed. The cost of such testing shall be met by the Contractor. Welders who have failed a repeat acceptance test shall not be permitted to weld.

All welding must be supervised by personnel who have had suitable training and are adequately experienced in the fabrication of welded structures. These welding supervisors must satisfy the requirements set out in AS/NZS 1554, AS 1796 and AS 2214.

The Contractor must appoint a welding inspector to test welds in accordance with the requirements of this Specification, and to ensure that all welds and the welding workshop, equipment, and personnel meet all Australian Standards. The cost for this shall be met by the Contractor. Welding inspectors must be

qualified to levels specified in AS 1796 and AS 2214, be from an independent NATA registered testing authority, and be approved by the Superintendent.

9 STONEWORK

9.1 Scope of Work

The stonework shall include:

(i) supply to the Site and stockpile new sandstone blocks for wall face. Recycled sandstone blocks shall not be used in the wall face

(ii) cut, trim and dress for use in the Works as required new sandstone blocks for wall face, and stockpiled recycled blocks for use in the back of wall

(iii) lay and fix all sandstone blocks including mortaring, grouting, pointing to joints, stone trimming for insertion of drainage elements as the like, and final cleaning of the seawall face

The extent of stonework shall be as shown on the Drawings and described in the Technical Specification.

The Contractor shall provide materials, masons and labourers, and all necessary tools and equipment, to cut, trim, dress, lay, fix and clean the sandstone as is required to complete all the work in a workmanlike manner.

9.2 Standards

Stonework shall comply with the following Standards except where noted otherwise or not relevant:

AS 3700 Masonry in buildings (SAA Masonry Code)

9.3 Sandstone Material Acceptance

9.3.1 Sandstone Acceptance Properties

All new sandstone supplied to the Site for construction of the face of the seawall shall be fresh or only slightly weathered, non-friable, and free from cracks, cleavage planes, seams, cross-laminations, shale lenses, sand balls, carbonate concretions and other defects which could contribute to the accelerated breakdown of the stone at an exposed estuarine site.

In addition, the sandstone comprising the masonry units shall have:

(i) minimum dry density of 2,250 kg/m^3;
(ii) saturated point load strength index *(Is50)* greater than 1.5 MPa;
(iii) sodium soundness weight loss less than 9 %;
(iv) clay minerals less than 15%.

9.3.2 Information to be Supplied

At least fourteen (14) days prior to supply of any sandstone blocks, the Contractor shall provide documentation to the Superintendent that demonstrates that the blocks to be supplied comply with the requirements of the Specification. The documentation to be provided shall include:

(i) details of the quarry from which the blocks are to be supplied, including identification of the sections of the quarry where the sandstone complies with the Specification;

(ii) a test report from a NATA registered testing authority on the physical and chemical properties of the blocks to be supplied. The report shall include the results of laboratory testing; and

(iii) details of the Contractor's quality control procedures which will ensure that the quality of the blocks supplied during the Contract will meet the requirements of the Specification.

If the above information supplied to the Superintendent does not comply with the requirements of the Specification, the sandstone material shall be rejected, and the Contractor will need to establish a new source which does comply.

9.3.3 Varying of the Source of Sandstone Blocks

If the Contractor wishes to vary the source of the sandstone blocks supplied, either from within the approved quarry or by changing quarries, the Contractor shall submit additional documentation as listed above to the Superintendent that demonstrates that the blocks from the new source comply with the requirements of the Specification.

9.4 Temporary Storage of Sandstone Blocks

All new blocks supplied to site for construction of the seawall face shall be stored neatly and laid on their bedding planes and on supports of adequate area such as not to overstress the stone. Storage shall promote good seasoning without staining, contamination, marking or damage.

Defective stone arising from inadequate storage shall be rejected.

9.5 Sandstone Blockwork

9.5.1 General

The Contractor shall be responsible for keeping all sandstone blocks undamaged during construction.

Unless noted otherwise on the Drawings, all stonework shall be constructed to the various forms and dimensions of the original and adjoining stonework and shall be carried up plumb to existing lines and to match the existing finishes.

The fixing of all stonework shall be carried out under the supervision of an experienced and competent mason. All onsite adjustment to stone joints or surfaces shall be carried out by a mason.

All site adjustment of stonework shall be the Contractor's responsibility. Broken, chipped or stained stone shall be rejected.

9.5.2 Face Finish

Finish of sandstone shall be “rock faced”, unless otherwise directed by the Superintendent.

9.5.3 Information to be Supplied

The following shall be advised to the Superintendent in writing before fixing of blockwork commences:

(i) mortar mix including sand type complete with grading; and
(ii) non-shrink grout name and manufacturer’s details.

9.5.4 Sample

At least three (3) days prior to the fixing of any repaired stonework, the Contractor shall prepare the following for approval by the Superintendent:

(i) a finished sample block; and
(ii) a mortar sample.

9.5.5 Workmanship

General

Perform the necessary cutting and shaping of stone to profiles as necessary to form replacement stones, making allowance for weathering, jointing, picking, rock facing, dressing, fixing and the like.

All stones shall be correctly and accurately fixed in level, plumb and square in courses on their natural quarry bed. Stonework tolerances are shown on the Drawings.

Work the bed planes to a sufficiently smooth surface without high or low spots to permit installation without undue strain on either the laid stone, or adjacent stronger or weaker stones.

The stone at the wall face shall be worked to match the adjoining stones with a “rock face” matching the existing masonry.

Matching Stonework at Ends of Repair

Where new stonework joins existing stonework, carefully cut out existing fretted stonework or cemented zones until competent stone is attained. Grind back, chip or otherwise remove the cement or fretted stone to the depth of the repair only where replacement stone is to be provided.

Rectify damage to adjacent stones not required to be removed to the satisfaction of the Superintendent. Where adjacent stone is decayed, notify the Superintendent before any work proceeds. Allow to make good the adjacent stone.

9.5.6 Fixing Stonework with Mortar and Grout

Fixing shall comprise mortaring the stone blocks in place followed by grouting to fill joints as required to achieve competent stonework. During fixing of the stone, no mortar or grout shall come into contact with the face of the stone.

Mortars shall be softer and more porous than the adjoining stones.

9.6 Cleaning

During fixing of stonework, use a dry brush to remove excess or dripped mortar from the face of the wall.

As a final clean down, use a detergent masonry cleaner. Do not use acid or abrasives.

9.7 Hold Points

The Contractor shall hold the works for inspection by the Superintendent as specified herein and including following hold points:

- Concrete foundation
- Placement of geofabric
- Completed sandstone block placement (or each course of sandstone blocks) prior to placement of engineered fill.

10 SUBSOIL DRAINAGE

10.1 Scope

The drainage work shall include:

i. supply and install panel drains;
ii. supply and place geotextile filter; and,
iii. wrap ends of panel drains in geofabric.

The extent of drainage work shall be as shown on the Drawings and described in the Technical Specification.

The Contractor shall provide materials, plumbers and labourers, and all necessary tools and equipment to complete all the drainage work in a workmanlike manner.

10.2 Materials

10.2.1 Panel Drain

Panel drains shall be Megaflo 450 supplied by Geofabrics Australasia Pty Ltd unless and alternate product is shown on the Drawings. An equivalent product and/or supplier may be approved by the Superintendent.

10.2.2 Geotextile

Geotextile shall be Texcel 400R supplied by Geofabrics Australasia Pty Ltd. An equivalent staple fibre non-woven fabric product and/or supplier may be approved by the Superintendent.

10.3 Installation

10.3.1 Panel Drain

Panel drains shall be laid on a bed of mortar at the prepend of sandstone blocks at the locations shown on the Drawings. The landside free end of the panel drain shall be securely wrapped in geotextile to prevent the loss of back fill material. Care shall be taken during placement of drainage material and backfill material to ensure the panel drains are not damaged. The Contractor shall remove and replace damaged drains at no expense to the Principal.

10.3.2 Geotextile

Geotextile shall be installed as per the manufacturer's recommendations. The placement of geotextile filter shall satisfy the criteria below:

- Ground Preparation – sharp edged rocks, stumps and the like are to be removed prior to laying of the geotextile;
- Placement – where practical, geotextile filter shall be unrolled across the prepared surface. Geotextile filter shall not be dragged across rough surfaces;
- Joining of Fabric Elements – fabric elements may be joined by either overlapping or sewing. Overlap widths shall be no less than 0.5 m with the direction of overlap taking into account the

overburden material supply direction. For sewing assembly 0.1 m overlap is sufficient to ensure continuity;
- Laying in Water – rapid immersion requires ballasting of fabric; and,
- Covering – the geotextile filter shall be covered as soon as practical. Geotextile filter shall not be left exposed for more than 14 days.

If the geotextile filter is damaged during placement, the Contractor shall remove and replace the damaged filter at the Contractor's expense.

Care shall be taken during placement of drainage material, fill material and compaction to ensure the geotextile material is not damaged.

11 Stormwater Outlets

11.1 Scope

The section of the Specification sets out requirements for stormwater outlet extensions associated with construction of the new foreshore protection works. Specific works covered under this Specification include supply and installation of the following as shown on the Drawings:

All pipe extensions shall be HDPE pipe manufactured in accordance with the requirements of AS/NZS 4130:2009 - Polyethylene (PE) pipes for pressure applications and installed in accordance with AS/NZS 2033:2008 – Installation of polyethylene pipe system.

11.2 Temporary Works and Protection

The Contractor shall make adequate provision for runoff flows at drainage works under construction to avoid damage or nuisance due to scour, sedimentation, soil erosion, flooding, diversion of flow, damming, undermining, seepage, slumping or other adverse effects to the Works or surrounding areas and structures as a result of the Contractor's activities.

The Contractor shall not implement any proposals to dam up or divert existing watercourses (either temporarily or permanently) without the prior written approval of the Superintendent.

The Contractor's material and equipment shall be located clear of watercourses or secured so that they will not cause danger or damage in the event of large runoff flows.

11.3 Siting of Pipe Outlets

Before commencing the reconstruction of a pipe outlet, the Contractor shall set out on site the pipe position to the location and levels shown on the Drawings, and shall present this set-out for inspection by the Superintendent.

11.4 Quality, Type and Minimum Size of Pipes

All drainage pipes shall be polyethylene. The pipe grade shall be PE100. The maximum Standard Dimension Ratio (SDR) shall be 13.6. The pipe extension shall match the existing diameter.

11.5 Bedding and Pipe Installation

Bedding and pipe installation shall comply with the manufacturer’s reference manual and directions.

No bedding material shall be placed until the foundations have been inspected and approved by the Superintendent.

Unless an alternate arrangement is shown on the Drawings, a continuous cushion of sand 75 mm thick shall be provided as bedding.

11.6 Backfilling and Compaction for Stormwater Outlet Structures

Refer Clause DEMOLITON AND EARTHWORKS, BACKFILLING AND COMPACTION FOR STORMWATER DRAINAGE STRUCTURES.

11.7 Jointing of Pipes

Flexseal EPDM Extra Wide Flexible Couplings or an approved equivalent shall be used to form connections between existing pipework and polyethylene pipe extensions.

12 Rock Work

12.1 Scope

The rock work shall comprise:

- supply and install geotextile filter;
- supply and place acceptable sandstone rocks.

Rock work excludes demolition, excavation and filling which are scoped in Clauses DEMOLITION AND EARTHWORKS.

The extent of the rock work is shown on the Drawings.

12.2 Geotextile Filter

12.2.1 Acceptance

The approved type and grade of the geotextile filter shall be Texcel 600R, or an approved equivalent, as shown on the Drawings.

12.2.2 Storage and Installation

On site storage and handling of the geotextile shall comply with manufacturer/supplier's recommendations. Preparation of subgrades for covering by the geotextile, and laying of the geotextile shall satisfy the following:

(i) Ground Preparation – sharp edged rocks, stumps and the like are to be removed prior to laying of the geotextile;

(ii) Placement – where practical, geotextile filter shall be unrolled across the prepared surface. Geotextile filter shall not be dragged across rough surfaces;

(iii) Joining of Fabric Elements – fabric elements may be joined by either overlapping or sewing. Overlap widths shall be no less than 0.5 m with the direction of overlap taking into account the overburden material supply direction. For sewing assembly 0.1 m overlap is sufficient to ensure continuity;

(iv) Laying in Water – rapid immersion requires ballasting of fabric; and,

(v) Covering – the geotextile filter shall be covered as soon as practical. Geotextile filter shall not be left exposed for more than 14 days

If the geotextile filter is damaged during placement, the Contractor shall remove and replace the damaged filter at the Contractor's expense.

12.3 Basalt Rock Material Acceptance

12.3.1 Rock Acceptance Properties

All new rock supplied to the site for construction of the rock work shall be fresh or only slightly weathered basalt, non-friable, and free from cracks, cleavage planes, seams, cross-laminations, shale lenses, sand balls, carbonate concretions and other defects which could contribute to the accelerated breakdown of the stone at a coastal site.

The rock used to construct the rock work shall comply with the following:

1) rock shall have a minimum dry density (AS 1141.6.1) of 2,500 kg/m^3 and the water absorption shall be less than 1.5%;
2) rock shall be rough and angular;
3) the ratio of the maximum dimension of any rock to the minimum dimension, measured at right angles to the maximum dimension, shall not exceed 2.5;
4) rock shall have a point load strength index (I_{s50}) (AS 4133.4.1) no less than 2 MPa;
5) rock shall exhibit a maximum sodium sulfate weight loss (AS 1141.24) of 9%; and,
6) individual rocks shall be hard, durable and clean and should be free from cracks, cleavage planes, joints, seams, chemical alteration or weathering and other defects which can result in the breakdown of the rock in the marine environment.

12.3.2 Rock Mass and Sizes

The armour and underlayer shall satisfy all of the rock mass criteria summarised in **Table 1**.

Table 1: Armour and Underlayer Rock Sizes

Component	Median Mass (M_{50}) [1]	Minimum Mass	Maximum Mass	Approximate Diameter [2]
Rip Rap	53 kg	20 kg	210 kg	0.15 to 0.5 m

Note:
1. 50% of the rock on the cumulative mass distribution curve shall exceed the median mass. This requirement will be satisfied if 50% of the units exceed the median mass.
2. The approximate diameter is based on size by sieve or grizzly.

12.3.3 Information to be Supplied

At least seven (7) days prior to supply of any rock, the Contractor shall provide documentation to the Superintendent for approval that demonstrates that the rock to be supplied complies with the requirements of the Specification. The documentation to be provided shall include:

(i) details of the quarry from which the rock is to be supplied, including identification of the sections of the quarry where rock complies with the requirements of the Specification;

(ii) a test report from a NATA registered Independent Testing Authority on the physical and chemical properties of the rock to be supplied. The report shall include the results of laboratory testing of the rock; and

(iii) details of the Contractor's quality control procedures, to assist the Superintendent establish that the quality of rock supplied during the Contract complies with the Specification.

If the above information, supplied to the Superintendent, does not comply with the requirements of the Specification, the rock shall be rejected and the Contractor shall need to establish a new source which does comply.

12.3.4 Varying the Source of Rock

If the Contractor seeks to vary the source of rock, the Contractor shall submit to the Superintendent for approval additional documentation as listed above that demonstrates that the rock from the new source complies with the requirements of the Specification.

12.3.5 Supply and Stockpiling of Rock

No rock shall be delivered to the site without written authorisation from the Superintendent following its consideration of documentation on the quarry source, rock properties and the Contractor's quality control procedures.

The Contractor shall maintain a daily log of imported rock delivered to the site. The log shall record the registration of each supply truck, its date and time of arrival on the site, the rock supply docket number issued by the quarry pertaining to the delivery, and a signature by a representative of the Contractor to verify the information.

During the course of construction of the rock work, the Contractor shall provide to the Superintendent each week a copy of the completed daily rock supply log and the original supply dockets relating to work undertaken in the previous week. The supply dockets shall include a record of loaded truck mass.

Stockpiling of rock on the site shall be limited to the minimum extent practicable for continuity of the Works.

12.3.6 Reuse of Rocks from the Site

Rocks sourced from excavation and demolition work on the site and which comply with the rock mass and size requirements, will be approved for reuse in the rock work (refer Clauses EARTHWORKS AND DEMOLITION).

12.4 Rock Works

12.4.1 Design Profiles

The Rock Works shall be constructed in the location shown and to the levels, widths and side slopes indicated on the Drawings.

Where transitions or variations in slope, level or geometry are shown on the Drawings, they shall be smooth and linear over the length of the transition with no abrupt changes in the outer surface of the rock structure.

The Contractor is responsible for providing stable rock placement batters with slope not exceeding 1:1.5 (vertical:horizontal) for all Rock Works.

12.4.2 Preparation of Bed Profile

The Contractor shall prepare the bed profile along the alignment of the Rock Works in accordance with the levels and side slopes shown on the Drawings.

Consideration will be given to the alteration of the excavation side slopes if the Contractor can show that the altered slope is stable and will not unduly affect the stability of the Rock Works in its completed state or at any stage of construction.

If the excavation levels shown on the Drawings cannot be achieved, the Superintendent shall be advised immediately. The Superintendent may direct placement of additional rock at the toe of the structure.

12.4.3 Placement of Rock

The Rock Works shall be placed to satisfy the following:

- rock shall be placed to minimise its breakdown on handling, production of fines and water contamination;
- rock shall be placed to achieve an even distribution of rock sizes without concentrations of smaller rock;
- the finished slope shall be no steeper than the slope specified in the Drawings;
- the requirement for 'standard placement' shall be achieved by individually placing rock armour to achieve a fully interlocked armoured layer with each rock having at least three points of contact with other rocks in the same layer. Rocks shall be wedged and locked together such that they cannot be moved without disturbing adjacent rocks;
- placement of rock shall commence at the toe and proceed upwards towards the crest;
- there shall be no free rocks on the surface of the armour layer. Pieces of armourstone broken during handling or placing shall be removed immediately at the Contractor's expense; and,
- surface of the armoured slope shall present an angular uneven face to the water. Armour rock smaller than the specified mass grading shall not be used to fill voids or to prop larger armour units in order to achieve the required profile.

Access shall be provided to all parts of the structure for the Superintendent to carry out inspections at any time throughout the duration of the Works.

12.4.4 Disposal of Unsuitable Material

The Contractor shall be responsible for removal from the site of all surplus material, rubbish, debris and material unsuitable for inclusion in the works. The material shall be disposed of at an approved and suitably licensed location.

12.5 Settlement

The Contractor shall make good any part of the Works that has been subject to any settlement within the structure that is beyond the specified structure tolerance and that may occur during the defects liability period. Making good of settlement shall be with materials and in a manner approved by the Superintendent.

12.6 Hold Points

The Contractor shall hold the works for inspection by the Superintendent as specified herein and including following hold points:

- Rock on site, prior to placement
- Excavation for placement of the rock toe
- Placement of geofabric
- Completed rock placement, including toe, prior to back fill around the toe.

13 CONSTRUCTION TOLERANCE

All construction tolerances shall be as per below.

13.1 Sandstone Block Tolerance

Sandstone block dimensions shall be 500mm ± 15 mm unless noted otherwise on the Drawings.

Elevation of top of individual courses to exhibit no obvious discontinuities.

Crest elevation of the seawall shall be RL 2.0 +40/-10mm unless specified otherwise by the Superintendent.

Risers and goings of the stairs shall be uniform with a tolerance of ± 5mm.

Change in height between adjacent stair blocks along a course shall be 3mm.

Thickness of mortar joint at wall face shall be 20mm +15/-10mm unless noted otherwise on the Drawings. The mortar joints at prepends where drainage is specified shall accommodate Megaflo panel drains.

13.2 Construction Tolerances

The construction tolerances for the Rock Works shall be as follows:

- ± 200 mm from the vertical and horizontal position of the armour rock shown on the Drawings.

Notwithstanding the above tolerances, the following criteria shall apply:

1. the mean actual vertical tolerance of a profile shall not be negative; and,
2. the thickness of the armour layer at all locations shall not be less than 80% of the nominal thickness shown on the Drawings.

Surveyed Rock Work profiles that exceed the tolerances specified herein may be accepted at the discretion of the Superintendent. Notwithstanding acceptance of non-conforming works, the Contractor will not be paid for supply and placement of any rock placed outside the construction tolerances specified herein.

13.3 Reinstatement of Reserve

All new and repaired turfed surfaces shall be suitably graded so as not to allow water to pond. The finished surface shall be evenly graded towards the seawall with no obvious mounds.

14 REINSTATEMENT, SITE DISESTABLISHMENT AND CLEANUP

14.1 Reinstatement

Except to the extent that the Site has been repaired and upgraded in accordance with the Works, the Contractor shall reinstate to its pre-construction condition all areas disturbed and any structures damaged during the course of the Works.

The photographic record of the pre-construction condition of the Site as recorded in the pre-construction condition assessment shall be used by the Superintendent in assessing the acceptability of any reinstated areas at the completion of the Works. A post-construction condition assessment shall be completed by the Contractor and submitted to the Superintendent prior to Practical Completion.

All vegetated areas disturbed by the Works shall be restored with appropriate grass species, approved by the Superintendent. Suitable turf shall be sourced and installed as per the supplier's recommendations. Turf shall be free of weeds or deleterious material.

14.2 Disestablishment

Upon completion of the Works, the Contractor shall clear the Site of all surplus materials, plant, fencing, Site shed, notice boards and the like, to the satisfaction of the Superintendent.

14.3 Cleanup

The Contractor shall be responsible for the removal and lawful disposal off site of all surplus spoil, rubbish or excess material, and for the final cleaning up of all areas covered by the Contract which shall be left clean and tidy up on completion of the Contract.

14.4 Manufacturer's Data Report

The Contractor shall compile a Manufacturer's Data Report in accordance with the Project Management Plan and provide two copies to the Superintendent. At a minimum, the Manufacturers Data Report shall include:

- Completed copy of all registers and other items required under the Project Management Plan;
- Monthly project reports;
- Material certificates and test reports;
- Survey reports and any other measurement certificates; and,
- Signed and completed Inspection and Test Plans.

Appendix A: Drawings

Appendix B: Geotechnical Investigation and Acid Sulfate Soils Assessment (JK Geotehnics and JK Environments, 2019)

Appendix C – Rip Road Design Report

Appendix D - Terrestrial Survey (Stephen Thorne and Associates)