City of Nedlands

Agenda

Sustainable Nedlands Committee Meeting

7 August 2017

ATTENTION

This Agenda has yet to be dealt with by the Committee.

The Administration Recommendations, shown at the beginning of each item, have yet to be considered by the Committee and are not to be interpreted as being the position of either the Committee or Council.

The Minutes of the meeting held to discuss this Agenda should be read to ascertain the decision of the Committee.

Before acting on any recommendation of the Committee a check must also be made in the Ordinary Council Minutes following the Committee Meeting to ensure that Council did not make a decision at variance to the Committee Recommendation.

Pollyanne Fisher
Policy & Projects Officer
4 August 2017

Table of Contents

City of Nedlands

Notice of a meeting of the Sustainable Nedlands Committee to be held in the Chambers, 71 Stirling Highway, Nedlands on Monday, 7 August 2017 at 5.00 pm.

Sustainable Nedlands Committee Agenda

Declaration of Opening

The Presiding Member will declare the meeting open at 5.00 pm and will draw attention to the disclaimer below.

(NOTE: Council at its meeting on 24 August 2004 resolved that should the meeting time reach 11.00 p.m. the meeting is to consider an adjournment motion to reconvene the next day).

Present and Apologies and Leave Of Absence (Previously Approved)

Councillors	His Worship the Mayor, R M Hipkins	
	Councillor N Shaw	(Presiding Member)
	Councillor R Binks	
Committee Members	Ms B Channon	
	Ms B Tyson	
	Mr G Davies	
	Mr E O'Loughlin	
	Mr A Mangano	
	Ms D Rees	
Staff	Ms P Fisher	Policy and Projects Officer
Leave of Absence (Previously Approved)		
Apologies	Mr R Griffiths	

Disclaimer

Members of the public who attend Council meetings should not act immediately on anything they hear at the meetings, without first seeking clarification of Council's position. For example by reference to the confirmed Minutes of Council meeting. Members of the public are also advised to wait for written advice from the Council prior to taking action on any matter that they may have before Council.

1. Public Question Time

A member of the public wishing to ask a question should register that interest by notification in writing to the CEO in advance, setting out the text or substance of the question. Questions tabled at the meeting may be unable to be answered due to the requirement for technical research and will therefore be answered direct afterwards.

Questions must relate to a matter contained within the agenda of this meeting.

2. Addresses By Members of the Public (only for items listed on the agenda)

Addresses by members of the public who have completed Public Address Session Forms will be invited to be made at this point.

3. Disclosures of Financial Interest

The Presiding Member to remind Councillors and Staff of the requirements of Section 5.65 of the *Local Government Act* to disclose any interest during the meeting when the matter is discussed.

A declaration under this section requires that the nature of the interest must be disclosed. Consequently a member who has made a declaration must not preside, participate in, or be present during any discussion or decision making procedure relating to the matter the subject of the declaration.

However, other members may allow participation of the declarant if the member further discloses the extent of the interest. Any such declarant who wishes to participate in the meeting on the matter, shall leave the meeting, after making their declaration and request to participate, while other members consider and decide upon whether the interest is trivial or insignificant or is common to a significant number of electors or ratepayers.

4. Disclosures of Interests Affecting Impartiality

The Presiding Member to remind Councillors and Staff of the requirements of Council's Code of Conduct in accordance with Section 5.103 of the *Local Government Act*.

Councillors and staff are required, in addition to declaring any financial interests to declare any interest that may affect their impartiality in considering a matter. This declaration does not restrict any right to participate in or be present during the decision-making procedure.

The following pro forma declaration is provided to assist in making the disclosure.

"With regard to …… the matter in item x….. I disclose that I have an association with the applicant (or person seeking a decision). As a consequence, there may be a perception that my impartiality on the matter may be affected. I declare that I will consider this matter on its merits and vote accordingly."

The member or employee is encouraged to disclose the nature of the association.

5. Declarations by Members That They Have Not Given Due Consideration to Papers

Members who have not read the business papers to make declarations at this point.

6. Confirmation of Minutes

6.1 Sustainable Nedlands Committee Meeting 12 June 2017

The minutes of the Sustainable Nedlands Committee held 12 June 2017 are to be confirmed.

7. Items for Discussion

Note: Regulation 11(da) of the *Local Government (Administration) Regulations 1996* requires written reasons for each decision made at the meeting that is significantly different from the relevant written recommendation of a committee or an employee as defined in section 5.70, but not a decision to only note the matter or to return the recommendation for further consideration.

7.1 Underground Power

Item submitted by Mr A Mangano. Underground power, next stage(s) and why they are justified.

7.2 Tree Planting Allen Park

Item submitted by Mr E O'Loughlin.

Attachments

1. Tree Planting – Allen Park

7.3 Allen Park Planning

Item submitted by Mr E O'Loughlin.

Attachments

1. Allen Park Planning

7.4 Enviro-scape Plan for Carrington Park

Item submitted by Director Technical Services, Mr M Glover.

A proposed enviro-scape plan for Carrington Park has been released for Community comment.

Attachments

1. Carrington Park Enviro-scape Master Plan Brochure

7.5 Nedlands Foreshore Conservation

Item submitted by Director Technical Services, Mr M Glover.

Introduction

In March 2004, the City of Nedlands community were invited to comment on the Nedlands Foreshore Enhancement and Management document prepared by Consultant's Belford – Taylforth. The document included 56 recommendations with respect to the conservation management of the Nedlands foreshore. The final document including all 56 recommendations was adopted by Council in November 2004.

Bushland Management

Later in 2004, the City adopted the Nedlands Foreshore Bushland Reserves Management Plan 2004 – 2009 prepared by consultant's Ecoscape (Australia) Pty Ltd. The objectives of the plan were to:

- Identify management priorities and funding opportunities;
- Involve the community in consultation;
- Identify areas of conservation, habitat, recreational, cultural and heritage significance; and
- Make recommendations for the conservation and enhancement of the remnant native vegetation.

In 2013 the management plan was replaced with three separate documents:

- Natural Areas Management Plan 2013 – 2018.
- Birdwood Parade Management Plan 2013 – 2018.
- Point Resolution Management Plan 2013 – 2018.

These documents have formed the basis of the City's conservation operations since 2013 included in both the operational and capital works budgets.

In 2016 the City commenced its Enviro-scape Master Planning (EMP) process. This process is based on strategic operations which considers all aspects related to an area/park/reserve including access (all abilities, vehicles, pedestrians); amenity (shade, parking, views); environment (water conservation, vegetation preservation, climate change) and fit for purpose (casual users, sporting groups, environmental groups). The EMP for Point Resolution Reserve will be open to public consultation within the next four weeks.

River Wall

The City commenced replacing the river wall commencing from a point west of Beaton Park in 2016. It is anticipated the City will complete the entire river wall through to Broadway carpark by 2025/26. The new design river wall consists of rock revetments, pocket beaches and rock groynes backed by a riparian vegetated strip and a dual use pathway. The first stage at 100m of rock revetment is complete (see photograph below) and the second stage at 200m of rock revetment through to the Perth Flying Squadron Yacht Club will commence in January 2018 (see attached report).

Stages 3 and 4 are currently in the planning stage and the City is seeking funding for construction in 2019/20 through to 2022/23 (see attached concept plans).

Attachments

1. Paul Hasluck Pocket Beaches Option 1;
2. Paul Hasluck Pocket Beaches between FSYC and NYC Option 2; and
3. Nedlands Stage 2 Riverwall Upgrade Technical Specification.

7.6 Light Emitting Diode (LED) Street Lighting and Smart Control

Item submitted by Director Technical Services, Mr M Glover.

Introduction

It was resolved at the Ordinary meeting of 25 July 2017 that Council:

2. *Confirms that all new street light networks associated with underground power are to be LED with the options to have smart control and to be owned and maintained by the City of Nedlands.*

Wikipedia describes a Smart City as "*an urban development vision to integrate information and communication technology (ICT) and Internet of things (IoT) technology in a secure fashion to manage a city's assets."*

The City of Nedlands has progressively been embracing Smart City technology to improve services to our residents and ratepayers. Examples of this include transition to the Cloud and centrally controlled irrigation systems. The introduction of a smart controlled and LED streetlight network will take the City to the next level.

Currently the City budgets $500k for operating the Western Power streetlight network plus 106 City owned streetlights (total 2305 streetlights). Assuming the Council supports the new underground power delivery model to complete the rest of the City and the Council decides to own and operate the entire streetlight network; the eventual cost to operate and maintain the network including smart control ($23k per annum) and appropriate asset replacement (luminaire at 20 years and pole at 40 years) would be in order of $285k per annum.

The potential benefits could include:

- 70 percent reduction in energy consumption;
- Well maintained street environment at night (safety and security);
- Ability to adjust the streetlights to suit the seasons or occasions;
- No light pollution into the night sky or onto private property;
- Ability to react to technology improvements; and
- Approximate 43 percent reduction in streetlight costs.

LED Street lighting

In March 2017, the Mayor, Max Hipkins and the Director Technical Services attended the 3rd International Street Lighting and Smart Controls Conference in Brisbane to gather information on the potential inclusion of LED street lighting in underground power programs. The learnings from the Conference that relate to street lighting projects include:

- LED lighting includes ability to meter power.
- Local Governments are taking back ownership of underground street light networks in Australia and internationally.
- The Western Power LED tariff costs $0.28 per day and the cost of power within it is approximately $0.07. Therefore, metered supply could provide a significant saving.
- A LED luminaire has an average dusk to dawn life of approximately 20 years.
- LED luminaires have demonstrated a maximum 0.7% failure rate at installation.
- Associated maintenance schedules have been reduced by up to 85%.
- LED luminaires do not require additional poles where existing network designs meet AS1158.
- LED luminaires do not produce unwanted light spill.
- LED luminaires can be retro-fitted to existing poles without any structural or cabling change.

Smart Control

Smart control provides the City with remote access and advanced functionality, including the ability to dim street lights and control their runtime by scheduling them to switch on/off as conditions (such as shorter/longer days) warrant. This network-based control may yield an additional 10 to 20 percent energy savings beyond just LED replacement, along with greater operations and management savings.

In addition, smart controlled streetlights provide continuous, accurate status information, including location, metering and diagnostics which enables the City to identify the specific streetlight, level of performance and cause of outage immediately. Due to their longer life and automated outage detection, smart controlled LED luminaires can eliminate up to 90 percent of site visits and reduce repair and maintenance costs through more precise maintenance crew coordination.

Should the City utilise smart control for the streetlight network, it can also consider more advanced communications and management tools including audio and video applications.

There are two general technologies to provide smart control within a streetlight network and these are:

- Radio Frequency (RF) wireless system where the contractor provides RF interconnected streetlight fittings which communicate with a central node that then connects by 3G to the control software. It would require two of these central nodes to service the City of Nedlands. Silver Spring Networks, Telensa and Mayflower are recognised contractors using this technology which is utilised internationally however it suits larger networks due to the cost of the central nodes.
- Mobile 3G network utilises soft sim cards in each streetlight fitting which connects to the software through the 3G network (same as a phone). It

does not require any further device for communication to the control software and can be applied to large (10,000 streetlights) or small (1 streetlight) projects and is therefore the preferred method for applying smart control. The Philips City Touch system provides a Photo Electric (PE) Cell, dimmer control, electronic metering, GPS and basic diagnostics in the single luminaire basic fitting.

Both technologies are contracted by subscription via the Cloud.

Nedlands (West Hollywood) Underground Power Project

The City is currently negotiating with Western Power for the street lighting in the Nedlands (West Hollywood) Underground Power Project to be LED technology with smart controls and the system to be owned and maintained by the City of Nedlands.

This is the first step in the City of Nedlands being recognised as Western Australia's first Smart City.

8. Date of next meeting

The next meeting of this Committee is scheduled for Monday 2 October 2017 commencing at 5.00 pm.

Declaration of Closure

There being no further business, the Presiding Member will declare the meeting closed.

7.2 – Attachment 1 – Tree Planting Allen Park

TREE PLANTING -- ALLEN PARK

Background

1. Mayor Max Hipkins has circulated an item referring to proposed tree planting in the City of Stirling. This is in the context of reducing "urban heat" produced when trees have been removed from suburban lots to accommodate ever larger dwellings.

2. In 2017, SNC had several presentations on this matter which highlighted the heat- forming effects of excessive tree removal.

3. As with other Wards, Coastal Ward has experienced a loss of trees and plant matter on suburban lots to accommodate larger dwellings.

Recommendation

SNC RECOMMENDS that:

(1) Allen Park be designated as a hub for Coastal Ward to counter heat-forming in this zone; and
(2) A substantial and accelerated program of tree planting be implemented at Allen Park.

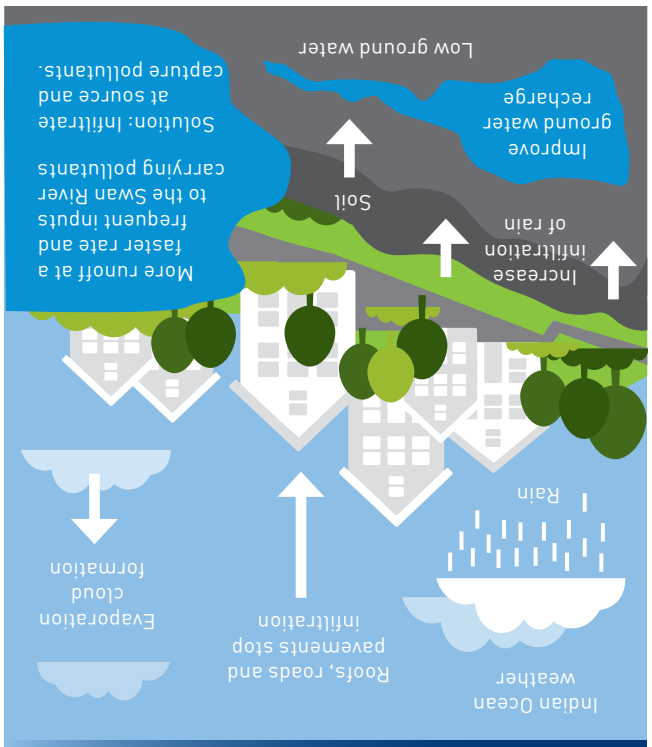
July 2017

7.3 – Attachment 1 – Allen Park Planning

ALLEN PARK PLANNING

Reason -- The Plan could have important sustainability implications for the Park which could be either positive or negative. SNC should be fully engaged in the planning process.

Recommendation -- That SNC be provided with a meaningful update of the planning process to date so that the Committee is fully informed and in a position to respond as necessary.



The enviro-scape plan will support the water cycle and the management of the ground water aquifers.

The boundary between watering and planting zones supports efficient water conservation practice.

How will the ground water aquifers work in the future?

The planning process also considers the management of ground water aquifers in terms of the total water cycle that includes storm water capture and infiltration into the aquifer, where it is stored, and eventual abstraction of the ground water for watering of parks.

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Carrington Park Enviro-scape Master Plan

What is Enviro-scape Master Planning?

Enviro-scape master planning is a strategic operational process that coordinates the future development of the City's park precincts.

It considers water quality and conservation (hydro-zoning, eco-zoning), the natural and built environment and climate change along with accessibility, amenity, community use and ensuring the park is fit for purpose.

The plan developed aims to ensure that community needs are served at the most economic whole-of-life cost.

What are the issues the master plan will address?

There are 67 parks in the City of Nedlands.
The enviro-scape plans to be prepared for each of these parks address the following issues:

Water use

The Department of Water and Environmental Regulation (DoWER) has capped the City's annual allocation of ground water used for irrigation at 709,300 kilolitres, based on 7,500 kilolitres per hectare of irrigated area per year.

There is a possibility the DoWER will reduce the allowance of water use to approximately 6,000 kilolitres per hectare, per year (equivalent to 2.4 Olympic-sized pools).

The City of Nedlands is a waterwise council.

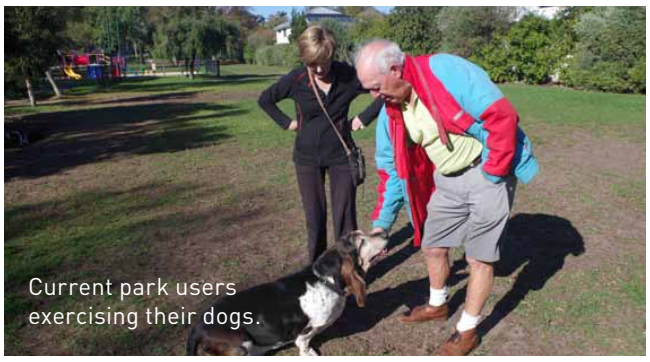
Climate Change

Continued climate change with increased temperatures and reducing rainfall, but increased intensity, requires a change of thinking in management practices.

An example of waterwise plants that require less water during the summer months.

Passive Recreation

An increase in demand and use for passive recreation requires the need to improve the management of passive turf surfaces within the dog exercise area to withstand deterioration in quality.



Current park users exercising their dogs.

Water Quality

The quality of the ground water is currently reduced due to the rain water being directed through the Karrakatta drainage system where the water finds its way into one large sump, instead of dispersing evenly across the superficial ground water aquifer. More direct infiltration into the aquifer will assist with improving ground water quality across the broader local area.

Vegetation

The planting of waterwise vegetation will support the reduction in ground water use that is likely to be imposed by Department of Water and Environmental Regulation in future years.

The enviro-scape plan will result in using less ground water for irrigation.

User Accessibility

Increased demand and a changing user profile requires a rethinking of accessibility within the park.

Pathways will be installed to link and separate eco-zoning and points-of-interest areas.

What is hydro-zoning and eco-zoning?

This process includes hydro-zoning, which is a water conservation practice that defines zones of use and plant types with differing watering requirements, and eco-zoning where the watering needs of plants are met by rainfall alone.

Carrington Park Enviro-scape Master Plan

Legend

- Extent of works
- Proposed contours
- Existing trees
- Proposed trees
- Existing notice board/shelter
- Limestone block wall
- Broom finished concrete
- Existing planting
- Existing turf
- Hydro-zone (long grass)
- Eco-zone (native planting)
- Coarse sand
- Underground drainage
- Sub-terranean infiltration
- Existing fence
- Proposed fence

Enviro-scape Master Plan proposed initiatives

Access

- New gates for dog users
- Pedestrian pathways to link points of interest and furniture
- Install pathways to separate turf areas from the eco-zoning areas
- Designs to meet accessibility requirements
- Investigate lighting perimeter paths

Amenity

- Seating placed in shade areas
- Plant more trees to increase shade
- Allow limited informal parking on the verge area at Weld Street
- Provide grassed areas with winter sun access

Environment

- Reconfigure reticulation for subterranean drainage infrastructure
- Develop hydro-zone and eco-zone areas
- Confirm potential for storm water capture and infiltration
- Establish tree mulch zones to support the health of existing trees
- New trees to be compatible with the dog exercise area

Fit for purpose

- Dog exercise area: plant resilient grass, install a sandpit, drinking water and dog waste bin system, and split the area between large and small dogs to discourage aggressive dog behaviour
- Playground: complies with accessibility requirements and maintain separation from dog area

What happens next?

The initiatives will be delivered over the long term. The following initiatives have been listed for the current and future Capital Works Program until 2018–19.

The Capital Works Program is reviewed on a yearly basis and, as part of this review, the priorities may change as a result of the condition and age of the assets changing.

The assets that require renewal will be replaced in accordance with this Enviro-Scape Master Plan.

The priorities for the coming financial years are:

2017–18 Capital Works Program

- Install subterranean storm water infiltration infrastructure
- Construct dog sand play swale
- Install internal paths
- Install new fence and gate to separate dog exercise areas
- Reconfigure irrigation system to accommodate new infrastructure

2018–19 Capital Works Program

- Renew section of existing perimeter fence
- Renew basketball backboard and hoop
- Replace existing entry gates with two-gated entrance configuration for dogs

How can I get involved?

Residents and park users are invited to provide feedback on the future upgrade and development of facilities at the park.

This area caters for a range of uses including dog exercise, children's playground and casual recreation.

The issues to be considered include the natural and built environment, water quality and conservation and climate change, along with accessibility, amenity, community use and ensuring the park is fit for purpose.

Information sessions on the proposed plan are scheduled for:

Thursday, 10 August 2017

From 4 pm to 6 pm
(sessions every half hour)

At the Hollywood–Subiaco Bowls Club, Smyth Road, Nedlands

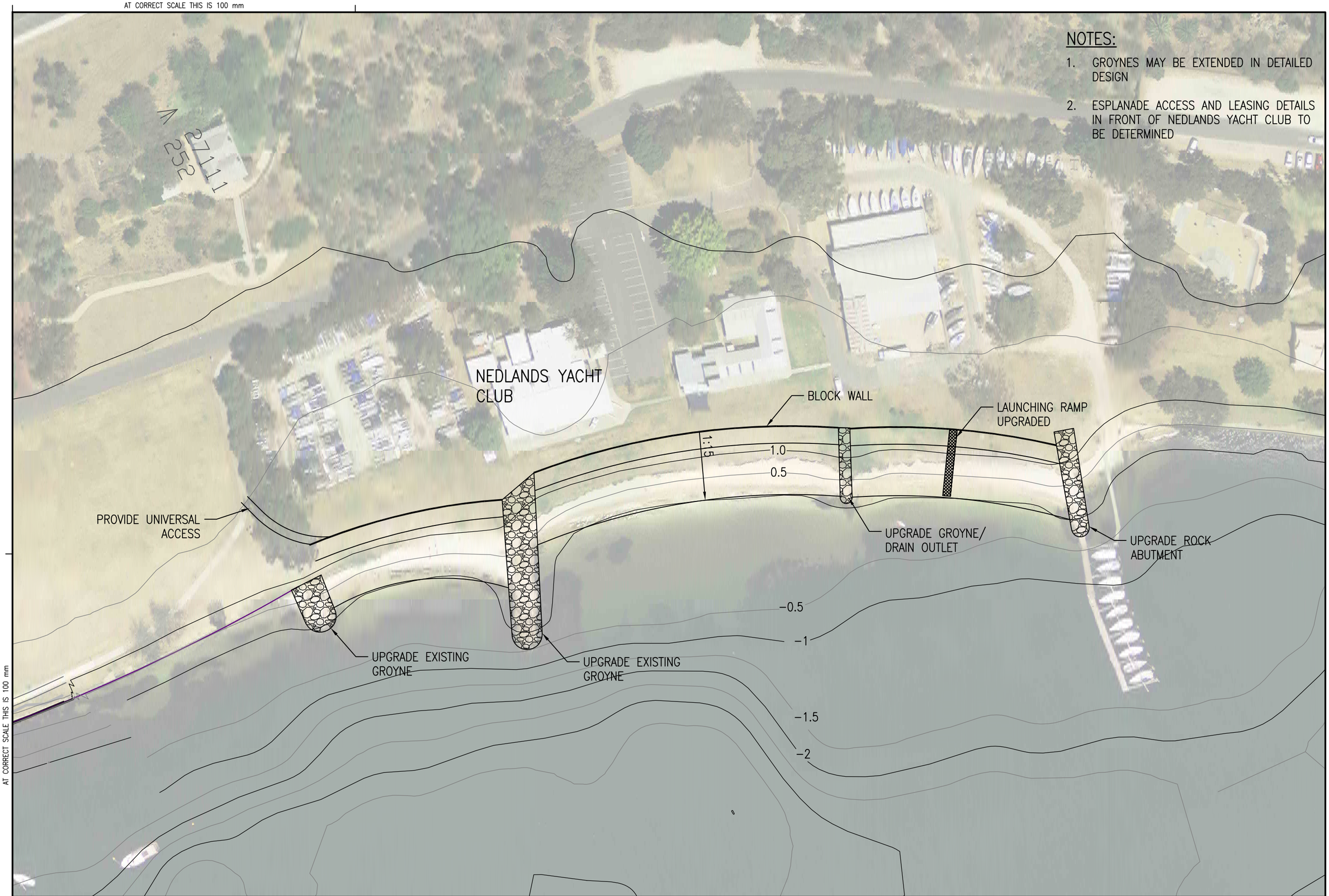
To RSVP for the information sessions and find out more, please visit **Your Voice Nedlands** at **yourvoice.nedlands.wa.gov.au**

Have your voice heard

City of Nedlands
YOUR VOICE

yourvoice.nedlands.wa.gov.au

AT CORRECT SCALE THIS IS 100 mm



NOTES:

1. GROYNES MAY BE EXTENDED IN DETAILED DESIGN
2. ESPLANADE ACCESS AND LEASING DETAILS IN FRONT OF NEDLANDS YACHT CLUB TO BE DETERMINED

AT CORRECT SCALE THIS IS 100 mm

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f: +61 8 9254 6699
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Paul Hasluck Reserve

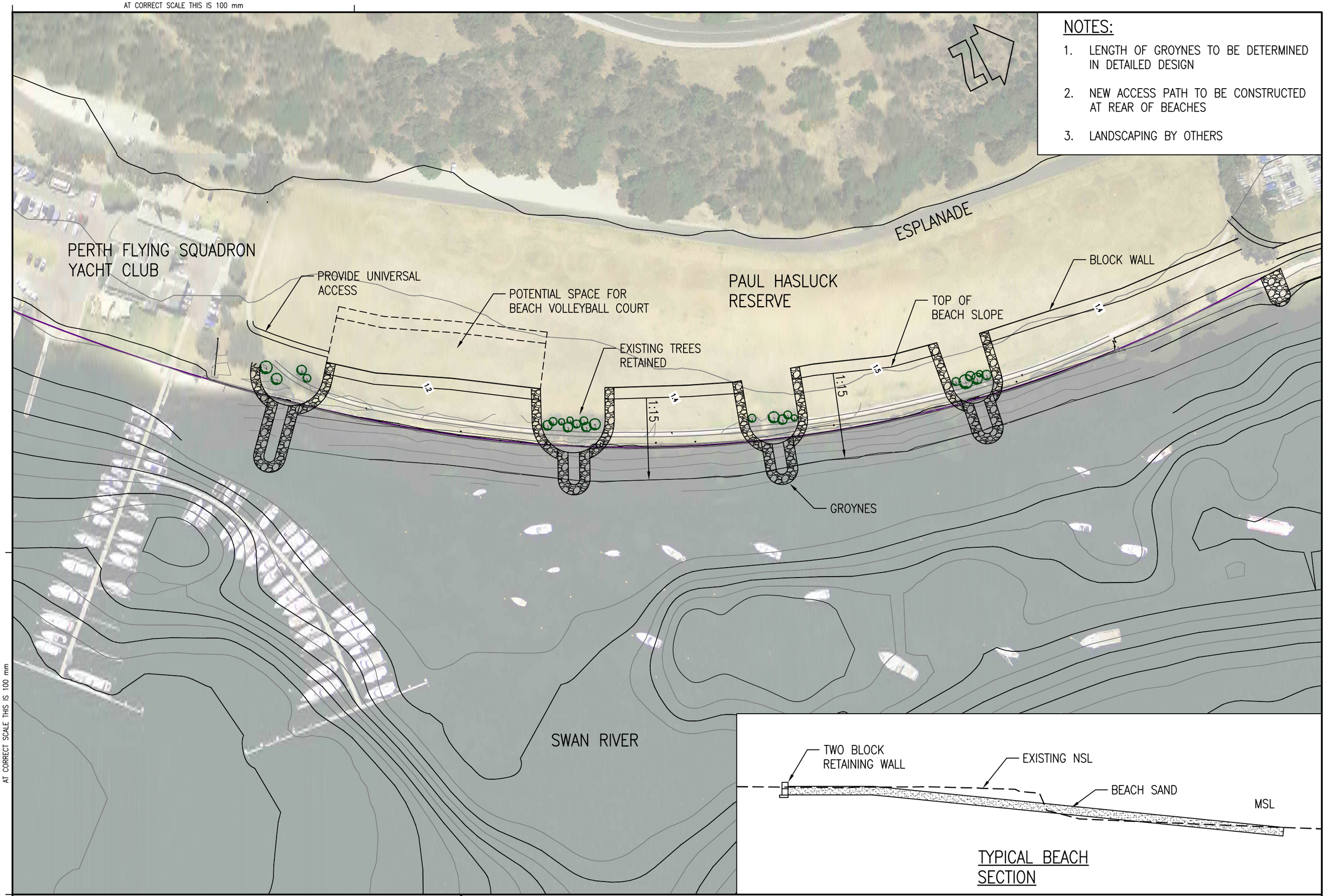
POCKET BEACHES OPTION 1

SCALE AT A3 1:1,000

OCTOBER 2013

SK1113-141013-1A

AT CORRECT SCALE THIS IS 100 mm



NOTES:

1. LENGTH OF GROYNES TO BE DETERMINED IN DETAILED DESIGN
2. NEW ACCESS PATH TO BE CONSTRUCTED AT REAR OF BEACHES
3. LANDSCAPING BY OTHERS

TYPICAL BEACH SECTION

AT CORRECT SCALE THIS IS 100 mm

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Paul Hasluck Reserve

POCKET BEACHES OPTION 2

SCALE AT A3 1:1,500

OCTOBER 2013

SK1113-231013-2A

m p rogers & associates pl ABN 14 062 681 252
creating better coasts and ports

R869 Rev 0

May 2017

City of Nedlands

Nedlands Stage 2 Riverwall Upgrade Technical Specification

marinas
boat harbours
canals
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K1395, Report R869 Rev 0
Record of Document Revisions

Rev	Purpose of Document	Prepared	Reviewed	Approved	Date
A	Draft for MRA review	J Chen	T Hunt	T Hunt	28/03/2017
0	Issued for Client use	J Chen	T Hunt	T Hunt	31/05/2017

Form 035 18/06/2013

Limitations of this Document

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Table of Contents

Table of Tables

1. Preliminaries

1.1 Description of Works

The Works will include the construction of a new Revetment over an approximately 360 m section of existing riverwall on the Nedlands Foreshore, a concrete access ramp and beach. Specifically, the works shall include:

- Preparation and implementation of appropriate management plans.
- Pedestrian, cyclist and traffic management.
- Mobilisation, site establishment and site preparation as required.
- Demolition, clearing and backfill as required.
- Supply, placement and curing of landscape and beach access path.
- Supply, delivery and placement of quarry products and all other materials necessary to complete the works.
- Supply and construction of a Limestone Block Crown Wall at the rear of the revetment crest.
- Supply and construction of Limestone Block Retaining Wall and all other materials necessary to complete the works.
- Supply, placement and curing of a concrete beach access ramp.
- Supply, delivery and placement of Geotextile Sand Containers.
- Supply, delivery and placement of Beach Sand.
- As-constructed survey of completed works.
- Demobilisation and site clean-up, including any reinstatements as required.

The Works will include all operations, labour, plant, materials, supervision, survey and everything else required to complete the whole of the Works as described in this Specification and as shown on the Drawings, or any additional works as directed by the Superintendent.

1.2 The Site

The site is located on the Nedlands Foreshore, off the Esplanade, Dalkeith, within the City of Nedlands and extends from the Stage 1 rock revetment (approximately 200 m west of the old Tawarri jetty) to the western end of the Perth Flying Squadron Yacht Club (PFSYC).

The Contractor is deemed to be thoroughly acquainted with all site characteristics which may influence the cost and completion of the works.

1.3 Documents

1.3.1 Drawings

The Drawings referred to in this Specification, and attached to this document, consist of those listed in the table below.

Table 1.1 Drawings

Drawing Number	Drawing Title
D1395-02-01	Drawing List & Locality Plan
D1395-02-02	Existing Conditions & Access
D1395-02-03	Layout – Sheet 1
D1395-02-04	Layout – Sheet 2
D1395-02-05	Revetment & Beach Sections
D1395-02-06	Ramp Sections & Details

1.3.2 Dimensions, Interpretation & Methods of Measurement of Works

Unless otherwise stated, all measurements of all parts of the Works are to be performed in accordance with AS 1181, Method of measurement of civil engineering works and associated building works.

Figured dimensions on drawings shall be used in preference to measurement by scale. Larger scale drawings shall be read in preference to smaller scale drawings.

The Contractor shall check all dimensions on site prior to commencement of construction. The Contractor shall make good at their own expense any defect due to a discrepancy which has not been brought to the notice of the Superintendent for clarification.

1.4 Warranty

The Contractor warrants that the completed Works, and every part thereof, and all materials, articles and goods used or incorporated therein or supplied by the Contractor in performance, or purported performance of this Contract, whether purchased by the Contractor under any patent or trade name or otherwise, shall comply with the quality, quantity, number, nature, description and condition that is required. The Contractor shall be liable for breach of this warranty notwithstanding that the Superintendent may have accepted the Works, or any part thereof, as satisfactorily executed or completed.

1.5 Compliance with Work Requirements

At all times throughout the duration of the Contract, the Contractor shall fully comply with the requirements of this Specification and any and all approvals, management plans or other plans or requirements that relate to this Work.

The Contractor shall indemnify the Principal and Superintendent from any and all damage or losses caused by, or resulting from, the failure to comply with this specification or any approvals, plans or requirements that relate to this Work.

1.6 Approvals

The Principal will be responsible for gaining the relevant approvals and permits for the works, including from the Department of Parks & Wildlife (Parks & Wildlife) and Department of Aboriginal

Affairs (DAA). The Contractor will be required to comply with all of the conditions of these approvals and others, as may be required.

Copies of the relevant approvals for the works will be provided to the Contractor when available. As part of these approvals, the Contractor will be expected to prepare, submit and gain approval for a Construction & Environmental Management Plan.

1.6.1 Aboriginal Heritage

The Site is located on the Swan River, which is a registered Aboriginal Site (DAA 3536 (Swan River)). The Contractor shall be aware of their obligations under the Aboriginal Heritage Act (1972). Any suspected Aboriginal cultural material shall be reported to the DAA.

Further information on the Contractors obligations may be obtained from the DAA website: www.daa.wa.gov.au

1.7 Management Plans

The Contractor will be required to prepare and implement the following Management Plans:

- Construction & Environment Management Plan (C&EMP).
- Occupational Health & Safety Management Plan (OHSMP).
- Pedestrian, Cyclist & Traffic Management Plan (TMP).
- Acid Sulphate Soil and Dewatering Management Plan (ASSDMP) if required.

The Contractor shall submit the Management Plans to the Superintendent and appropriate authorities for consideration and approval within 2 weeks of Contract award. The works shall not be commenced until the Contractor has written approval of all Management Plans from all relevant authorities.

1.7.1 Construction & Environment Management Plan

The Contractor is required to prepare and implement a C&EMP for the works and ensure that the works comply with all relevant environmental regulations. This includes satisfying conditions imposed by Parks & Wildlife, DAA or other approval agencies.

The C&EMP shall include details of:

- Site layout plan.
- Detailed work methodology, including Quality Control and all reinstatements.
- Environmental and waste management as outlined in the permission conditions from Parks & Wildlife (including turbidity management and re-fuelling arrangements).
- Work programme.

As part of the turbidity and debris management for the Swan River, the Contractor will be required to deploy and manage a silt curtain around the works area. This is to be documented in the C&EMP. The Contractor is to note the requirements for reporting of plumes to Parks & Wildlife.

The Contractor shall allow within the works programme a period of 6 weeks after submission of the C&EMP for approval by Parks & Wildlife. Works are not allowed to commence on site until this approval has been granted by Parks & Wildlife and other stakeholders.

1.7.2 Pedestrian, Cyclist & Traffic Management Plan

The site experiences traffic, pedestrians and cyclists. The Principal, in addition to any other Authority that is responsible for the care, control and management of any roads that the Contractor will be using during the Works will review the Contractor's Pedestrian, Cyclist & Traffic Management Plan and the Contractor shall meet all of these Stakeholders requirements for the duration of the Works.

It is expected that pedestrian and cyclist access along the foreshore will be maintained during the works unless this is not possible due to safety concerns. The Contractor's Pedestrian, Cyclist & Traffic Management Plan shall highlight any closures required to the Dual Use Path, diversions or temporary measures required to allow access.

A preliminary Cyclist, Pedestrian and Traffic Management Plan shall be submitted with the Contractor's Tender and a detailed plan be submitted within 14 days of Contract award.

1.7.3 Acid Sulphate Soils and Dewatering Management Plan

It is not envisaged that Acid Sulphate Soils management will be required for this Works. However, should the Contractor determine excavation greater than 100 m^3 or dewatering is required, the Contractor shall develop an Acid Sulphate Soils and Dewatering Management Plan (ASSDMP) and include details of dewatering management and monitoring to the requirements of the Department of Water. Any investigation works required for this ASSDMP will be at the Contractor's cost.

1.8 Occupational Health & Safety

It is the responsibility of the Contractor to ensure the safety of all persons working on site and to take all precautions to protect the public for the duration of the contract period.

The Contractor will be required to ensure they comply with all relevant Occupational Health & Safety legislation and their OH&S Policy. The Contractor is to be familiar and compliant with the requirements contained in the Occupational Safety and Health Act 1984 and the Occupational Safety and Health Regulations 1996.

For further information on the Occupational Safety and Health Act and Regulations please refer to: www.worksafe.wa.gov.au

The Contractor shall take all precautions necessary to ensure the safety of workers employed at the site. The Contractor shall also take all necessary precautions to protect members of the public from accident, injury or hurt, whether engaged on their lawful occasions or trespassing on areas abutting or adjacent to the works. The Contractor shall provide, erect and maintain adequate barriers, as necessary.

1.9 Noise & Vibration

The Contractor shall arrange its operations and shall provide silencing equipment to its plant at its own expense to whatever extent is necessary to satisfy the requirements of the Local Authority Health Department in relation to the sound level arising from the Contractor's operations near the boundaries of existing occupied properties.

The construction work must also be carried out in accordance with control of noise and vibrations as outlined in AS 2436-2010 *Guide to noise and vibration control on construction, demolition and maintenance sites*.

1.10 Dust & Wind-blown Material Control

The Contractor shall be responsible for the effective control of all dust and windborne material emanating from the Site as a result of the works throughout the period of the Contract.

The Contractor shall be responsible for the suppression and control of dust and smoke pollution from development sites in strict accordance with "A Guideline for Prevention of Dust and Smoke Pollution from Land Development Sites in Western Australia" (Department of Environmental Protection, November, 1996).

1.11 Construction Signage

The Contractor shall supply and erect appropriate signage to the approval of the Superintendent outlining the Works and the organisations involved in the Works.

1.12 Protection of Existing Services & Infrastructure

The Contractor shall establish the location of all existing services on the Site. In particular, the Contractor shall contact the Dial Before You Dig service and enquire about existing services and infrastructure on the Site (phone 1100 or www.1100.com.au). The Contractor shall be responsible for locating and protecting all existing service lines, pipes, cables and fixtures whether or not they are shown on the Drawings.

The Contractor shall plan and execute the Works in such a manner to avoid any damage or disruption to existing services or infrastructure on the Site. The Contractor shall repair or replace any damaged to any working services or infrastructure on the Site. The Cost of such works is deemed to be included in the Contract Sum.

1.13 Existing Condition & Vegetation

Prior to any works commencing onsite, the Contractor and Superintendent shall walk the site and document any damaged areas of the current infrastructure which may be affected by the Works. The Contractor and Superintendent shall also nominate any vegetation which may require trimming to avoid damage by vehicles or machinery. The Contractor is **not** to trim any vegetation, including existing trees, without the prior approval of the Superintendent.

There are several established trees in the vicinity of the works. The Contractor shall ensure that these trees are protected for the duration of the works.

1.14 Disposal of Debris & Waste Water

The Contractor shall be responsible for the removal and disposal of all waste material, rubbish and any other by-product of the works at no cost to the Principal. All debris and waste material, including excess water and water used in cleaning are to be disposed as per the requirements of the Department of Environmental Regulation, latest Environmental Protection Act, the Local Authority and conditions imposed by the Superintendent.

No debris or contaminated water is to enter the river, and it shall be removed and disposed of at a suitable location.

The Contractor shall obtain a site for such disposal and obtain any permits required for the disposal operations.

1.15 Site Clean Up & Reinstatement

Demobilisation and site clean-up shall include all reinstatements. Any damage occurring during the works shall be repaired to a reasonable state, to the satisfaction of the Superintendent. Excessive damage to the site, vegetation or other items of infrastructure during the Works other than that deemed reasonable by the Superintendent shall be repaired at the Contractor's cost.

Reinstatement of areas or assets affected by the Works but under ownership or control of the Principal, Parks & Wildlife or others shall be to the approval of the Superintendent on advice from the Principal, Parks & Wildlife or other managing authority.

1.16 Industrial Relations

1.16.1 Notification

If the Contractor becomes aware of any issue related to industrial relations which may cause disruption to the progress of the works, they shall immediately notify the Superintendent.

1.16.2 Contractor's Responsibility

The Contractor acknowledges and agrees that they shall be solely responsible for industrial relations on the site and that the Contract Sum includes an allowance to compensate the Contractor for all risks associated with industrial relations including without limitation demarcation disputes, increases in labour costs, changed work practices, site allowances (whether existing or which subsequently become payable within the construction industry) and any reduction in construction industry working hours per week.

1.17 Interference with the Works

The Contractor shall be deemed to have allowed in its submission for vandalism and interference. There shall be no claims for extension of time or cost of repairs as a result of any such disruption.

The Contractor shall ensure that all equipment, materials and property belonging to, or in the care of the Contractor, both on and off the site, are sufficiently secure from theft or damage by others. Any equipment that is left on site is the responsibility of the Contractor.

1.18 Limitation of Inconvenience

The Contractor shall take all measures to minimise disruption to traffic on roads, pathways, the waterway, and the foreshore reserve adjacent to the Works.

Interference with the use or enjoyment of any property shall be limited to that which cannot reasonably be avoided and shall be restricted to the minimum time necessary for the satisfactory execution of the work involved. The Contractor shall plan and execute the Works in a manner that minimises the inconvenience to the public.

1.19 Contractor's Representative

The Contractor shall at all times maintain full supervision of the Works by a competent Representative / Foreman experienced in this class of works.

The Contractor's Representative shall have full authority to receive and act on instructions of the Superintendent or their Representative.

The Contractor's Representative shall, during the period of the Contract, co-operate with all authorities, property owners or other persons affected by the Works, notify them in advance of commencement of any section of work which affects them and at all times strive to maintain a courteous and helpful manner in any dealings with them.

1.20 Contractor's Site Facilities

1.20.1 Site Facilities

The Contractor shall be wholly responsible for the cost of the installation and removal of temporary sanitation, power, water, telephone, roads, fencing, landings, offices, sheds and any other facilities the Contractor may require. The Contractor shall keep such areas in a clean and tidy condition during the Contract period and, at the completion of the Contract, the Contractor shall clear the work area and leave the site in a clean and tidy condition to the approval of the Superintendent.

1.20.2 Accommodation for Workforce Personnel

The Contractor shall ensure that there are suitable sanitary and other accommodations for use by its personnel. The sanitary accommodation shall be kept in a clean and hygienic condition and shall satisfy the requirements of the Local Authority Health Department in all respects. On completion of the Works all sanitary facilities shall be removed the ground thoroughly disinfected and the Site restored to its original condition.

1.21 Marking of the Works, Fencing & Restricting Public Access

1.21.1 General

The Contractor shall provide, maintain and exhibit such fences, barriers, signs and notices on and around the Works as may be required to make the area safe for the general public during the period of the Works. The notice boards are to be located near the places of truck movements as required by the relevant Authority and the Superintendent.

The Contractor shall continually monitor the construction activities and ensure that the general public is not exposed to any danger from the operations. If there is a risk of danger to the general public, then the Contractor shall liaise with the Superintendent and the relevant Authority and formally close off the appropriate sections of the site to the public for the period that they would represent a danger to the public.

On completion of the Works the Contractor shall remove all fences, barriers, signs, etc to the approval of the Superintendent.

The Contractor shall be fully responsible for the control and safety of the Works and safety on the Site for the full duration of the Works. The Contractor shall provide access to the Works for others as required.

1.21.2 Marking of Marine Works

Should the Department of Transport deem that the works are a possible hazard to marine vessels, the Contractor shall provide, maintain and exhibit such day marks, lights, warning lights, barriers, signs and notices on or around the Works as may be required to make the area safe for navigation and the general public during the period of the Works.

In particular, but not limited to, the Contractor shall:

- Provide all navigation aids, to the requirement of the Marine Safety Division of the Department of Transport if floating curtains or any other possible marine obstruction are in place.

- Install and maintain adequate notice boards, warning of danger from the works in progress.

- On completion of the Works remove all day marks, lights, barriers, etc to the approval of the Superintendent.

1.21.3 Recovery & Removal of Sunken Equipment & Material

In the event of any of the Contractor's materials or machinery falling into the water, sinking or floating loose from the site, the Contractor shall notify the Superintendent and Parks & Wildlife as soon as possible.

Any materials which fall into the water due to any cause whatsoever connected with the execution of the Works shall be removed, raised or recovered as soon as possible.

Until the wrecks or sunken equipment or materials have been removed the Contractor shall set up such buoys and display at night such lights and do all such things for the safety of navigation as may be required.

1.22 Temporary Stockpile Area

The Contractor shall confirm proposed locations for temporary stockpile of materials with the Superintendent.

The Contractor shall take appropriate measures to ensure that no damage occurs to the roads, paths or landscaping in the area during the Works. Any damage resulting from the Works shall be repaired at the expense of the Contractor and to the approval of the Superintendent and Principal.

1.23 Services

The Contractor shall be responsible for supplying any power and water services for use in the Works.

1.24 Setting Out & Survey Control

The Contractor is responsible for all survey that is needed to adequately set out the Works and control the operations needed to complete the Works.

The setout of the Works is to be carried out by a qualified and experienced Engineering Surveyor. The Contractor shall report any apparent survey discrepancies to the Superintendent immediately.

1.25 Weather, Tides & River Conditions

The Contractor shall allow for all weather conditions throughout the Contract period and for all delays caused by the weather, tides, currents and river conditions. No extra payment or extensions of time shall be made for such delays. The Contractor must be prepared to vary its operations and works methodology to suit the changing weather or river conditions.

The Contractor shall plan and execute the work to minimise damage of partially completed Works due to weather or the action of the river. The Contractor shall repair all damage to partially completed Works immediately and at no additional cost to the Principal.

1.26 Works By Others

The following additional works may be completed by others in the foreshore area:

- Landscaping.

The works by others may be completed in conjunction with the Contract Works. The Contractor shall work constructively with any other Contractors on site to allow access to complete those works as required.

2. Demolition, Clearing & General Earthworks

2.1 General

The Contractor shall complete demolition, clearing and backfill works as required to allow construction of the new Landscape & Beach Access Path, Beach Access Ramp, Limestone Block Retaining Wall, Rock Revetment, Limestone Block Crown Wall and Beach Section. These shall generally include:

- Removal of the capping slab or top block of the existing riverwall to allow construction of the revetment.
- Full removal of a section of the concrete riverwall to allow construction of the limestone block retaining wall.
- Removal of section of the existing path to allow construction of the new landscape & beach access path.
- Other demolition and clearing as required to complete the works.
- Backfill as required.

2.2 Demolition & Clearing Requirements

The Contractor will be required to remove the capping slab or top block on the existing riverwall to allow construction of the new Revetment.

The Contractor shall remove and dispose of the existing capping slab or top block to the extent shown on the Drawings. The Contractor shall allow for all costs of removal and disposal at an appropriate site. Alternatively, the Contractor may stockpile the removed capping slab or top block and reuse it as Filter Rock if it meets the grading requirements of this Specification.

The Contractor shall ensure that during the removal of the capping slab or top block, failure to adjacent riverwall sections does not occur. The Contractor shall repair or replace any damage caused by the Works to any adjacent riverwalls. The Cost of such works is deemed to be included in the Contract Sum.

The Contractor shall allow for all other demolition and clearing as required to allow construction of the new Revetment and beach section as shown on the Drawings. The Contractor shall allow for all costs of removal and disposal at an appropriate site.

The Contractor shall note that for the construction of the revetment there is no requirement to completely remove the existing riverwall in the Works area. It is intended that the capping slab is removed and the Revetment is constructed over the existing riverwall. For construction of the limestone block retaining wall, the existing riverwall is required to be completely removed.

2.3 Excavation

The Contractor shall excavate existing material as required to complete the works to the lines, levels and dimensions shown on the Drawings.

2.4 Dewatering

Should the Contractor determine that dewatering is required, the Contractor is responsible for the necessary approvals, design, construction, maintenance and removal of any dewatering system. Details of the proposed work methodology shall be included in the Construction Environmental Management Plans to be prepared by the Contractor and approved by the Superintendent prior to the commencement of the Works.

3. Landscape & Beach Access Paths

3.1 Compacted Subgrade

The subgrade shall be compacted to achieve a suitable surface for the placement of the concrete path. The subgrade shall have an in situ density of not less than 95% of the maximum dry density to a depth of 500 mm determined in accordance with AS 1289.5.2.1 (modified compactive effort).

The finished levels of the subgrade shall be within ± 20 mm of the design levels. The subgrade shall be approved by the Superintendent before placement of the path.

3.2 Concrete Paths

The Contractor shall construct the Concrete Paths to the lines, levels and dimensions shown on the Drawings. The Contractor shall also link the existing path network to the new concrete paths as shown on the Drawings and directed by the Superintendent.

The Concrete Paths shall be a minimum of 100 mm thick. The concrete shall have a characteristic strength of at least 25 MPa at 28 days. The maximum aggregate size shall be 20 mm and the slump shall be in the range of 80 to 100 mm.

Water used in concrete shall be of potable quality and free from all impurities which may have a harmful effect on the concrete. Chemical Admixtures shall be approved by the Superintendent prior to use and shall comply with the requirements of AS 1478.1.

The proposed mix details shall be forwarded to the Superintendent for approval prior to placing any concrete. One sample of concrete for the paths shall be tested for every 60 m of path.

The concrete shall be manufactured, transported, placed, vibrated and cured to the requirements of AS 3600 and the durability requirements of AS 4997.

All formwork shall be to requirements of AS 3610 and, where required, be designed by the Contractor. Forms shall remain in place until the concrete has a minimum average compressive strength of 15 MPa.

All concrete works shall be completed to the requirements of the Cement and Concrete Association of Australia's handbook Guide to Concrete Construction HB 64 – 2002.

The surface of the concrete shall be broom finish and non-slip with smooth edges, approximately 75mm wide at edges and joints.

3.3 Path Joints

Contraction joint shall be formed by a saw cut at least one quarter and not more than one third of the concrete thickness to induce cracking. Alternatively an approved preformed crack inducer may be adopted with approval of the Superintendent. Contraction Joints shall be installed every 2.5 m of footpath. The Contractor shall provide details of the proposed arrangement of the Contraction Joints for approval by the Superintendent prior to pouring.

Expansion/Isolation Joints shall be cut at every 5 m interval and shall be 10 mm Parchem StiffJoint or an equivalent approved by the Superintendent.

4. Concrete Access Ramp

4.1 General

The scope for the construction of the concrete beach access ramp include the following.

- Compaction of the subgrade.
- Supply, placement and compaction of the crushed limestone subbase.
- Supply, placement, installation, curing and finishing of concrete ramp and associated components.

The scope of works shall include all items listed in this Specification or shown on the Drawings.

4.2 Referenced Documents

The work shall be carried out in accordance with the latest editions, at the time of Tender closing, of the following Standards and design manual.

Table 4.1 Reference Documents

Standard	Title
AS 1012.13	Methods of Testing Concrete – Determination of the Drying Shrinkage of Concrete for Samples prepared in the Field or in the laboratory
AS 1141.6.1	Methods for sampling and testing aggregates – Particle density and water absorption of coarse aggregate – Weighing-in-water method
AS 1289.5.2.1	Methods of testing soils for engineering purposes – Soil compaction and density tests – Determination of the dry density or moisture content relation of a soil using modified compactive effort
AS 1379	Specification and Supply of Concrete
AS 1478.1	Chemical Admixtures for Concrete, Mortar and Grout
AS2349	Method of sampling Portland and Blended cements
AS/NZS 2350	Methods of testing Portland and Blended cements
AS 2758	Aggregates and Rock for Engineering Purposes
AS 3600	Concrete Structures
AS 3610	Formwork for Concrete
AS 3972	General Purpose and Blended Cements
AS4671	Steel reinforcing materials
AS/NZS 4680	Hot-dip galvanized (zinc) coatings on fabricated ferrous articles
AS 4997	Guidelines for the design of maritime structures
SAA HB 64	Guide to concrete construction

4.3 Materials

The concrete for the access ramp shall contain the specific types of materials listed in the following table and in the following clauses. Chemical admixtures may be used only if listed below or approved by the Superintendent.

The concrete shall be designed and produced so that the properties listed in Table 4.2 and 4.3 are achieved. The various concrete types used in the works are summarised in the following table.

Table 4.2 Concrete Properties

Property	Value
Description	Grey Reinforced
Grade	SC50
Finish	Angled Ridges as shown on the Drawings
Mandatory Admixture	XYPEX C5000
Max. Nominal Aggregate Size	20mm
Cement Type	GB

Table 4.3 SC50 Concrete Additional Requirements

Property	Value
Slump	80 mm
Minimum Cement Content	> 420 kg/m^3
Maximum Water / Cement Ratio	0.4
Drying shrinkage at 56 days (AS 1012.13)	<600x10^{-6} mm/mm
Admixtures – Permitted	WR-Re, SP

The selection, proportioning and mixing of the concrete materials shall be such as to produce a mix which works readily into corners and angles of the forms and around reinforcement with the method of placement employed on the work, but without permitting the material to segregate or excess free water to collect on the surface. The resultant concrete shall be sound and have the other qualities specified.

Premixed concrete shall be manufactured and supplied in accordance with the requirements of AS 1379.

Cement

Cement used in the Works shall be blended cement (Type GB) or general purpose (Type GP) and shall comply with the requirements of AS 3972.

Supplementary cementitious materials (SCMs) comprising either or both fly ash and slag at combined levels above 7.5% and amorphous silica at a level not exceeding 10% may be used. The Contractor shall submit the proposed mix details to the Superintendent for approval prior to commencing concrete production.

Aggregates
Concrete aggregates shall comply with the requirements of AS 2758.1. Aggregates shall be crushed rock with maximum water absorption of 2.5% suitable for exposure classification C in accordance with AS 2758.1.

Water
Water used in concrete and for curing shall be of potable quality, free from all impurities, which may have a harmful effect on the concrete. Total dissolved solids shall not exceed 1000 mg/L and sulphate or chloride salts shall not exceed 500 mg/L. Water shall meet the requirements of AS 1379.

Admixtures
Chemical admixtures, where specified in Table 3.2 or 3.3, or if approved for use, shall comply with the requirements of AS 1478.1, and shall be used in accordance with the practices detailed in Appendix B of AS 1478.1.

The water reducing-retarding (WR-Re) and superplasticising (SP) admixtures shall be approved by the Superintendent.

The catalytic crystalline admixture shall be XYPEX ADMIX C5000 or approved equivalent and shall conform to the requirements of AS 1478.1, type Special Purpose and be of dry, cementitious powder type. The catalytic additive shall remain reactive whenever moisture is available within the concrete and shall cause the permanent filling of capillaries, bleed tracts and small voids within the concrete with a multiplicative, non - soluble crystalline growth. The catalytic additive shall not detract from normal plastic and hardened concrete characteristics.

Fly Ash, Slag & Amorphous Silica
Fly ash, slag, and amorphous silica shall comply with the requirements of AS 3582.1, AS 3582.2 and AS/NZS 3582.3 respectively.

Other Materials
Curing compounds shall not be used on maritime concrete. The use of penetrating chemicals for chloride inhibitors, such as silanes, siloxanes or other surface coatings, precludes the use of chemical curing compounds on maritime concrete.

Steel primer, bonding agents, joint fillers, sealers and other materials used in the Works shall be identified in the Contractor's Work Plan and approved by the Superintendent prior to commencement of the Works.

4.3.1 Reinforcing Steel
Steel reinforcement for the various elements of the Works shall comply with AS/NZS 4671.

Reinforcement (immediately prior to concrete placing) shall be free from loose mill scale, loose rust, mud, oil, grease, and other non-metallic coatings that would reduce the bond between the concrete and the reinforcement.

All steel reinforcement shall have the following properties:

- Strength Grade 500
- Ductility Class L

- Shape D (deformed)

The size of the reinforcing bar shall be to the dimensions indicated on the Contractor's Drawings.

All reinforcing bars shall be cut and bent in accordance with AS 3600.

All reinforcing steel shall be hot-dipped galvanised in accordance with AS/NZS 4680 with a minimum average coating of mass 600 g/m^2. Cages shall be fabricated and welded prior to galvanising.

Acceptable manufacturers and processors of steel reinforcement must hold a valid certificate of approval, issued by the Australian Certification Authority for Reinforcing Steels Ltd (ACRS), or to an equivalent certification system as may be approved in writing by the Superintendent.

Evidence of compliance with this clause must be obtained when contract bids are received.

Should the Contractor wish to use reinforcing steel that is not covered by long-term quality levels of AS/NZS 4671, approval must be obtained in writing prior to such use.

In seeking such approval, the Contractor shall nominate the members in which each individual batch of reinforcing steel is to be used and shall also state the country, mill of origin and the specification to which the steel for that member is produced, and clearly demonstrate how it is equivalent to that specified by AS/NZS 4671.

Certificates from a NATA laboratory of chemical composition and physical properties of all reinforcing steel will be required. All testing will be in compliance with Clause B7 of AS/NZS 4671, including frequency of sampling and testing.

Steel not covered by the long-term quality level of AS/NZS 4671 shall not be ordered or placed before written approval has been obtained. Once such approval has been obtained, the materials shall be cut and bent in accordance with AS 3600.

The Contractor, when requested by the Superintendent, shall supply copies of test certificates representing routine tests carried out for yield and ultimate strengths, elongation, and cold bend performance carried out by the reinforcing steel manufacturer.

Reinforcing steel shall be stacked clear from the ground and labelled for positive identification.

Any welding of the steel reinforcement shall be in accordance with AS/NZS 1554.3.

Splicing of reinforcement shall only be done in accordance with AS 3600 and where approved by the Superintendent. Where approved, any splicing shall be completed to develop 100% of the yield strength.

4.3.2 Subgrade

The subgrade shall be compacted to achieve a suitable surface for the placement of the Geotextile and Subbase. The Subgrade shall have an in-situ density of not less than 95% of the maximum dry density to a depth of 500 mm determined in accordance with AS 1289.5.2.1.

Details of the proposed methodology to achieve the required compaction shall be included in the Contractor's Management Plans.

The subgrade shall be approved by the Superintendent prior to the placement of the Geotextile or Subbase.

4.3.3 Subbase

For the Concrete Access Ramp the Contractor shall place an aggregate subbase as shown on the Drawings to the satisfaction of the Superintendent. The subbase shall consist of 20 mm nominal aggregate. The Contractor shall screed the subbase to provide a continuous and flat base for the placement of the underlay membrane and concrete.

For the Concrete Pavement the Contractor shall place a crushed limestone subbase. The crushed limestone for the Subbase under the concrete pavements shall comply with the following grading requirements.

Table 4.4 Crushed Limestone Grading

Sieve Size	% Passing By Weight
75mm	100%
19mm	50-75%
2.36mm	30-50%
0.075mm	0-15%

The subbase shall be placed so that the compacted subgrade is not disturbed or broken up and the even thickness specified is achieved. Finished surface level tolerances shall be +0 mm to –10 mm. Subbase materials shall not be placed on a waterlogged subgrade.

The subbase shall be watered to an optimum moisture content and compacted to a density of not less than 95% of the maximum dry density when tested in accordance with AS1289.5.2.1.

4.3.4 Underlay Membrane

The underlay membrane shall be flexible, polymeric film, nominally 0.2 mm thick and manufactured from suitable high-quality ingredients satisfying the requirements of AS 2870.

4.4 Formwork

All formwork shall be to the requirements of AS 3610. Formwork design shall be the responsibility of the Contractor. Documentation and calculations may be required to be submitted to verify adequacy of the work. A stripping schedule is to be developed in accordance with AS 3610.

The surface finish of formed or stripped surfaces shall be Class 2 in accordance with AS 3610.

Forms shall be cleaned and coated with an approved oil or release agent each time before concrete is placed. All forms shall be approved prior to commencement of concreting operations.

4.5 Form Removal

Forms shall remain in place until the concrete has a minimum average compressive strength of 32 MPa.

Forms shall be removed without damaging the concrete. Bars or other tools shall not be used as a level against the concrete in removing the forms.

Any damage to the concrete occurring during the form removal shall be repaired promptly by an approved method.

4.6 Placing & Fixing Reinforcement

4.6.1 Placing

Reinforcement shall be placed in the locations shown in the Drawings. Laps and other details shall comply with AS 3600.

4.6.2 Fixing

Reinforcement shall be placed and securely held in its correct position by the use of approved supports.

Chairs, spacers, and stools used as supports for reinforcement shall be purpose made of concrete. Plastic or metal chairs are not permitted. Cementitious chairs shall be thoroughly wetted down before pouring concrete.

The supports shall be adequate to withstand construction traffic and shall be sufficient in number and spacing to maintain the reinforcement in its correct position during the concrete placing, compaction and finishing operations.

4.6.3 Placing Tolerances

Unless otherwise shown on the Drawings, the reinforcement shall be fixed and maintained in its correct position within the tolerances specified in AS 3600.

4.7 Placing, Compacting & Finishing

4.7.1 Approvals

The Contractor shall give at least 24 hours' notice of their intention to place concrete in any area, to enable the area to be inspected, checked and approved prior to commencing placing.

Unless approval is given no concrete shall be placed in that section of the Works. Any concrete placed without approval shall be demolished and removed from the Works at the Contractors expense.

4.7.2 Delivery

The concrete shall be transported from the delivery vehicle to its final position as rapidly as possible by a means which will prevent segregation or loss of materials or contamination, and in such a way that proper placing of the concrete will not be adversely affected.

4.7.3 Placing

Concrete shall be deposited in such a manner as to require a minimum of rehandling and shall be distributed so that when consolidated and finished, the thickness, surface shape and level shown in the Drawings will be obtained.

The concrete shall be placed so that its working face is generally vertical, and normal to the direction of placing. It shall be placed uniformly over the width of the element and in such a manner as to minimise segregation.

Workers shall not be permitted to walk on the concrete during placement with boots coated in soil or other deleterious substances.

Hand spreading of concrete shall be done with shovels, not rakes.

Concrete placing shall be carried out continuously between forms and/or construction joints and in such a manner that a plastic concrete face is maintained. Where their location is shown in the Drawings, construction joints shall neither be relocated nor eliminated without approval. Where no construction joints are shown in the Drawings, the location of any joints which may be required shall be approved.

4.7.4 Compacting

All concrete, including that adjacent to forms or existing concrete, shall be compacted by mechanical vibration through the use of internal vibrators and/or vibrating-beam screeds as detailed herein.

Concrete elements up to 200 mm thick shall be compacted and screeded to the required surface profile using a vibrating beam. Internal vibrators shall be used to supplement the compaction adjacent to the side forms and at construction joints.

Concrete elements greater than 200 mm thick shall be initially compacted using internal vibrators. The concrete shall then be screeded to the required surface profile using a vibrating beam.

The internal vibrators shall be operated to produce noticeable vibrations at a distance of 300 mm from the head. The number of vibrators on site shall not be less than one per 7 m^3 of concrete placed per hour, and the Contractor shall ensure that at least one vibrator in working order is held in reserve at all times.

The vibrators shall be inserted into the concrete to such depth as will provide full compaction. The vibrators shall be operated by quickly inserting and slowly withdrawing them in a uniform pattern at a spacing to ensure full compaction over the entire concrete element. Vibrators shall be inserted and withdrawn vertically. The duration of vibration shall be sufficient to ensure full compaction, but not longer than 30 seconds in any one location. Vibrators shall not be used for spreading concrete.

Particular attention shall be paid to the vibration of concrete adjacent to side forms and construction joints. Any honeycombing will be grounds for rejection of the placed concrete.

Vibrating beams shall incorporate double beams made of extruded aluminium or steel, or metal-shod timber sections with edges at least 75 mm wide. They shall be at least 300 mm longer than the width of the Slab being compacted, and equipped with handles to allow the assembly to be drawn over the concrete surface from the outside of the forms.

Two passes shall be made with the beam over each section of the base at a rate of between 0.5 to 1.0 m per minute. During the first pass of the beam, a uniform ridge of concrete about 50 mm deep shall be maintained ahead of the beam over its entire length. On the second pass only a slight roll of concrete shall be maintained along the beam.

The vibrating action of the beam shall be stopped whenever the beam is stationary.

4.7.5 Finishing

Finishing operations comprising levelling, floating, trowelling and texturing, shall commence following compaction of the concrete and shall be completed as soon as possible in the appropriate sequence/time.

The addition of water to the concrete surface to assist in finishing operations shall not be permitted. However, in hot weather or dry, windy conditions the application of water to the surface in the form of a fog, or fine mist spray, or the spraying of the surface with an approved aliphatic alcohol may be permitted.

No material shall be applied to the surface of the concrete to soak up surface moisture.

4.7.6 Levelling

Following compaction, minor irregularities and score marks in the concrete surface shall be eliminated by means of a hand-operated, long-handed float.

Where necessary, the float shall be used to smooth and fill in open-textured areas in the concrete surface.

4.7.7 Floating

Floating shall be undertaken using approved powered mechanical equipment.

Floating shall not commence until all surplus moisture has been removed or evaporated from the surface of the concrete, and the surface is sufficiently hard to resist displacement under the action of the float.

Floating shall be undertaken in a regular pattern over the entire surface of the concrete to produce a closed and level surface.

4.7.8 Trowelling

Trowelling shall be undertaken using approved powered mechanical equipment. Hand trowelling shall be used to finish small areas that are unable to be covered by mechanical equipment and along edges.

Trowelling shall commence after the surface has been power floated. Trowelling shall not commence until the surface is sufficiently hard to resist displacement under the action of the trowel.

The blades of the trowel shall be tilted such that maximum pressure is applied without leaving ridges on the surface of the concrete.

4.7.9 Surface Texturing / Finish

Trafficable surfaces shall be provided with a coarse broomed finish. The whole upper surface of the ramp shall be broomed in a direction perpendicular to the ramp direction.

4.8 Curing

Concrete shall be water-cured by protection against loss of moisture and rapid temperature changes for a period of not less than 7 days from completion of the finishing operations. Curing shall comprise initial curing followed by moist curing.

No curing compounds shall be used as these preclude the use of penetrating chemicals for chloride inhibitors which may be required in the future.

Before concrete placing commences, all equipment needed for adequate curing of the concrete shall be on hand and checked ready for use.

Curing shall commence as soon as practicable, but no more than 3 hours after completion of the finishing operations or stripping of formwork.

Failure to comply with the specified curing requirements shall be cause for immediate suspension of the concreting operations.

The side ramp slabs exposed by the removal of forms shall be cured by one of the methods detailed herein.

The use of covering material that contains or becomes contaminated with sugar in any form, tannic acid, or any other substance considered detrimental to Portland cement concrete shall not be permitted.

4.8.1 Initial Curing

Immediately after the finishing operations have been completed and until the moist curing has been applied, the surface of the concrete shall be kept continuously damp by means of a water fog or mist applied with approved equipment.

4.8.2 Moist Curing

Common methods of moist curing include covering with hessian and continuously spraying with water or ponding with water. The following are accepted methods.

Covering with Hessian

As soon as possible after the finishing operations have been completed and the concrete has set sufficiently to prevent damaging the surface, the forms and entire surface of the newly-laid concrete shall be covered with wet hessian mats, or other approved material.

Hessian mats shall have sufficient width, after shrinkage, to cover the entire width and faces of the concrete element. Provision shall be made to securely anchor the mats to ensure that they remain in place in windy conditions. The mats shall overlap each other at least 150 mm. The mats shall be kept continuously wet and in intimate contact with the concrete edges and surface for the duration of the specified curing period.

The hessian and water used to keep the hessian damp shall be clean and free of any material that may cause staining of the surface or affect the concrete properties.

Ponding with Water

As soon as possible after the finishing operations have been completed and the concrete has set sufficiently to prevent damage to the surface, water shall be ponded over the surface so as not to leave any of the concrete surface exposed. The water level shall be maintained to ensure the concrete surface does not become exposed and dry out due to evaporation or other water loss.

Where there are no upturns around the perimeter of the slab, suitable bunds shall be provided to retain the water.

The water used and any material used for perimeter bunds shall be clean and free of any contaminants that may cause staining or affect the concrete properties.

4.9 Joints & Edges

The Contractor shall provide joints to the locations and details as shown on the Drawings.

Expansion and isolation joints shall be formed using Parchem Stiffjoint or equivalent approved.

Contraction joint shall be formed by a saw cut at least one quarter and not more than one third of the concrete thickness to induce cracking. Alternatively an approved preformed crack inducer may be adopted with approval of the Superintendent.

All joints are to be sealed with an approved joint sealant.

4.9.1 Dowel

Expansion and isolation joints shall incorporate dowels of the type, details and at the centres shown in the Drawings.

Dowels shall be prepared and placed across joints where indicated on the Drawings. Dowels shall be correctly aligned and securely held parallel to the surface of the finished base during placing and finishing operations.

All dowels intended to be cast into the concrete shall be clean and free from oil, grease, loose rust and other foreign material when the concrete is placed to permit maximum bonding with the concrete.

4.10 Protection of Concrete

All concrete shall be protected against all damage prior to the final acceptance of the Works.

4.10.1 Construction Traffic

Irrespective of age, trafficking of pavements by tracked or solid-wheeled construction equipment shall not be permitted.

4.10.2 Unhardened Concrete

Unhardened concrete shall be protected from rain and flowing water.

4.11 Adverse Weather Conditions

4.11.1 Concreting in Hot Weather

When the shade temperature is likely to exceed 30°C, or climatic or other conditions are likely to result in the temperature of the concrete exceeding 35°C when placed, some or all of the following precautions shall be taken in placing, curing, and protecting the concrete as necessary and as directed.

The forms and reinforcement shall be sprinkled with water immediately before placing the concrete.

Concrete shall be placed at the lowest temperature practicable, and in no case exceeding 35°C by adopting one or more of the following measures as required:

- Aggregates shall be shaded from the sun.

- Mixing water shall be cooled.
- Mixing and placing of the concrete shall be done during the coolest period of the day.

Concrete shall be transported, placed and finished continuously, and as rapidly as possible.

During the placement and finishing operations, an approved aliphatic alcohol shall be sprayed over the exposed surfaces in accordance with the manufacturer's specifications to limit evaporation of water. This procedure may be carried out whenever there is a break in the sequence of placing and finishing operations.

As soon as possible after finishing operations have been completed, curing operations shall be commenced. Initial curing shall be provided if the final moist curing method cannot be commenced immediately after finishing operations have been completed.

4.11.2 Concreting in Cold Weather

If it is necessary to place concrete when the ambient temperature of the air is below 10°C, or climatic or other conditions are likely to result in the concrete temperature falling below 5°C when delivered, or when the concrete is likely to be subjected to freezing conditions before the expiration of the specified curing period, placing shall only proceed upon full compliance with the following provisions.

The forms shall not be frozen and shall be entirely free of frost when the concrete is deposited.

The temperature of the concrete when placed shall not be less than 5°C. Heating of the mixing water and/or aggregates shall be undertaken as necessary to ensure the minimum temperature of 5°C at the point of discharge. All methods of equipment for heating shall be subject to approval.

The aggregates shall be free of ice, snow, and frozen lumps before entering the mixer.

An approved method of curing shall be commenced as soon as possible after finishing.

Suitable covering and/or other means shall be provided for maintaining the concrete at a temperature of at least 10°C, for not less than 72 hours after placing, and at a temperature above freezing for the remainder of the curing period. At the end of the curing period, concrete temperature shall be allowed to fall gradually.

Salt, chemicals, additives of other foreign material shall not be mixed with the concrete to prevent freezing.

Any concrete damaged by freezing shall be removed to the full depth and replaced.

4.11.3 Protection Against Rain

No concrete shall be placed during rain, and unhardened concrete shall be protected from rain and flowing water.

When rain appears imminent, concreting operations shall cease and all concrete less than 24 hours old shall be protected. Waterproof covers for the protection of the surface of all concrete less than 24 hours old shall be available on Site at all times, and concreting should not commence until this provision is complied with.

4.12 Testing & Acceptance of Concrete

4.12.1 Testing Requirements

The concrete shall be sampled and tested for strength in accordance with the requirements of AS 1379 and AS 3600. All test results shall be forwarded to the Superintendent for approval as soon as they become available.

Two strength and two slump tests shall be taken on random samples from each type of concrete used in the Works.

Drying shrinkage shall be tested on two random samples from the Works.

Test cylinders shall be taken during the Works for determining the time for form stripping. These test cylinders shall be field cured and shall be in addition to the tests required in accordance with AS 3600.

4.12.2 Acceptance Criteria

Strength

The criteria for compliance with any of the characteristic strength requirements of this Specification shall be in accordance with AS 1379.

Slump

The slump shall be deemed-to-comply if the appropriate requirements of AS 1379 are satisfied.

4.12.3 Rejection Criteria

Hardened concrete shall be liable to rejection if:

- it is porous, segregated, or honeycombed;
- the reinforcing steel has been displaced from its correct location;
- inserts or other items embedded in the concrete have been displaced from their specified position; or
- work can be shown to be otherwise defective or non-compliant with this Specification.

Concrete that is liable to rejection may be permitted to be retained on the basis of satisfactory results being obtained from one or more of the following:

- An appraisal of the statistical information related to the concrete strength;
- A structural investigation;
- Additional tests (such as outlined in AS 1379); or
- Approved remedial work is undertaken.

Where concrete work has been finally rejected it shall be removed to the extent determined, and replaced.

4.13 Construction Tolerances

Following completion, the finished surfaces of the various concrete elements shall be tested for conformance to the grades, lines and levels shown on the Drawings, and for surface flatness.

Construction with intent to use the maximum tolerances shall not be permitted.

For the poured in-situ slab, the following tolerances shall be achieved:

- Surface levels – the finished surface shall conform to the levels, grades and cross-sections shown on the Drawings to the extent that any point on the finished surface shall not vary by more than 10 mm above or below the level indicated.
- Surface flatness – the finished surfaces of the various sections of the slab shall not deviate from the testing edge of an approved 3 m straightedge by more than 6 mm.
- The finished surface must marry up to the adjacent works to the satisfaction of the Superintendent.

4.14 Handling & Transport

The Contractor is responsible for providing adequate protection to precast elements so that they are not damaged during handling and transport.

The Contractor is responsible for all fittings required for the handling of precast elements. Prior to fabrication approval shall be obtained from the Superintendent for the location and type of any fittings or lifting anchors.

Once the precast elements are installed in their final position the holes from the lifting anchors and other such fittings for handling shall be filled with an approved sealant to the approval of the Superintendent.

5. Geotextile Sand Container

5.1 General

The scope of the Geotextile Sand Container (GSC) works includes the supply and installation of GSC to provide protection to the Beach Access Ramp, new beach and any additional work or variations ordered by the Superintendent.

5.2 Materials

The materials to be supplied, delivered and placed shall include the following:

- 0.75m^3 ElcoRock® Vandal Resistant GSC both sides.
- 0.75m^3ElcoRock® Vandal Resistant GSC both sides. Scour Flap Short Side.
- 0.75m^3ElcoRock® Vandal Resistant GSC both sides. Scour Flap Long Side.
- 2.5m^3 ElcoRock® Vandal Resistant GSC both sides.
- 2.5m^3ElcoRock® Vandal Resistant GSC both sides. Scour Flap Long Side.
- Sand Fill for GSC's
- Geotextile

All costs associated with the excavation, transport and placement of sand sourced from the stockpile are deemed to be included within the Contractor's prices.

5.3 GSC Materials

5.3.1 Geotextile Sand Containers

The Works propose to use ElcoRock® Geotextile Sand Containers or an approved equivalent as approved by the Superintendent.

The Contractor can contact Geofabrics Australia for ordering, correct filling / closure procedures and hire arrangements for filling frames and specialised lifting frames ("J" bin).

5.3.2 GSC Fill

The sand fill should be generally free of objects greater than 30 mm in diameter that may cause puncturing of the GSC container. The Contractor shall screen the fill to be used for filling of the GSC's to ensure that no object greater than 30 mm in diameter is placed within the GSC container.

5.4 GSC Method of Works & Placement

5.4.1 General

The Works involve the filling and closure of the GSC containers, placement of the GSC Containers to form the GSC scour protection structure.

5.4.2 Work Method

The Works associated with the GSC are to be completed systematically in layers – commencing with the base layer. Each layer shall be finalised before works on the next layer commences.

Prior to commencing Works associated with the placement of the GSC scour protection, the initial set out survey shall be approved by the Superintendent.

5.4.3 Geotextile Sand Containers

Approximate quantities and layout of the 0.75 m^3 and 2.5 m^3 GSCs are shown on the Drawings. These Drawings have been based on typical on site filled measurements of the 0.75 m^3 and 2.5 m^3 GSC's. The typical site filled dimensions are shown on the Drawings.

The filled dimension of the bags can vary due to handling and filling techniques. The Contractor shall make an allowance for additional bags if required to meet the lines and levels on the Drawings.

Should a GSC have significantly different dimensions to the typical GSC dimensions, the Contractor shall, if directed by the Superintendent, relay, refill or replace the GSC at no additional cost.

5.4.4 Fill for Geotextile Sand Containers

Fill for the GSC containers shall be clean sand free of roots, organic matter and other foreign material and shall not contain any particle greater than 30 mm in diameter. The fill material shall be free of sharp objects (such as rocks or glass) which could lead to the puncturing of the GSC. The Contractor shall include all costs associated with sand screening within the Contract sum.

The Contractor shall source the sand fill material from a suitable sand pit. The Contractor shall arrange for the opening up and operation of all sand pits required for completion of the Works. These arrangements shall include payment of royalties and obtaining approvals or permits if required and any other charges associated with opening up, testing, excavating, operating and winning from the sand pits.

The Contractor shall be responsible for any construction, upgrading and maintenance of access roads required between the sand pits and public roads. All such costs shall be deemed included in the Contract sum.

The Contractor shall construct, upgrade and maintain as required for the duration of the Contract all access roads required between the sand pits and public roads.

5.4.5 Geotextile Sand Containers Filling and Placing Procedures

Filling Procedures

The GSC's are to be filled hydraulically with a sand slurry. Specialised filling and placement equipment is required from Geofabrics Australia for filling and lifting the GSC's. The minimum equipment below is required for the filling and placing the GSC's. The Contractor shall use at a minimum the equipment below:

- 100 mm diameter water pump; and
- 20 Tonne Excavator for placement of the GSC.

During filling the bags should be filled such that the sand is over the capacity of the GSC bags. The excess sand is then removed by hand to enable closure of the GSC to the best recommendations of the manufacturer.

Filling shall be undertaken on relatively flat ground free from debris to minimize damage to the bags from falling over whilst in the filling frame or being punctured by unsuitable materials.

The Contractor shall obtain the correct filling methodology and suitable filling equipment from the GSC manufacturer/supplier to ensure acceptable filling levels are achieved. The Contractor shall undertake proper filling, sewn closure and handling procedures to the satisfaction of the Superintendent.

Placement Procedure

Placement of the GSC's shall be by Geofabrics Australia's approved J bin or an equivalent approved by the Superintendent. Shall GSC's be placed in a method other than that approved, the Superintendent may wish for the GSC's to be relaid or should the GSC have been damaged in the placement process, be replaced at the Contractors cost.

The Contractor is to ensure that the filling trunks of the GSC's are always adjoining another GSC. No filling trunk should be on the exposed face of the GSC. If a GSC is placed with the filling trunk on the outside the Superintendent shall request the Contractor to relay the orientation of the bag.

The joins between GSC's shall be staggered horizontally and vertically between layers to maximise the interlocking of the GSC structure.

The GSCs shall be placed to the dimensions, lines, levels and slopes shown on the Drawings. The GSCs shall be placed such that crest level and layer thickness is to the design dimensions shown on the drawings plus 0.1 m and minus 0.1 m.

Horizontal placement of the GSC's shall be within 0.05m of the adjoining bag. The GSC's shall be laid flat from the J bin and ensure that they have not been pushed or rolled into position such that the GSC does not lay flat. Bags not laid flat or in close proximity to adjoining bags to the satisfaction of the Superintendent shall be relaid at the Contractors expense.

The Contractor shall ensure the following occurs in the handling of the GSC.

- The GSC handling is kept to a minimum during the filling and transporting process.
- Handling equipment used on site is adequate as determined by the GSC supplier or the Superintendent and does not pose any risk of damage to the GSC and in particular, the edge seam of the GSC; and
- The Contractor's personnel handle the GSC with care. Dragging the containers over abrasive surfaces shall not be allowed.
- The Contractor shall store the GSCs in such a manner to ensure they are not damaged by vandalism, storms or movement of people and equipment.

5.5 Quality Control & Acceptance Testing

5.5.1 General

The Contractor shall continuously monitor the quality, strength, size, grading and placement of all GSC's and other materials used in the Works. The Contractor shall undertake a program of inspection, testing and supervision that will ensure that all materials incorporated into the Works conform to the full requirements of these Specifications. Such quality control and acceptance testing shall be to the satisfaction of the Superintendent.

5.5.2 Geotextile Sand Containers

The Contractor shall conduct a visual inspection of the GSC for signs of damage prior to filling. The Contractor shall record and indicate to the Superintendent and supplier prior to the filling of any GSC:

- Any GSC which should be rejected and removed from site because they have unacceptable flaws; and
- Any containers which contain minor repairable flaws.

The Superintendent may take random samples of the GSC filling dimensions throughout the course of the works. The Contractor shall remove and re-fill or replace, at the Contractors cost, any GSC found not to meet the Manufacturer's recommendations or the general dimensions outlined in this Specification and attached Drawings.

6. Limestone Block Retaining Wall

The Contractor shall construct a new limestone block retaining wall to replace the existing concrete riverwall. This shall generally include:

- Confirmation of geotechnical conditions and foundations.
- Preparation of the Sub-Grade.
- Supply and placement of the Sub-Base.
- Supply and construction of the Concrete Footing.
- Supply and placement of the Geotextile.
- Supply and construction of the Limestone Block Retaining Wall.

The scope of works includes all works necessary for the construction of the new limestone block wall as shown on the Drawings, noted in this Specification or otherwise instructed by the Superintendent.

6.1 Sub-Grade & Sub-Base

The Contractor shall outline in their C&EMP how they will address dewatering and compaction of the sub-grade and sub-base material. The Contractor is to confirm that adequate geotechnical conditions and foundations are achieved prior to construction of the riverwall.

Target requirements are that the sub-grade shall be compacted to achieve 7 blows with a Perth Sand Penetrometer between 150 and 400 mm below the surface level in accordance with AS 1289 F3.3.

A sub-base comprising of 20 mm nominal aggregate and free draining sand shall be installed to the lines, levels and dimensions as shown on the Drawings.

Details of the proposed work methodology shall be included in the C&EMP and ASSDMP (if required) to be prepared by the Contractor and approved by the Superintendent and Parks & Wildlife prior to the commencement of the Works.

6.2 Concrete Footing

The limestone block walls shall be laid on a concrete footing to the lines, levels and dimensions shown on the drawings. The concrete footing shall be a minimum of 150 mm thick. The concrete shall have a characteristic strength of at least 50 MPa at 28 days. The maximum aggregate size shall be 20 mm and the slump shall be in the range of 60 to 120 mm.

Water used in concrete and for curing shall be of potable quality and free from all impurities which may have a harmful effect on the concrete. Chemical Admixtures shall be approved by the Superintendent prior to use and shall comply with the requirements of AS 1478.1.

The proposed mix details shall be forwarded to the Superintendent for approval prior to placing any concrete. One sample of concrete for the footing shall be tested.

The concrete shall be manufactured, transported, placed, vibrated and cured to the requirements of AS 3600 and the durability requirements of AS 4997. The concrete shall be water cured for 7 days using a methodology approved by the Superintendent.

All formwork shall be to requirements of AS 3610 and, where required, be designed by the Contractor. Forms shall remain in place until the concrete has a minimum average compressive strength of 32 MPa.

All concrete works shall be completed to the requirements of the Cement and Concrete Association of Australia's handbook Guide to Concrete Construction HB 64 – 2002.

6.3 Reconstituted Limestone Blocks

All exposed blocks shall be reconstituted limestone. The blocks shall be 350 x 350 x 1000 mm reconstituted limestone blocks of suitable strength that they will not break in handling and placing, and suitable durability that they will last at least 50 years in the marine environment without significant degradation.

The reconstituted limestone blocks shall have a minimum Surface Saturated Dry Density of 1.8 t/m3 and unconfined compression strength of 7 MPa. One density and one strength test shall be done in accordance with AS 1012.9 for each batch of blocks produced. The results shall be provided to the Superintendent for approval prior to laying any blocks. The Contractor shall ensure that each batch of blocks can be separately identified on site with the corresponding test results.

Blocks used in the rear of the wall that are not exposed may be an alternative colour provided they meet the above specifications and are approved for use by the Superintendent.

The Contractor shall ensure that on the river side face of the retaining wall, each exposed block is laid such that the most de202nse face of the block is laid on the exposed river side of the wall.

6.4 Laying Limestone Blocks

The reconstituted limestone blocks shall be laid to the lines, levels and dimensions shown on the Drawings and the requirements of AS 3700 Masonry Code. The blocks shall be laid to stretcher bond and header bond patterns as per the drawings and Superintendent's instructions. All joints shall be completely filled with mortar and the face joints shall be raked flush with the edge of the blocks. External joints shall be raked to a depth of 75 mm and pointing mortar inserted, struck flush and tooled to give a polished dense water shedding finish in accordance with AS 3700 durability requirements.

Bedding mortar shall be a M3 mortar comprising of clean sand, lime, Portland cement complying with AS 3972 and water in the following proportions:

- 1 part by volume cement.
- 1 part by volume lime.
- 6 parts by volume clean sand.

All bedding mortar may be grey in colour.

Limestone pointing mortar shall be an M4 mortar used to fill the first 75 mm of all external joints. Limestone pointing mortar shall be a mixture of clean white sand, yellow bricklayers sand (not more than 1 part), lime, approved white cement complying with AS 3972 and water in the following proportions:

- 1 part by volume cement.
- 0.25 part by volume lime.
- 3 parts by volume clean sand.

Pointing mortar shall match the general colour of the reconstituted limestone blocks used in the walls.

All mortar shall comply with the durability and materials requirements of AS 3700. All mortar shall have an unconfined compressive strength not less than 7 MPa at 28 days. Compressive strength test is required to confirm the mortar strength, all testing shall be in accordance with AS 2350.11.

Premixed masonry cements shall not be used without evidence of the durability provisions required by AS 3700 to the satisfaction of the Superintendent.

6.5 Geotextile

Geotextile shall be placed behind the wall and under the toe scour protection as shown on the Drawings.

All Geotextile shall be Texcel 600R or an equivalent approved by the Superintendent.

The minimum overlap between sheets shall be 1.0 m for the full length of the lap, after placement of quarry or other materials on top of the cloth.

The Contractor shall plan and execute the placement of the Geotextile to ensure that there is no damage to the Geotextile during placement and that it forms a continuous barrier to prevent the leaching of fines from the material beneath.

All damaged areas of Geotextile shall be repaired by overlaying the area with new Geotextile with a minimum overlap of 1.0 m from the damaged area. The Contractor shall lay the Geotextile to the best recommendations of the manufacturer.

6.6 Backfill Immediately Behind Limestone Walls

The compacted backfill immediately behind the limestone block walls shall be clean, free draining sand, totally free from organic material. Not more than 4% shall pass a 75 µm sieve. The Contractor shall place and compact the backfill in a planned and controlled manner to achieve the lines and levels shown on the Drawings without damaging or dislodging the limestone block walling.

The fill shall be placed and compacted in layers not more than 500 mm thick when compacted. All layers shall extend the full width of the backfill area. The backfill shall be compacted to achieve 6 blows with a Perth Sand Penetrometer between 150 and 400 mm below the surface level in accordance with AS1289 F3.3.

6.7 As Constructed Survey – Limestone Block Retaining Wall

The “As Constructed” Surveys of the Limestone Block Retaining Wall works shall be completed and submitted to the Superintendent for approval prior to Practical Completion being achieved. The survey shall be in a form approved by the Superintendent. As Constructed information shall at a minimum include:

- Crest Height of Limestone Walling.
- Front Crest Line of Limestone Walling.

The surveys shall be presented in the form of “As Constructed” Survey Drawings, showing the “As Constructed” information, scale, datum and other pertinent information including the design profile and constructed profile and shall be signed by the surveyor and the Contractor. Electronic copies of these drawings shall be sent to the Superintendent within one week of completion of the Works. Electronic copies shall be in pdf and Autocad (dwg) formats. A signed paper set of the “As Constructed” Survey Drawings shall be provided to the Superintendent at the completion of the Works.

The Certificate of Practical Completion of the Works will not be issued until the Superintendent has received and reviewed the full set of approved “As Constructed” Survey Drawings.

6.8 "As-Constructed" Drawings

The Contractor shall keep one set of full size prints of the Contract Drawings for "As-Constructed" purposes. This set of prints shall be maintained in a clean condition on site and shall be marked up by the Contractor to show the details of the "As-Constructed" Works.

"As-Constructed" measurements shall be made by a qualified surveyor or professional engineer. Deviations from the Contract Drawings shall be marked on the prints in red ink with unchanged dimensions and levels underlined in red ink. Each drawing shall be certified "As-Constructed" dated and signed by the Contractor as soon as practicable after completion of the work shown on that drawing. In due course the full set of "As Constructed" Contract Drawings shall be delivered to the Superintendent.

7. Rock Revetment

7.1 General

7.1.1 Scope of Works

The scope of works for the construction of the Revetment shall generally include:

- Preparation of the site and general earthworks to allow construction.
- Supply and placement of Geotextile.
- Supply and placement of Filter Rock and trimming of the material to provide an even slope and consistent crest width across the Revetment.
- Supply and placement of Armour Rock.
- Supply and placement of Limestone Block Crown Wall.
- Supply and placemen of Beach Sand.

The scope of works includes all works necessary for the building of the Revetment as shown on the Drawings, noted in this Specification or otherwise instructed by the Superintendent.

7.2 Existing Riverwall Preparation

There is no intent to remove the existing riverwall. The concrete capping slab or top block is to be removed and the new Revetment is to be constructed over the existing riverwall.

Once the concrete capping or top block has been removed, any large voids behind the wall shall be filled with Filter Rock prior to placement of the Geotextile.

7.3 Geotextile

7.3.1 General

The Geotextile shall be Texcel 900R or equivalent approved by the Superintendent. Any proposed alternatives will only be assessed based on minimum properties.

7.3.2 Placing Geotextile

The Geotextile shall be placed as shown on the Drawings. The minimum overlap between sheets shall be 1.0 m for the full length of the lap, after placement of quarry or other materials on top of the cloth.

The Contractor shall plan and execute the placement of the Geotextile to ensure that there is no damage to the Geotextile during placement and that it forms a continuous barrier to prevent the leaching of fines from the material beneath.

All damaged areas of Geotextile shall be repaired by overlaying the area with new Geotextile with minimum overlap of 1.0 m from the damaged area. The Contractor shall lay the Geotextile to the best recommendations of the manufacturer.

7.4 Quarried Materials

The materials to be supplied, delivered and placed in the Revetment Works shall include the following:

- Armour Rock – Limestone.
- Filter Rock – Limestone.

All materials brought onto the site shall be certified “clean” as defined by the Department of Environment and Conservation’s *Landfill Waste Classification and Waste Definitions 1996*, be uncontaminated and free from rubble, weeds and disease.

7.4.1 Density & Strength of Rock

All rock used in the Revetment shall have sufficient strength, hardness and durability that it will not break in handling, transport and placement operations and provide a durable structure that will have a service life of more than 50 years in the marine environment without breakdown or deterioration of the stones.

All rock used in the Revetment shall have a Saturated Surface Dry Density (SSDD) of 2.0 tonnes/m^3 or greater, and a Point Load Index Strength, Is(50), of 0.7 MPa or greater.

7.4.2 Armour Rock

Armour Rock shall consist of individual hard, dense, angular limestone quarry rocks broken out by explosives. It shall be free of any cleavages, fractures, fissures or weak planes, and be of such strength that it will not break in handling and placing.

Not more than 10% of Armour Rocks shall have the greatest dimension more than three times the least dimension.

Armour Rocks shall vary in mass from 0.5 tonnes minimum to approximately 1.5 tonnes maximum. At least 50% of Armour Rocks by number shall have a mass greater than 1.0 tonnes.

7.4.3 Filter Rock

The Filter Rock shall consist of quarried, unweathered Limestone spalls of such strength that they will not break in handling and placing.

The Filter Rock shall be well-graded, run of quarry material between 50 mm and 600 mm. At least 50% of the Filter Rock shall be greater than 350 mm. The proportion of quarry fines less than 100 mm (but still greater than 50 mm) shall not be more than 20% by volume.

7.4.4 Beach Sand

The sand used to renourish the beach section shall be coarse river sand free of any vegetation, debris rubbish, gravel or rock. Beach sand shall have a nominal diameter (D50) greater than 0.6 mm. The Beach Sand shall be Bakers Hill or Gin Gin Quartz or equivalent as approved by the Superintendent.

7.4.5 Sources of Supply of Quarried Materials

The Contractor shall make their own arrangements for sourcing and supplying all quarried materials used in the Works. These arrangements shall include obtaining approvals or permits, payment of royalties, if required, and any other charges incidental to opening up, excavating, operating and winning from the quarries, including the rehabilitation, construction, upgrading and maintenance of any access roads required between the quarries and pits and public roads.

All such costs shall be deemed to be included in the prices submitted for the Works.

7.4.6 Quarry Operations

Operations

In the operation of quarries, the Contractor shall comply with the Local Government Model By-Laws (Extractive Industries) No.9 to such extent as is required by the Local Authority and the relevant Western Australian Regulations for mines.

Explosives

The location and design of explosives magazines, method of transporting explosives, use of explosives and in general the precautions taken to prevent accidents shall be in accordance with the relevant Western Australian Mining Regulations, Mining Safety and Inspection Regulations , Explosives and Dangerous Goods Act and Regulations and with the requirements of AS 2187.

7.5 Transport & Storage of Quarry Materials

7.5.1 Truck Routes & Traffic

The Contractor shall make their own arrangements for the loading, delivery, unloading, temporary stockpiling and final delivery of all quarry materials required for completion of the Works. These arrangements shall include the payment of all charges and obtaining of approvals and permits from the relevant Authorities associated with the maintenance of public roads and haul roads between the quarry and the Works.

The Contractor shall be liable for any action arising from damage to public roads, which was caused by the Contractor's use of those roads.

The Contractor shall endeavour to minimise the disruptions caused by truck traffic and other work activities, and is liable for any damage caused to roads by truck traffic. The Contractor shall obtain approval for the proposed truck routes from Main Roads WA, the Local Authority and the Superintendent.

7.5.2 Delivery

Each truckload of quarry material shall consist of one class only.

If in the opinion of the Superintendent any rock delivered to the site does not comply with the requirements of this specification and cannot be reclassified, the Superintendent will reject the load. Any load so rejected shall be removed from the site immediately.

7.5.3 Storage

Quarry materials shall be stored in stockpiles, arranged in a manner that will prevent the intermixing of rock classes or fill of different types and contamination by other materials.

7.6 Placing Quarried Materials in Revetment

7.6.1 Temporary Access Tracks

The Contractor shall construct any temporary access tracks or works required to complete the Works. The Contractor shall remove all temporary works when they are no longer required. The Contractor shall liaise with the Superintendent and Main Roads WA regarding access to the Works area.

7.6.2 Filter Rock

The Filter Rock shall be delivered and placed to the dimensions, lines, levels and slopes shown on the Drawings. The Contractor shall exercise care in placing the Filter Rock materials to the

satisfaction of the Superintendent to ensure that segregation does not occur. The Contractor shall, if directed by the Superintendent, replace such material at no extra cost.

Following the completion of a section, the Contractor shall survey the surface of the Filter Rock for tolerance and submit the results to the Superintendent for review and approval.

Filter Rock materials placed directly on the Geotextile shall be placed carefully to ensure that the Geotextile is not damaged or dislodged. Filter Rock material shall not be dropped from more than 0.5 m directly onto the Geotextile.

7.6.3 Placing Armour Rock

The Armour Rock shall be delivered and placed to the dimensions, lines, levels and slopes shown on the Drawings. The Armour Rock shall be placed such that crest level and armour thickness is to the design dimensions shown on the drawings plus 0.2 m and minus 0.0 m.

Armour Rock shall be placed by crane or hydraulic excavator or other machine approved by the Superintendent in a manner that Armour Rocks are lifted and then placed firmly on to but do not displace the previously placed layer. The placement of Armour Rock shall commence at the toe of the section being constructed and work progressively up the section to the crest. Individual Armour Rocks shall be in close contact with at least three other rocks of the same layer. Armour shall be placed such that a clear length along the face being armoured of not less than 10 metres of the previous layer is visible for inspection at any time.

The Contractor shall take care when placing the Armour Layer to ensure that Armour Rock of minimum weight within any class is not placed together in any one area. The placement of the Armour Rock shall be random with respect to location and orientation on the structure.

The Contractor at no additional cost shall remove all Armour Rock that has rolled beyond the extent of the Revetment and is not part of the structure.

7.6.4 Rate of Placing

The Armour Rock shall be placed progressively on the trimmed Filter Rock up to the full height of the section that is being constructed. The Armour shall be placed on the Filter Layer immediately after the completed Filter Layer for that stage has been inspected and approved by the Superintendent.

7.7 Placing Beach Sand

Beach Sand shall be paced to the lines, levels and dimensions shown on the Drawings to the satisfaction of the Superintendent. The Beach Sand shall be placed to achieve a minimum thickness of 300 mm.

7.8 Quality Control & Acceptance Testing for Rock Works

7.8.1 General

The Contractor shall continuously monitor the quality, density, size, grading and placement of all quarried, sand and other materials used in the Works. The Contractor shall undertake a program of inspection, testing and supervision that will ensure that all materials incorporated into the Works conform to the full requirements of the Specification. Such quality control and acceptance testing shall be to the satisfaction of the Superintendent.

7.8.2 Armour Rock Samples

At the commencement of the Works, the Contractor shall supply the following samples of Armour Rock to be used in the Works. One set of samples shall be placed at each quarry site and one set of samples shall be placed at the works site.

- Three (3) approximately cubic Rock Samples having approximate masses of 0.5, 1.0 and 1.5 tonnes.

After weighing, the samples shall be marked with their masses and retained at the sites for visual reference purposes for the duration of the Works. All costs associated with the supply, weighing, measurement, maintenance and removal of the samples shall be deemed to be included in the Contract Sum.

7.8.3 Quality Control of Armour Rock & Filter Rock

The Contractor shall undertake density tests of all materials supplied for the Works. All testing shall be carried out at a laboratory registered by the National Association of Testing Authorities (NATA) for the required tests. All costs associated with the laboratory testing shall be deemed to be included in the Contract Sum.

Prior to the commencement of the work on Site, the Contractor shall complete laboratory testing of the rock proposed to be used in the Works. Saturated Surface Dry Density (SSDD) tests shall be completed in accordance with AS1141.6.1. SSDD tests shall be carried out on three (3) representative samples of rock material from each of the Contractor's proposed quarries. In addition, three (3) Point Load Index tests for each limestone quarry shall be provided. The test results shall be forwarded to the Superintendent at least 2 weeks prior to commencement of quarrying operations for review prior to granting approval to use the quarry.

During the work on Site, the Superintendent may request one additional SSDD test and point load index test. The costs of these tests are deemed to be included within the Contract sum. The samples for the tests shall be selected by the Superintendent during the construction of the Works to monitor conformance with this Specification. The results of these tests shall be made available to the Superintendent within 1 week of taking the samples.

During the Works, in addition to the Contractor's quality management and control provisions, the Superintendent shall monitor the quality of the quarry products by systematic measurements of the Armour Rock and Filter Rock material.

If in the opinion of the Superintendent the Armour Rock does not comply with this Specification, it shall be weighed to determine if the individual Armour Rocks match this Specification. The provision of weighing devices and the costs of such testing shall be deemed to be included in the Contract Sum.

The Superintendent may request that a sample of the Filter Rock be graded to verify that it meets the requirements of this specification. The costs of such testing shall be deemed to be included in the Contract Sum.

7.8.4 Quality Control of Beach Renourishment

The Contractor shall provide a sample of the proposed Beach Renourishment for approval by the Superintendent prior to the delivery and placement of the Beach Renourishment. The Superintendent may reject a load of Beach Renourishment if it does not match the general appearance or characteristics of the original sample.

Prior to commencement of the Beach Renourishment, the Contractor shall provide a Particle Size Distribution (PSD) analysis of the proposed Beach Renourishment for approval by the Superintendent. The Contractor shall not commence stockpiling or placing the Beach Sand until approval has been granted by the Superintendent. All testing shall be carried out at a laboratory registered by the National Association of Testing Authority (NATA) for the required tests. The Superintendent may request additional PSD analysis throughout the works. The Contractor shall include the cost of the PSD analyses within the Contract Sum.

7.9 Limestone Block Crown Wall

A two block high limestone block crown wall shall be installed along the rear of the Armour Rocks. This wall shall form a barrier for the path and turf at the rear of the wall and reduce the volume of overtopping through the rear of the Armour Rocks. This wall shall be finished to a high standard due to its highly visible location to the satisfaction of the Superintendent.

7.9.1 Compacted Sub Grade

The Contractor shall compact the existing sub grade in a planned and controlled manner to achieve the lines and levels shown on the Drawings.

The sub grade shall be compacted to achieve 7 blows with a Perth Sand Penetrometer between 150 and 400mm below the surface level in accordance with AS1289 F3.3.

7.9.2 Limestone Road Base

Geotextile be laid as shown in the drawings and shall continue along the interface of the compacted sub grade and limestone Road Base.

A minimum layer of 150 mm of limestone Road Base shall be used for a blinding layer between the compacted sub grade and concrete footing.

Any voids at the rear of the cut concrete capping slab shall be filled with compacted Road Base.

Road Base shall consist of crushed Limestone of approved hardness and durability and shall be free from clay lumps and excess organic matter or other foreign material. It shall be freshly blended prior to delivery.

The grading of the portion passing a 19 mm AS sieve shall conform to the requirements set out in Table 6.1.

Table 6.1 Road Base Grading

Sieve Size (AS sieve) - mm	Percent by Weight passing - %
19.00	100
9.50	70-80
4.75	40-65
2.36	30-50
0.425	12-30
0.075	3-12

The ratio of the portion passing the 0.075 mm sieve to the portion passing the 0.425 mm sieve shall fall within the range of 40-60%. The portion of the total sample retained on the 19 mm sieve shall not exceed 5% of the total sample.

7.9.3 Concrete Footing

The Limestone Block Wall shall be laid on a layer of vibrated concrete to the lines, levels and dimensions shown on the Drawings. The concrete footing shall be a minimum of 150 mm thick. The concrete footing shall have a characteristic strength of at least 32 MPa at 28 days. The maximum aggregate size shall be 20 mm and the slump shall be in the range of 60 mm to 120 mm.

Water used in concrete and for curing shall be of potable quality and free from all impurities which may have a harmful effect on the concrete. Chemical Admixtures shall be approved by the Superintendent prior to use and shall comply with the requirements of AS 1478.1.

The proposed mix details shall be forwarded to the Superintendent for approval prior to placing any concrete. One sample of concrete for the footing shall be tested for every 60 m of Limestone Block Wall.

The concrete shall be manufactured, transported, placed, vibrated and cured to the requirements of AS 3600 and the durability requirements of AS 4997.

All formwork shall be to requirements of AS 3610 and, where required, be designed by the Contractor. Forms shall remain in place until the concrete has a minimum average compressive strength of 15 MPa.

All concrete works shall be completed to the requirements of the Cement and Concrete Association of Australia's handbook Guide to Concrete Construction HB 64 – 2002.

The concrete footing shall be poured in separate panels no greater than 12 metres long. Contraction joints, backed with a bond breaker and filled with a suitable flexible sealant shall be located at 5 metre centres.

7.9.4 Limestone Blocks

The limestone blocks shall be 350 x 350 x 1000 mm reconstituted limestone blocks of suitable strength that they will not break in handling and placing, and suitable durability that they will last 50 years in the marine environment without significant degradation.

The limestone blocks shall have a minimum Surface Saturated Dry Density of 1.8 t/m^3 and unconfined compression strength of 7 MPa. One density and one strength test in accordance with AS 1012.9 shall be done prior to the laying of any blocks and for every additional 60 metres of Limestone Block Walling or change in block supplier. The results shall be provided to the Superintendent for approval prior to laying any blocks.

Laying Limestone Blocks

The limestone blocks shall be laid to the lines, levels and dimensions shown on the Drawings and the requirements of AS3700 Masonry Code. The blocks shall be laid to stretcher bond patterns as per the Drawings and the instructions of the Superintendent. All joints shall be completely filled with mortar and the face joints shall be raked flush with the edge of the blocks. External joints shall be struck flush and tooled to give a polished dense water shedding finish in accordance with AS 3700 durability requirements.

All mortar shall be a limestone coloured M4 mortar and match the general colour of the reconstituted limestone blocks used in the walls.

Limestone pointing mortar shall be a mixture of clean white sand, yellow bricklayers sand (not more than 1 part), lime, approved white cement complying with AS 3972 and water in the following proportions.

- 1 part by volume cement.
- 0.25 part by volume lime.
- 3 parts by volume clean sand.

All mortar shall comply with the durability and materials requirements of AS 3700. All testing shall be in accordance with AS 2350.11. All mortar shall have an unconfined compressive strength not less than 5 MPa at 28 days. Premixed masonry cements shall not be used without evidence of the durability provisions required by AS 3700 to the satisfaction of the Superintendent.

7.9.5 Drainage Holes

Nominal 100 mm PVC Pipe shall be placed as drainage holes through the Limestone Block Wall at approximately 5 m centres. The pipe shall be fully surrounded by mortar.

The location and levels of the drainage holes shall be confirmed with the Superintendent to be appropriate for the finished levels behind the wall.

7.10 As Constructed Survey

The “As Constructed” Surveys of the Revetment works shall be completed progressively with the Works and progressively made available to the Superintendent. The surveys shall be in a form approved by the Superintendent and include cross-section measurements of dimensions and levels at every 10 m of the Revetment. As a minimum they shall contain:

- Final Trimmed Filter Rock levels.

- Final Armour Rock levels.
- Back and front of crest, changes of grade and toe extents.
- Thickness, slope and levels of the Beach.

The surveys shall be presented in the form of “As Constructed” Survey Drawings, showing the “As Constructed” information, scale, datum and other pertinent information including the design profile and constructed profile and shall be signed by the surveyor and the Contractor. Electronic copies of these drawings shall be sent to the Superintendent within one week of completion of a section of the Works. Electronic copies shall be in pdf and Autocad (dwg) formats. A signed paper set of the “As Constructed” Survey Drawings shall be provided to the Superintendent at the completion of the Works.

The Certificate of Practical Completion of the Works will not be issued until the Superintendent has received and reviewed the full set of approved “As Constructed” Survey Drawings.

7.11 "As-Constructed" Contract Drawings

The Contractor shall keep one set of full size prints of the Contract Drawings for "As-Constructed" purposes. This set of prints shall be maintained in a clean condition on site and shall be marked up by the Contractor to show the details of the "As-Constructed" Works.

"As-Constructed" measurements shall be made by a qualified surveyor or professional engineer. Deviations from the Contract Drawings shall be marked on the prints in red ink with unchanged dimensions and levels underlined in red ink. Each drawing shall be certified "As-Constructed" dated and signed by the Contractor as soon as practicable after completion of the work shown on that drawing. In due course the full set of "As Constructed" Contract Drawings together with all As Constructed Survey Drawings shall be delivered to the Superintendent.

8. Appendices

Appendix A Drawings

Appendix A Drawings

City of Nedlands

NEDLANDS RIVERWALL UPGRADE STAGE 2

CHAINAGE 730 TO 1,085m

DRAWING No.	TITLE
D1395-02-01	DRAWING LIST & LOCALITY PLAN
D1395-02-02	EXISTING CONDITIONS & ACCESS
D1395-02-03	LAYOUT - SHEET 1
D1395-02-04	LAYOUT - SHEET 2
D1395-02-05	REVETMENT & BEACH SECTIONS
D1395-02-06	RAMP SECTIONS & DETAILS

GENERAL NOTES:

1. THESE DRAWINGS ARE TO BE READ IN CONJUNCTION WITH THE SPECIFICATION. ANY DISCREPANCIES ARE TO BE REFERRED TO THE SUPERINTENDENT BEFORE PROCEEDING.
2. SURVEY COMPLETED BY THE CITY OF NEDLANDS BETWEEN 2007 AND 2013. HORIZONTAL DATUM IS MGA94 ZONE 50, VERTICAL DATUM IS AUSTRALIAN HEIGHT DATUM (AHD). THE LEVELS AND CONTOURS REFLECT THE SURFACE AT THE TIME OF SURVEY ONLY.
3. THE CONTRACTOR SHALL PROTECT ANY SERVICES IN THE WORKS AREA. CONTACT DIAL BEFORE YOU DIG ON 1100.
4. SET OUT COORDINATES AND DIMENSIONS ARE TO BE CONFIRMED ON SITE PRIOR TO WORKS COMMENCING. REFER ANY DISCREPANCY TO THE SUPERINTENDENT. IF IN DOUBT ASK.
5. AERIAL PHOTOGRAPH PROVIDED BY LANDGATE TAKEN IN 2013.
6. DISTANCES AND LEVELS SHOWN IN METRES, DIMENSIONS IN MILLIMETRES, UNLESS NOTED OTHERWISE.
7. THE CONTRACTOR SHALL PROTECT ALL TREES WITHIN THE WORKS AREA.
8. SITE ACCESS AND LAYDOWN AREAS TO BE CONFIRMED WITH SUPERINTENDENT PRIOR TO WORKS.
9. CONTRACTOR TO OBTAIN ALL NOTICES TO MARINERS AND TEMPORARY MARKERS REQUIRED TO COMPLETE THE WORKS.
10. ON COMPLETION OF THE WORKS A SET OF MARKED UP AND SIGNED "AS CONSTRUCTED" DRAWINGS SHALL BE FORWARDED TO THE SUPERINTENDENT.

CAD: D13950201A

REV	DATE	APPROVED	AMENDMENT	REV	DATE	APPROVED	AMENDMENT
A	19.05.17	TSH	PRELIMINARY ISSUE				

This plan is not to be used for construction unless issued as Rev 0 and signed below

CLIENT: City of Nedlands

DESIGNED	CHECKED	APPROVED
J. CHEN	T. HUNT	
DRAWN	CHECKED	
T. VAN BEEM	T. HUNT	

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coastal and port engineers
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admin@coastsandports.com.au

PROJECT: NEDLANDS RIVERWALL UPGRADE – STAGE 2

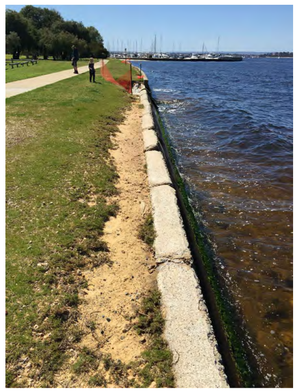
TITLE: DRAWING LIST & LOCALITY PLAN

SCALE AT A1: 1:2,000 | DRAWING NUMBER: D1395-02-01 | REV: A

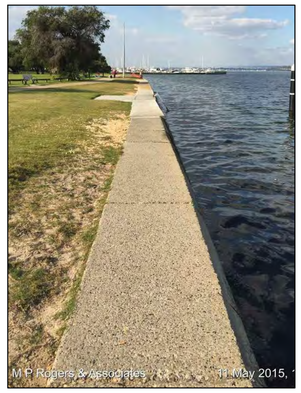
A1 CORRECT SCALE IHIS IS 100 mm

PHOTOGRAPH 1

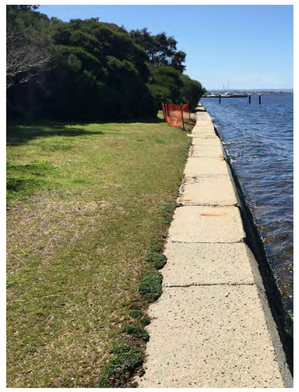
PHOTOGRAPH 2



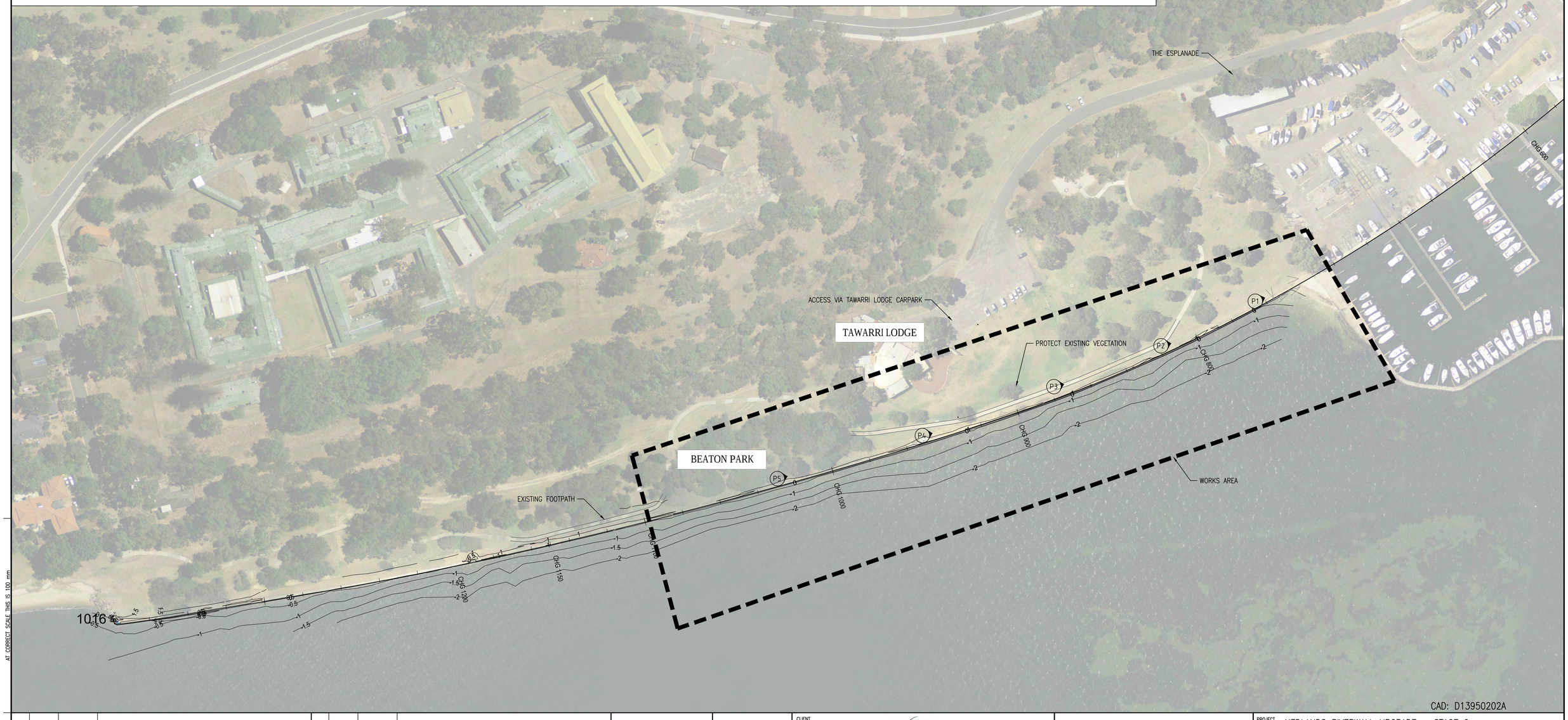
PHOTOGRAPH 3



PHOTOGRAPH 4



PHOTOGRAPH 5



CAD: D13950202A

AT CORRECT SCALE THIS IS 100 mm

REV	DATE	APPROVED	AMENDMENT
A	19.05.17	TSH	PRELIMINARY ISSUE

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CLIENT City of Nedlands

DESIGNED	CHECKED	APPROVED
J. CHEN	T. HUNT	
DRAWN	CHECKED	
T. VAN BEEM	T. HUNT	

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admin@coastsandports.com.au

PROJECT NEDLANDS RIVERWALL UPGRADE – STAGE 2

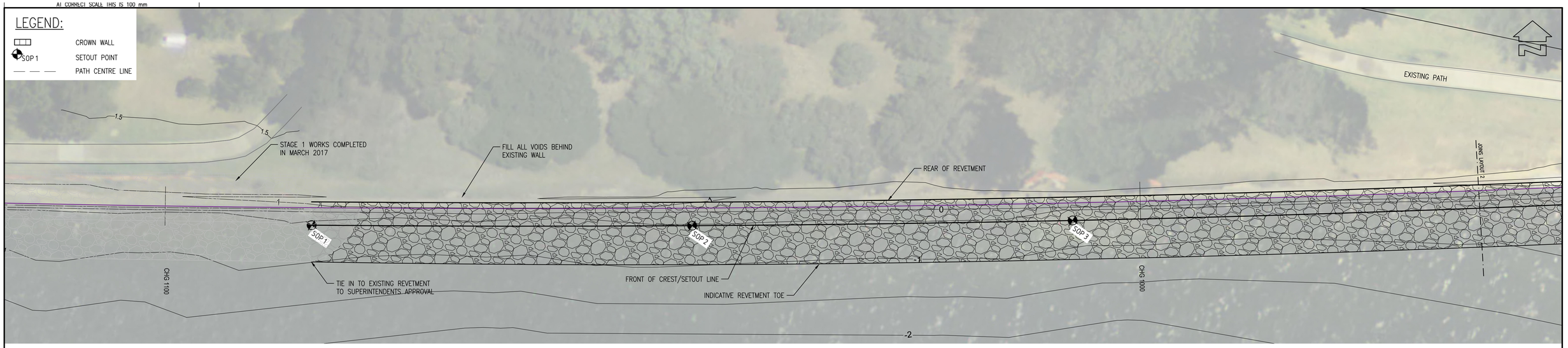
TITLE EXISTING CONDITIONS & ACCESS

SCALE AT A1	DRAWING NUMBER	REV
1:1,000	D1395-02-02	A

A1 CORRECT SCALE THIS IS 100 mm

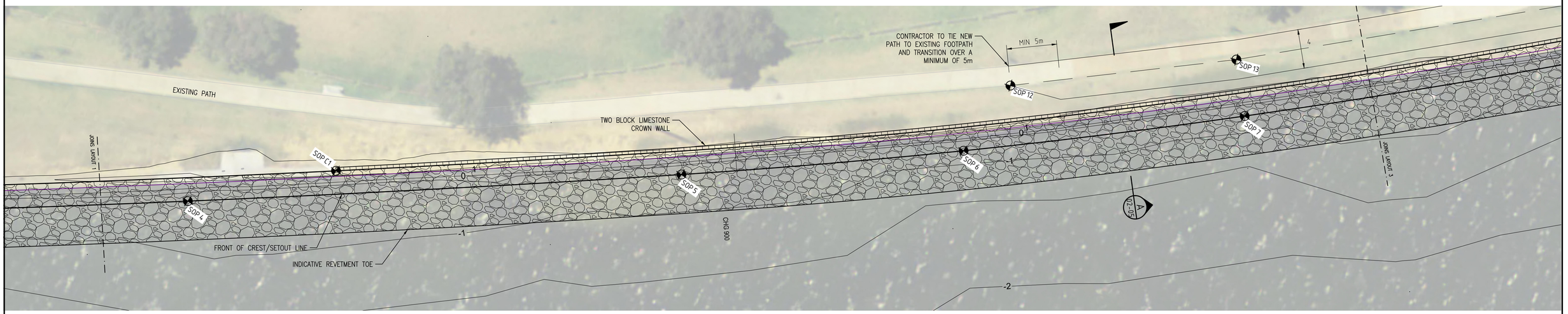
LEGEND:

- CROWN WALL
- SOP 1 — SETOUT POINT
- PATH CENTRE LINE



LAYOUT 1

1:200



LAYOUT 2

1:200

SETOUT POINTS			
SETOUT POINTS	EASTING	NORTHING	STRUCTURE TYPE
SOP1	387,113.444	6,458,636.905	REVETMENT
SOP2	387,151.188	6,458,646.844	REVETMENT
SOP3	387,188.778	6,458,657.346	REVETMENT
SOP4	387,237.336	6,458,671.877	REVETMENT
SOP5	387,285.567	6,458,687.461	REVETMENT
SOP6	387,312.922	6,458,697.222	REVETMENT
SOP7	387,339.880	6,458,708.031	REVETMENT
SOP8	387,380.780	6,458,726.560	REVETMENT
SOP9	387,416.402	6,458,744.746	REVETMENT
SOP10	387,423.625	6,458,743.979	REVETMENT
SOP11	387,430.483	6,458,750.715	RVETMENT
SOP12	387,315.861	6,458,704.909	PATH
SOP13	387,337.577	6,458,713.409	PATH

SETOUT POINTS			
SETOUT POINTS	EASTING	NORTHING	STRUCTURE TYPE
SOP14	387,373.182	6,458,729.405	PATH
SOP15	387,395.595	6,458,740.498	PATH
SOP16	387,414.964	6,458,778.440	PATH
SOP17	387,406.007	6,458,746.918	PATH
SOP18	387,412.233	6,458,756.176	PATH
SOP19	387,416.497	6,458,769.493	PATH
SOP20	387,417.010	6,458,777.114	PATH
SOP21	387,423.737	6,458,760.546	PATH
SOP22	387,424.647	6,458,756.651	PATH
SOP23	387,428.744	6,458,761.428	PATH
SOP24	387,429.220	6,458,757.457	PATH
SOP25	387,434.623	6,458,761.911	PATH
SOP26	387,435.010	6,458,757.962	PATH

SETOUT POINTS			
SETOUT POINTS	EASTING	NORTHING	STRUCTURE TYPE
SOP27	387,436.968	6,458,762.571	PATH
SOP28	387,438.464	6,458,759.971	PATH
SOP29	387,443.023	6,458,766.057	PATH
SOP30	387,444.534	6,458,763.457	PATH
SOPC1	387,251.232	6,458,678.767	CROWN WALL
SOPC2	387,420.332	6,458,749.609	CROWN WALL
SOPR1	387,419.119	6,458,754.953	RAMP
SOPR2	387,421.927	6,458,749.813	RAMP
SOPR3	387,429.206	6,458,752.137	RAMP
SOPR4	387,430.093	6,458,752.631	RAMP
SOPR5	387,435.297	6,458,755.567	RAMP
SOPW1	387,420.611	6,458,749.098	LIMESTONE BLOCK RETAINING WALL
SOPW2	387,442.734	6,458,761.583	LIMESTONE BLOCK RETAINING WALL

NOTES:

1. CONTRACTOR TO PROTECT EXISTING WALL ADJACENT TO WORKS.
2. CONCRETE CAPPING MAY BE CRUSHED AND USED AS FILTER ROCK OR BACKFILL BEHIND EXISTING WALL PROVIDING IT MEETS THE FILTER ROCK SPECIFICATION.
3. THE CONTRACTOR IS TO RECTIFY ANY DAMAGE CAUSED TO THE EXISTING PATH DURING THE WORKS. THE CONTRACTOR SHALL LIAISE WITH THE SUPERINTENDENT PRIOR TO THE FOOTPATH REINSTATEMENT.

CAD: D13950203A

AT CORRECT SCALE THIS IS 100 mm

REV	DATE	APPROVED	AMENDMENT	REV	DATE	APPROVED	AMENDMENT
A	19.05.17	TSH	PRELIMINARY ISSUE				

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CLIENT: City of Nedlands

DESIGNED	CHECKED	APPROVED
J. CHEN	T. HUNT	
DRAWN	CHECKED	
T. VAN BEEM	T. HUNT	

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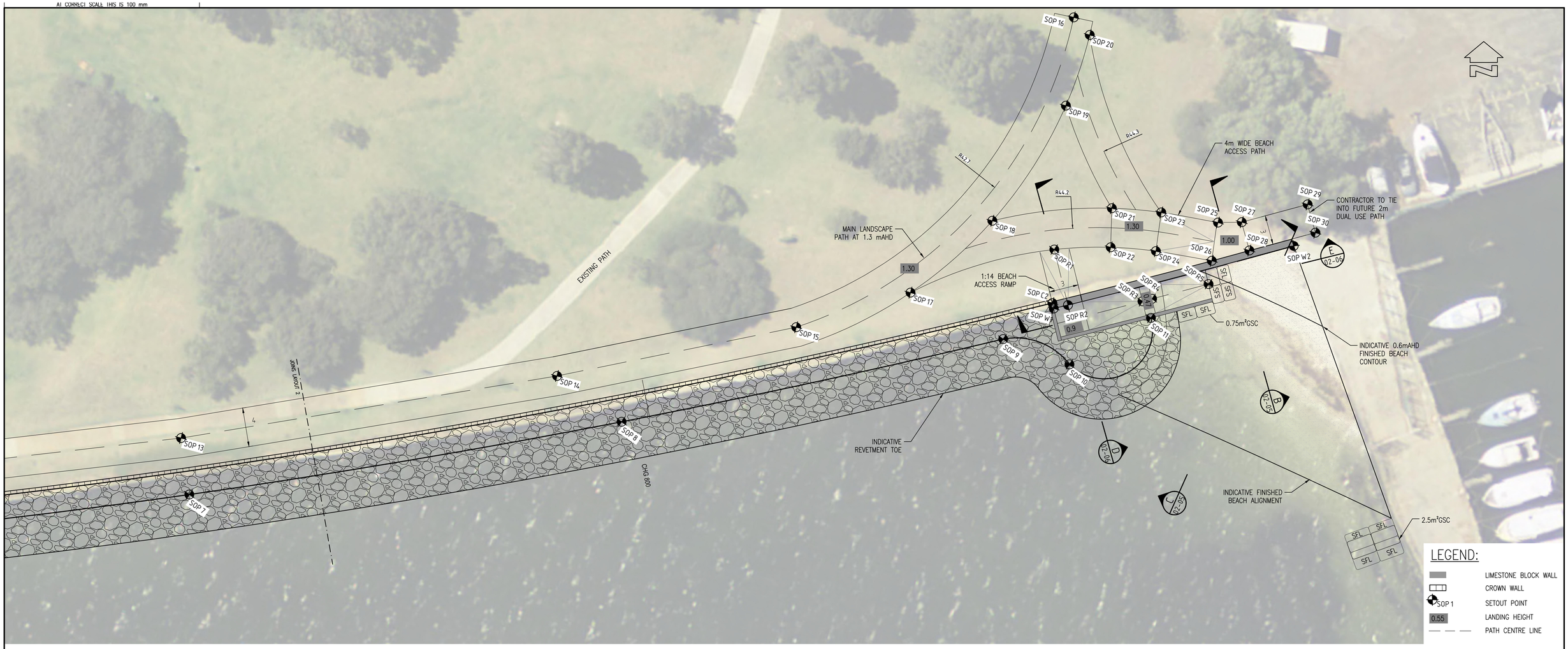
PROJECT: NEDLANDS RIVERWALL UPGRADE – STAGE 2

TITLE: LAYOUT SHEET 1

SCALE AT A1	DRAWING NUMBER	REV
1:200	D1395-02-03	A

A1 CORRECT SCALE: 1MIS IS 100 mm



LEGEND:

- LIMESTONE BLOCK WALL
- CROWN WALL
- SOP 1 — SETOUT POINT
- 0.55 — LANDING HEIGHT
- PATH CENTRE LINE

LAYOUT 3

1:200

SETOUT POINTS			
SETOUT POINTS	EASTING	NORTHING	STRUCTURE TYPE
SOP1	387,113.444	6,458,636.905	REVETMENT
SOP2	387,151.188	6,458,646.844	REVETMENT
SOP3	387,188.778	6,458,657.346	REVETMENT
SOP4	387,237.336	6,458,671.877	REVETMENT
SOP5	387,285.567	6,458,687.461	REVETMENT
SOP6	387,312.922	6,458,697.222	REVETMENT
SOP7	387,339.880	6,458,708.031	REVETMENT
SOP8	387,380.780	6,458,726.560	REVETMENT
SOP9	387,416.402	6,458,744.746	REVETMENT
SOP10	387,423.625	6,458,743.979	REVETMENT
SOP11	387,430.483	6,458,750.715	RVETMENT
SOP12	387,315.861	6,458,704.909	PATH
SOP13	387,337.577	6,458,713.409	PATH

SETOUT POINTS			
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SOP21	387,423.737	6,458,760.546	PATH
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SOP23	387,428.744	6,458,761.428	PATH
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SOP25	387,434.623	6,458,761.911	PATH
SOP26	387,435.010	6,458,757.962	PATH

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SOP28	387,438.464	6,458,759.971	PATH
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SOPC1	387,251.232	6,458,678.767	CROWN WALL
SOPC2	387,420.332	6,458,749.609	CROWN WALL
SOPR1	387,419.119	6,458,754.953	RAMP
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SOPR3	387,429.206	6,458,752.137	RAMP
SOPR4	387,430.093	6,458,752.631	RAMP
SOPR5	387,435.297	6,458,755.567	RAMP
SOPW1	387,420.611	6,458,749.098	LIMESTONE BLOCK RETAINING WALL
SOPW2	387,442.734	6,458,761.583	LIMESTONE BLOCK RETAINING WALL

GSC NOTES:

1. STD – DOUBLE SIDED VANDAL DETERRENT
2. SFL – DOUBLE SIDED VANDAL DETERRENT SCOUR FLAP LONG EDGE
3. SFS - DOUBLE SIDED VANDAL DETERRENT SCOUR FLAP SHORT EDGE
4. WHERE GSC TYPE NOT SPECIFIED DOUBLE VANDAL DETERRENT STANDARD BAGS TO BE USED

NOTES:

1. CONTRACTOR TO PROTECT EXISTING WALL ADJACENT TO WORKS.
2. CONCRETE CAPPING MAY CRUSHED AND USED AS FILTER ROCK OR BACKFILL BEHIND EXISTING WALL PROVIDING IT MEETS THE FILTER ROCK SPECIFICATION.
3. THE CONTRACTOR IS TO RECTIFY ANY DAMAGE CAUSED TO THE EXISTING PATH DURING THE WORKS. THE CONTRACTOR SHALL LIAISE WITH THE SUPERINTENDENT PRIOR TO THE FOOTPATH REINSTATEMENT.

CAD: D13950204A

AT CORRECT SCALE THIS IS 100 mm

REV	DATE	APPROVED	AMENDMENT	REV	DATE	APPROVED	AMENDMENT
A	19.05.17	TSH	PRELIMINARY ISSUE				

This plan is not to be used for construction unless issued as Rev 0 and signed below

CLIENT: City of Nedlands

DESIGNED	CHECKED	APPROVED
J. CHEN	T. HUNT	
DRAWN	CHECKED	
T. VAN BEEM	T. HUNT	

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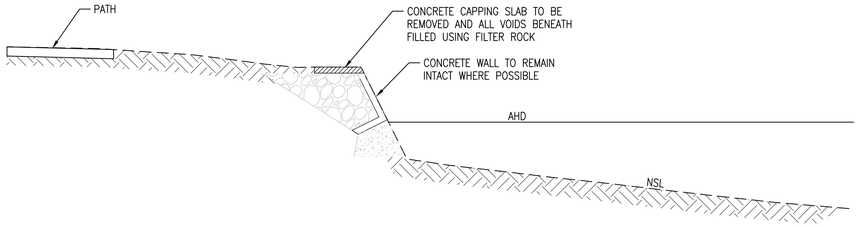
PROJECT: NEDLANDS RIVERWALL UPGRADE – STAGE 2

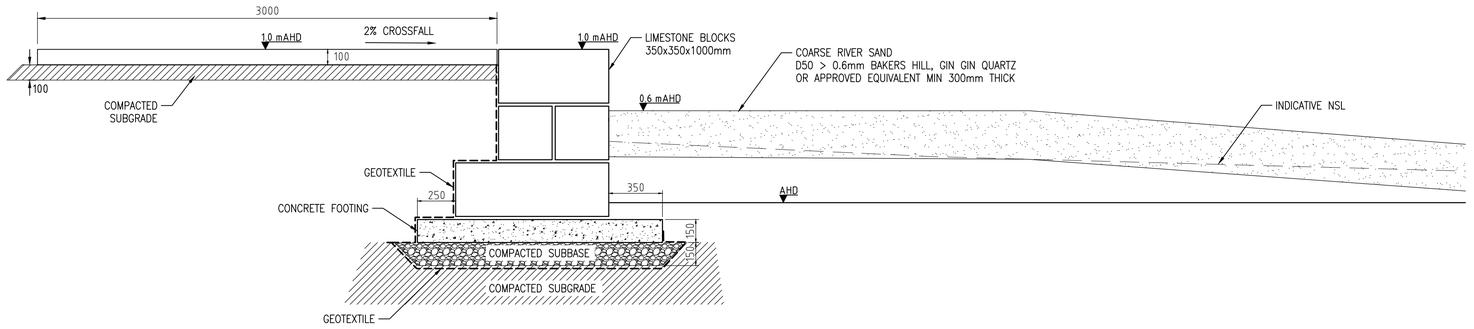
TITLE: LAYOUT SHEET 2

SCALE AT A1	DRAWING NUMBER	REV
AS SHOWN	D1395-02-04	A

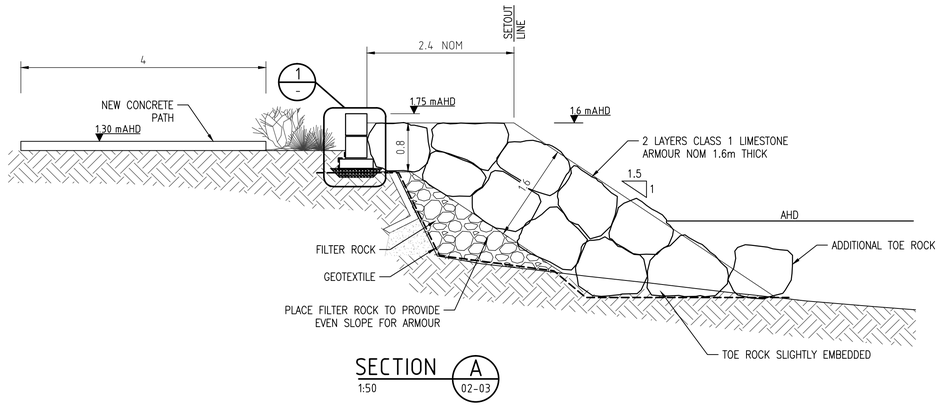
A1 CORRECT SCALE THIS IS 100 mm



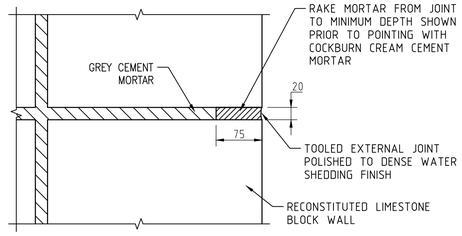
TYP EXISTING SECTION
1:50



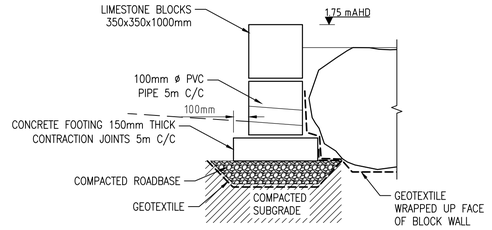
SECTION B
1:50



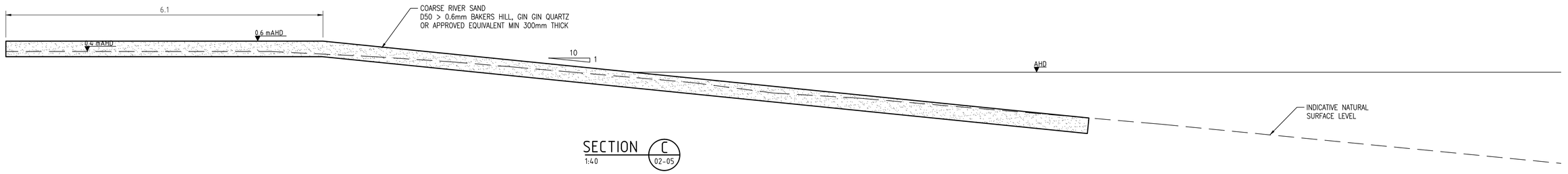
SECTION A
1:50 — 02-03



TYP MORTAR DETAIL
1:20



DETAIL 1
1:20



SECTION C
1:40 — 02-05

NOTES:

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CAD: D13950205A

REV	DATE	APPROVED	AMENDMENT
A	19.05.17	TSH	PRELIMINARY ISSUE

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DRAWN	CHECKED	
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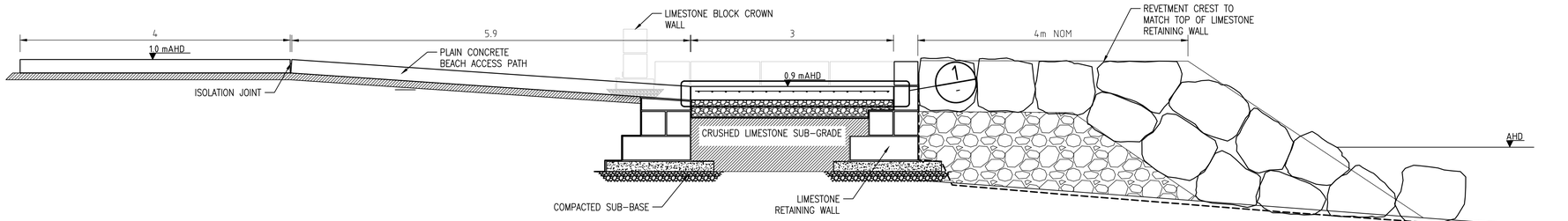
PROJECT: NEDLANDS RIVERWALL UPGRADE – STAGE 2

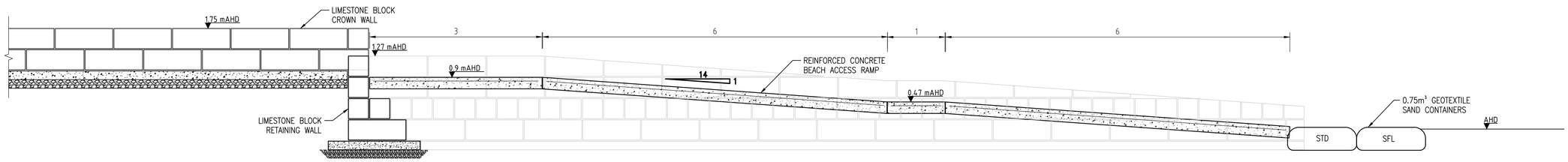
TITLE: REVETMENT & BEACH SECTIONS

SCALE AT A1: AS SHOWN | DRAWING NUMBER: D1395-02-05 | REV: A

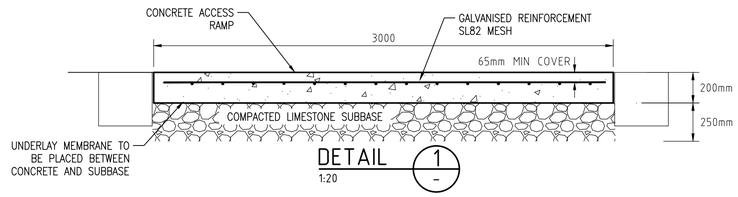
AT CORRECT SCALE THIS IS 100 mm



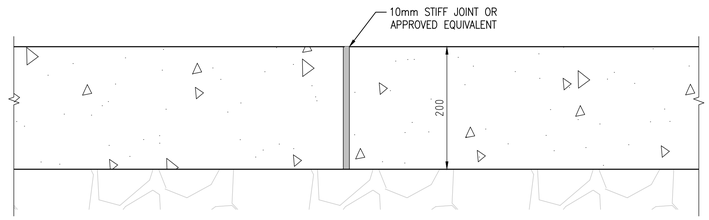
SECTION D 1:40 (02-04)



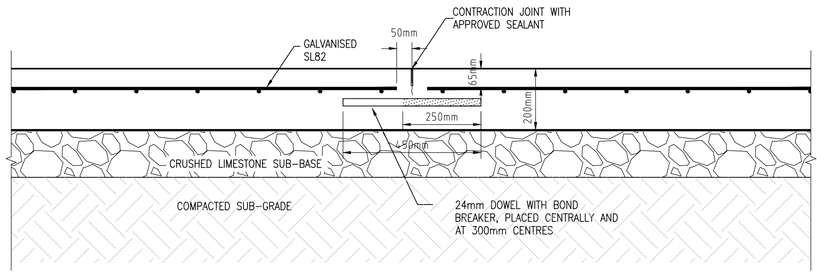
SECTION E 1:40 (02-04)



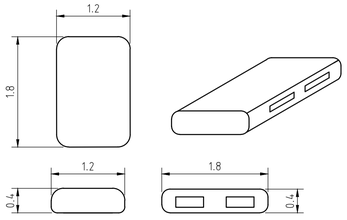
DETAIL 1 1:20



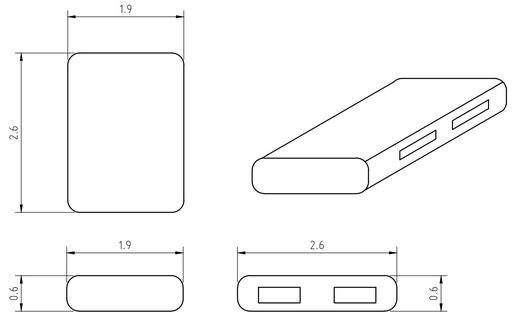
TYP EXPANSION/ISOLATION JOINT
1:5



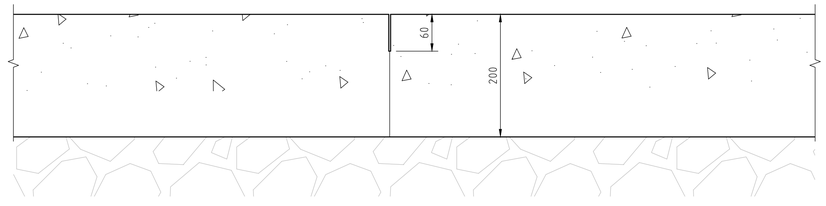
TYPICAL CONTRACTION JOINT FOR ACCESS RAMP
1:10



TYP 0.75m³ GSC DETAIL
NTS



TYP 2.5m³ GSC DETAIL
NTS



TYPICAL CONTRACTION JOINT FOR FOOTPATH
1:5

GSC NOTES:

1. STD – DOUBLE SIDED VANDAL DETERRENT
2. SFL – DOUBLE SIDED VANDAL DETERRENT SCOUR FLAP LONG EDGE
3. SFS - DOUBLE SIDED VANDAL DETERRENT SCOUR FLAP SHORT EDGE
4. WHERE GSC TYPE NOT SPECIFIED DOUBLE VANDAL DETERRENT STANDARD BAGS TO BE USED

CAD: D13950206A

REV	DATE	APPROVED	AMENDMENT
A	19.05.17	TSH	PRELIMINARY ISSUE

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PROJECT: NEDLANDS RIVERWALL UPGRADE – STAGE 2

TITLE: RAMP SECTIONS & DETAILS

SCALE AT A1: AS SHOWN | DRAWING NUMBER: D1395-02-06 | REV: A

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